IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 07, Issue 10 (October. 2017), ||V2|| PP 07-10

Determination of Radionuclides in Soil Samples from Gura – Topp Using XRF Techniques

[1]AbdulkarimM.S. [2]Sadiq Umar and[3]Ahmed Mohammed
[1]*Department of applied Science, College of Science and Technology Kaduna Polytechnic, Kaduna-Nigeria*
[2]*Department of Physics, Ahmadu Bello University Zaria, Kaduna-Nigeria*
[3]*Department of Physic, School of Science Education, Federal College of Education (Technical), Gusau, Zamfara-Nigeria*

Abstract: Although commercial mining activities has been carried out for decades on Gura-Top soil. Metal and radionuclides pollution of the environment as a result of abandoned mining activities is an acute problem nowadays as a result of continuous artisanal and small scale mining activities still going on. Twelve soil sampleswithin the range of 0-10cm from the study site were collected using random sampling technique and analyzed using X-ray fluorescence technique. The findings revealed that Uranium-238 and thorium-232 are the only two radionuclides found in all the soils samples with mean activity concentration higher than the average values of soil in Nigeria and other countries. One of the recommendations is that further research beyond the scope of this research be conducted to ascertain the pollution level of these radionuclides.

Keywords: - Radionuclides,Soil Samples ,Gura –Topp, XRF

Date of Submission: 15-08-2017 Date of acceptance: 31-10-2017

I. INTRODUCTION

Nigeria's abundant solid minerals constitute some of the largest known deposits in recent years under different categories made up of precious metals, stones and industrial minerals like coal, tin, gold, marble, limestone and others(Merem *et al.* 2017). Nigeria therefore, has strong potential for economic activities, business opportunities for mining sector and could attract investors.

The first active mining in Nigeria began when the city of Jos in central Nigeria became a center of tin-mining and by 1930s world map highlighted Nigeria as one of the sixth regions in the world showing distribution of tin production with Nigeria, China and Siam accounted for 15 to 25% of global tin production (Kayode F., 2016).

Grace J.J.,(1982) reported that by the end of 1960 the mining industry in the Jos-Plateau went on steady decline. Major foreign companies Amalgamated Tin Mining of Nigeria, Bisichi-Jantar, Gold and Base, Exlands, Kaduna prospectus folded up and consolidated into what now remains today as consolidated Tin Mines of Nigeria Limited. In 1970, the Federal Government of Nigeria had established the Nigeria Mining Corporation in Jos to spear headed the development and exploitation of the development and exploitation of solid minerals, including Tin.With the discovery of oil, commercial mining declined and artisanal and scale mining continue to take place due to lack effective legislative law.

In addition to this, Obateru (2004) and Olaseni (2006) reported that, in an environment such as the Tin Mining Region, which has experienced neglect, long after the active mining activities, utilities and services in relation to dwellings are evident. Despite the site has been abandon years without active mining taken place except that due to artisanal and small scale. The site soil and neighboring environment might have been polluted with mining activities.

Metal pollution of the environment as a result of abandoned mining activities is an acute problem nowadays(Eva M.G., 2006).Mining is one of the important pathways by which soils are contaminated. Contaminated soil serves as a direct source of radio-nuclides and heavy metals leading to the contamination of all agricultural products and animals. Contaminated soil used in green houses could add significantly to the air and water quality. Mining could also result to clearing of vegetation, reduces biological activities and decreases productivity of the soil ( ).

Mbaya (2013)added that: exploration and exploitation of minerals from the earth have always resulted in deviations from the natural state of the environment.Also, Jiriko (2015) emphasized that, the presence of heavy metals and radioactive substances in most mining settlements have possessed a great challenge with varying dimensions especially environmental quality.Generally mining exploration and exploitation directly or

indirectly affects both the living and non-living things through the physical and chemical modification of the soil environment (Adewole and Adesina, 2011).

The tin mining activities in the suburbs of Jos, Plateau State, Nigeria, have resulted in technical enhancement of the natural background radiation as well as higher activity concentrations of primordial radionuclides in the topsoil of mining sites and their environs (Abubakar *et al.* 2015).It is behind this background that the research aim at identifying the radionuclides presents in the study area and determines their activity concentrations in soil samples using x-ray fluorescence technique.

II. METHODOLOGY

2.1 Sample location

The study area is soil around Gura-topp abandoned tin mining plant Jos-plateau state.

2.2 Sample collection

Using random sampling techniques, twelve samples were collected from different soil sampling points within a depth range of approximately 0 -10cm with the help of a hole, packer, poly bags, indelible ink maker, tape rule and a Global positioning system (GPS) to specify the location of each sampling points.

2.3 Analysis

The soil samples were air dried, crushed and sieved to 90µm at Mineral Resources Engineering Kaduna Polytechnics, Kaduna. 30g of each of these samples were then putting in a clean transparent mini tablet polythene bags and labeled with indelible ink and taken to Nigerian Institute of Mining and Geosciences (NIMG), Jos Plateau statefor XRF analysis.

III. RESULTS

3.1 Radionuclides Activity Concentrations

Theactivity concentrations of ^{238}U and ^{232}Th from the results of the XRF analyses 3.1 below. However, for this study; the percentage weights and activity concentrations for ^{40}K in the soil sample(s) are taken as 0.00 + 0.00 ppm which implies the absence of Potassium in the soil sample or the activity concentration of potassium is below the detection limit of the instrument.

Table 3. 1: Activity Concentration of ^{238}u, ^{232}th, ^{40}k,In Soil Sample inBq/Kg

S/N	Sample Code	Concentrations (Bq/Kg)		
		^{238}U	^{232}Th	^{40}K
1	GT J1	1890.53 ± 50.38	7084.13 ± 39.30	0.00 ± 0.00
2	GT J2	139.67 ± 11.60	200.32 ± 4.66	0.00 ± 0.00
3	GT J3	2847.16 ± 88.67	8149. 11 ± 36.86	0.00 ± 0.00
4	GT J4	533.64 ± 21.24	1423.03 ± 10.71	0.00 ± 0.00
5	GT J5	314.43 ± 29.88	469.05 ± 6.86	0.00 ± 0.00
6	GT J6	369.51 ± 23.21	567.70 ± 6.21	0.00 ± 0.00
7	GT J7	200.19 ± 12.84	348.79 ± 5.60	0.00 ± 0.00
8	GT J8	252.92 ± 14.57	330.07 ± 5.39	0.00 ± 0.00
9	GT J9	309.24 ± 23.46	628.69 ± 7.38	0.00 ± 0.00
10	GT J10	612.18 ± 34.45	1100.30 ± 10.67	0.00 ± 0.00
11	GT J11	555.99 ± 18.03	1262.05 ± 10.23	0.00 ± 0.00
12	GT J12	506.22 ± 29.88	1132.00 ± 9.66	0.00 ± 0.00
	MINIMUM	139.67± 11.60	200.32 ± 4.66	0.00 ± 0.00
	MAXIMUM	2847.16± 88.67	8149.11 ± 36.86	0.00 ± 0.00
	RANGE	**1**39.67±11.60	200.32±4.66	0.00 ± 0.00
	MEAN	710.97±29.85	1891.27 ± 12.79	0.00 ± 0.00

Table 3. 2 shows the locations and elevations of each sampling points where the samples were collected.

Sample Code	Locations		Elevations (meters)
	Northing	Easting	
GT J1	9^0 49' 51.1"	8^0 54' 48.0"	1,306
GT J2	9^0 49'50.3"	8^0 54' 42.9"	1,294
GT J3	9^0 49' 58.9"	8^0 54' 40.9"	1,295
GT J4	9^0 50' 0.49"	8^0 54' 50.3"	1,317
GT J5	9^0 50'8.7"	8^0 54' 34.6"	1,295
GT J6	9^0 50'8.6"	8^0 54' 27.1"	1,291
GT J7	9^0 50' 1.2"	8^0 54' 28.1"	1,296
GT J8	9^0 50'0.9"	8^0 54' 32.5"	1,297
GT J9	$9^0$49' 56.6"	8^0 54' 21.6"	1,284
GT J10	9^0 49' 50.4"	8^0 54' 35.5"	1,232
GT J11	9^0 49'49.6"	8^0 54' 41.1"	1,299
GT J12	9^0 49'50.5"	8^0 54' 38.3"	1,296

IV. DISCUSSION

Table 3.1 shows the concentrations of radionuclides (uranium, thorium and potassium) in the twelve soil samples that were analyzed. The mean concentration of Potassium (0.00ppm) implies the absence of potassium in the soil samples.

4.1 Uranium

Uranium contributed *0.08%* to the total elements concentration percentage abundance ; with mean activity concentration of *710.97 ± 29.85 Bq/Kg* which is high compared to the world's average. Thus, the activity concentrations of uranium as measured from the samples in decreasing order are*: GT J3>GT J1 >GT J10>GT J 11> GT J4 >GT J12 >GT J6 >GT J5 > GT J9 >GT J8 >GT J7 >GT J2;* with the maximum concentration of 2847.16 ± 88.67 Bq/Kg measured in sample GT J3 and minimum concentration of *139.67 ± 11.60 Bq/Kg* measured in GT J2 as seen in table 3.1 Thus the observed activity concentrations at the site far exceed the range and mean value in Nigeria and other countries.

4.2 Thorium

For the percentage abundance,thorium contributed *0.70%* to the total radionuclide concentration found the study site ; with a mean activity concentration of *1891.27 ± 12.79 Bq/Kg* higher compared to the world's average. Thus, the activity concentrationsof the radionuclide of thorium measured from the samples decreasesin order of*:* ***GT J3****>GT J1 >GT J10>GT J 11> GT J4 >GT J12 >GT J6 >GT J5 > GT J9 >GT J8 >GT J7 >****GT J2;* with the maximum concentration of *8149.12 ± 36.88 Bq/Kg measured* in GT J3 and minimum concentration of 200.*32 ± 4.66 Bq/Kg* found with GT J2 as displayed in table 3.1 above. Thus the observed activity concentrations at the site far exceed the range and mean value of Nigeria and other countries.

V. CONCLUSION

Uranium-238 and thorium-232 are two radionuclides found in the study site with elevated mean activity concentrations above world average.

REFERENCES

[1] Abubakar Sadiq Aliyu, Timothy Alexander Mousseau, Ahmad Termizi Ramli,and Yakubu Aliyu Bununu (2015). Radioecological impacts of tin mining, https://link.springer.com/article/10.1007%2Fs13280-015-0677-1#main-content

[2] Adewale M.B., Adesina M.A. (2011). "*Impact of marble mining on soil properties in a part of guinea savanna zone of southwestern Nigeria"*; *Ethiopian J. Environ. Studies Manage*,4: 1-8 (http://dx.doi.org/10.4314/ejesm.v412.1)

[3] Eva Margui Grabulosa (206). Analytical Methodologies on X-Ray Fluorescence Spectrometry and Inductively Couple Plasma Spectroscopy for the Assessment of Metal Dispersal around Mining Environments, A Dissertation Presented to Department of Chemistry, University of Girona.

[4] Grace J.J.(1982). Tin Mining on the plateau before 1920 I the isichei E(ed). Studies in the History of Plateau State, Nigeria Chapter 11

[5] Kayode Fawemi (2016). Nigerians Solid Mineral Sector: Alternative Investment Opportunities, www https://.chathamhouse.org/sites/files/chathamhouse/events/2016-05-19-Nigeria-solid-minerals-appg-transcript.pdf

[6] Jiriko, G.K., Wapwera S.D., Mallo, D.M. and Rikko, L.S.,(2015). An Assessment of Environmental Quality: a case of the Jos Plateau Tin Mining Region. SWIFFT journal of Geography and Regional Planning Vol. 1(2) pp.012-024, http://www.swifftjournals.org/sjgrp

[7] Merem E.C.., Twumasi Y., Wesley J., Isokpehi P., Shenge M., Fageir S., Crisler M., Romorno ., Hines A., Hirse G., Ochai S., Leggett S., and Nwagboso E.,(2017). Assessing the Ecological Effect of Mining I West Africa: The Case of Nigeria, International Journal of Mining Engineering and Mineral Processing 2017,6(1):1-19

[8] Mbaya, R.P.(2013). Land Degradation Due to Mining: The Gunda Scenairo International Journal of Geography and Geology Journal homepage: http;//aessweb.com/jounal- detail.php?id=5011

[9] Obateru, R.I. (2004). Land Sub division Basics Penthouse Publications (Nigeria) Olaseni A.M. (2006). Rural Development Planning in Nigeria, Environmental Studies Series, Concept Publications Limited

1AbdulkarimM.S Determination of Radionuclides in Soil Samples from Gura –Topp Using XRF Techniques." IOSR Journal of Engineering (IOSRJEN) , vol. 7, no. 10, 2017, pp. 07-10.