



ASSESSMENT OF ENVIRONMENTAL EFFECT OF ABANDONED URANIUM MINE SITE IN MIKA VILLAGE OF TARABA STATE NIGERIA

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ABSTRACT

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Uranium ore has been mine for decades before it was abandoned in Mika village of Yorro LGA of Taraba state. Uranium mining poses high risk of radiation exposure to members of the public and local community. Despite the high risk associated with uranium ore deposit and mining in the area, the local community have continued to live in the surroundings of the abandoned mine sites and engaging in their day to day socio-economic activities. No attempt has been made to investigate the characteristics and current condition of the abandoned uranium mine site in the area and its potential impacts on the socio-economic life of the people. This study examined the potential environmental impact that could arise from the abandoned uranium mine site and associated past activities. Data was generated through desk review of existing data sources, including literatures, field observation and measurements of abandoned uranium mine pits and related features. Measuring tape and Garmin 12 X GPS (Global Positioning System) was used in the measurements. Interview of key informants was also carried out. Findings from the study show that the uranium ore is found on hill top (425metre above sea level). The mine wastes and overburden were deposited around the mine pits. Most of the overburden materials have been washed away. Findings from the study revealed that scooping of uranium ore samples have been ongoing in Mika area before independence in 1960. The uranium mineral samples collected from the site were taking to France and subsequently to Iran. Despite the risk posed by the abandoned uranium mine pit, the local communities insist that they did not observe any strange sickness or effects associated with the mining activities. Many of them depend on the water collected in the abandoned uranium mine pit for domestic consumption. Based on the findings, the study recommends periodic monitoring of water and agricultural crop to ascertain the possible effects of radioactivity associated with the uranium ore deposits in the area and enlightenment of the local communities on the potential impact of the abandoned uranium mines on their land, soil, air and water in the area.

Contribution/Originality: The study is one of the few studies that have investigated the characteristics and current condition of abandoned uranium mine site in the study area and its potential impacts on the socio-economic life of the people.

1. INTRODUCTION

Nigeria and Taraba state are well endowed with abundant solid mineral resources. This abundant solid mineral resource has attracted the interest and engagement of informal and conventional miners in the area. The state and country in general has huge opportunities for investment in solid mineral resource development given the abundance of expansive areas of unexplored mineral potentials (Merem *et al.*, 2017). However, these potentials have been neglected for a long period of time as a result of the discovery of crude oil in the country.

The mineral occurrences, new discoveries and speculations are being made especially by the artisanal and small scale miners in many parts of the state and country. In most cases, the mineral occurrences were just reported. Real evaluation of the grade of mineral ore or the reserve estimates were never carried out (Department of Solid Mineral Resource, 2005).

Uranium is one of the mineral resources found in the state. It is a very heavy metal which can be used in the development of nuclear energy and weapon. Uranium occurs in most rocks in concentrations of 2 to 4 parts per million and are common in the Earth's crust as other mineral resources such as tin, tungsten and molybdenum. The Nigerian Uranium Mining Company (NUMCO) was established to handle the exploration and mining of uranium in Nigeria. It was established as a public/private partnership with Total Compagnie Minière of France, which owned 40% of the company. In 1989, Total pulled out of the partnership, and in 1993 the government reassigned NUMCO's responsibilities to the Nigerian Geological Survey. NUMCO Corporation was dissolved in 1996, and the government is in the process of liquidating its remaining assets. Recently, several important uranium deposits were discovered in Cross River State, Adamawa State, Taraba State, Plateau State, Bauchi State, and Kano State by the British Geological Survey.

In Taraba state, the three uranium ores that have been found occur in Lau, Yorro and Zing LGAs. They are Arnotite, pitchblende and torbernite. Investigations by the Nigerian Uranium Mining Company (NUMCO) in 1980s obtained as reserve estimate of 52 metric tonnes in one site that was investigated in details. All other prospects are yet to be evaluated. The uranium reserve at Mika was put at about 52T eU. The grade was 0.63% eU, at depth of 130m (Siyani, n.d). Uranium is used as pitchblende in nuclear reactors for the production of various energy, nuclear weapons, photography and chemical reagents.

Uranium is a radioactive mineral that is toxic chemically, being comparable with lead. As a result of this, uranium metal is often handled with gloves as a sufficient precaution. Uranium mining in an area can result in exposure to human health in the surrounding communities if contamination travels offsite through air, surface and ground water. Uranium mining can result in contamination of the soil, sediments or from gamma radiation given off by radio nuclides in contaminated materials. Uranium tailings and waste are often disposed on sites during mining activities. When rain falls, it washes some of the materials down slope to the surrounding farmlands and streams. The existing pathways of radiological and chemical materials in the study area to humans and living organisms include inhalation, ingestion, and absorption through the skin and gamma radiation. The local communities can also be exposed through eating, drinking, breathing, skin contact or from gamma ray emissions from radio nuclides. The pollution of local water supplies around uranium mines and processing plants have been well documented for developed countries. Potential source of environmental impact in the area could be radium rich mineralization and originating radon emissions.

Uranium mining poses high risk of radiation exposure to members of the public and local community. Persons living in the vicinity of uranium deposits may receive some incremental exposure from the natural radioactivity in the area, from exploration activities and from mining, should mine development proceed (Senes Consultants Limited Ottawa Ontario, 2008). This means that a high level of due diligence and care needs to be taken from exploration through to eventual resource exploitation, especially when there is competition for land use, or when the exploration is to be carried out close to peoples' homes or in environmentally sensitive locations (SCLOO,

2008). The effect of uranium mining has always been known to be disastrous. These effects can be made worst by the absence of effective environmental health and safety laws guiding uranium mining activities in a place.

In the study area, uranium has been mine for decades before it was abandoned. The mining is the small scale open pit mining using simple equipment. Despite the high risk of uranium mining in the area, the local community have continued to live in the area surrounding the abandoned mine sites and engaging in their day to day socio-economic activities. Although much has been known about environmental impact of mining onsite and offsite, this study is concerned with the unique impacts of abandoned uranium mine site and past mine activities, processing and waste disposed on the site. The study attempts to appraise past uranium mine activities in the area. Undoubtedly, it is evident that streams and rivers where these chemicals and toxic materials drain into serve the villages and towns along them. It is also most likely that their drinking water could have been poisoned by radioactive elements from the abandoned uranium mine site, thereby causing morbidity and mortality conditions among residents. No attempt has been made to investigate the characteristics and current condition of the abandoned uranium mine site in the area and its potential impacts on the socio-economic life of the people. This study examined the potential environmental impact that could arise from the abandoned uranium mine site and associated past activities. It also assessed the likely social impact of the past uranium mining activities on the people in the study area.

1.1. Objectives

The specific objectives of the study include:

- i. To examine the mining operation methods and practices adopted in the study area.
- ii. To examine the effects of the mining practices adopted in the study area.
- iii. Find out the effects of mining on farming (food production) activities within the Study area.

2. MATERIAL AND METHODS

2.1. Description of Study Area

Yorro LGA is located between latitude 8°42'N to 9°12'N and longitude 11°20'E to 11°45'E. Yorro LGA with a land area of about 1,304 km² has a population of 89,410 (45,548 male and 43,862 female) according to the 2006 national population census. The present Yorro Local Government Area was created in 1991. Yorro LGA is bounded to the north by Lau LGA, to the northeast and southeast by Mayo Belwa (Adamawa State), to the east by Zing LGA, to the west by Jalingo LGA and to the south by Bali LGA (Fig. 1). Yorro LGA has four districts and four development areas. The districts are; Nyaja, Kwajji, Sawa and Kassa districts. The development areas are; Pantisawa, Lankaviri, Kassa and Pupule. In each district, there is a district head and a supervisor for development areas. Their duties are to coordinate the general activity of the LGA, State and Federal Government in the rural areas. Yorro is a hilly and mountainous area, surrounded by chains of mountains, with only about 25 percent of the land been cultivable (Oruonye and Abbas, 2011). The mountains here are part of the Shebshi Mountain which extends up to the Republic of Cameroon. Settlements are highly dispersed and consist of farm stead and isolated compounds. Settlements are also found at the foot of the mountains and consist of round thatch huts with conical roof made of grass matings. Some of the compounds are fenced with live plants called Kerina in local language.

The soil of the area consists of sandy loam soil which developed on the basement complex rocks in the region. The vegetation of the area is the montane vegetation type which consists of tall trees at the foot of the mountain, shrubs at the hillslope and grasses at the top of the hill. Yorro is drained by the Malale River and so many smaller streams that took their sources from the various mountains in the locality.

Yorro LGA has little infrastructure and appears to be one of the poorest and least developed LGAs in the state (Oruonye and Abbas, 2011). There is no road network in the area and hence, most settlements are not accessible except by motor bike. This contributed to the problem of poor social amenities in the area. However, the LGA is well endowed with abundant mineral resources which include iron ore, gemstone, kaolin, aquamarine and gypsum.

In Yorro LGA, hunting is the traditional occupation of the people while farming is the most important economic activity. Cattle rearing and petty trading are also carried out in the area. Important crops produced in the area include yam, maize, groundnut, guinea corn, bambara nut, millet, tiger nut and cassava.

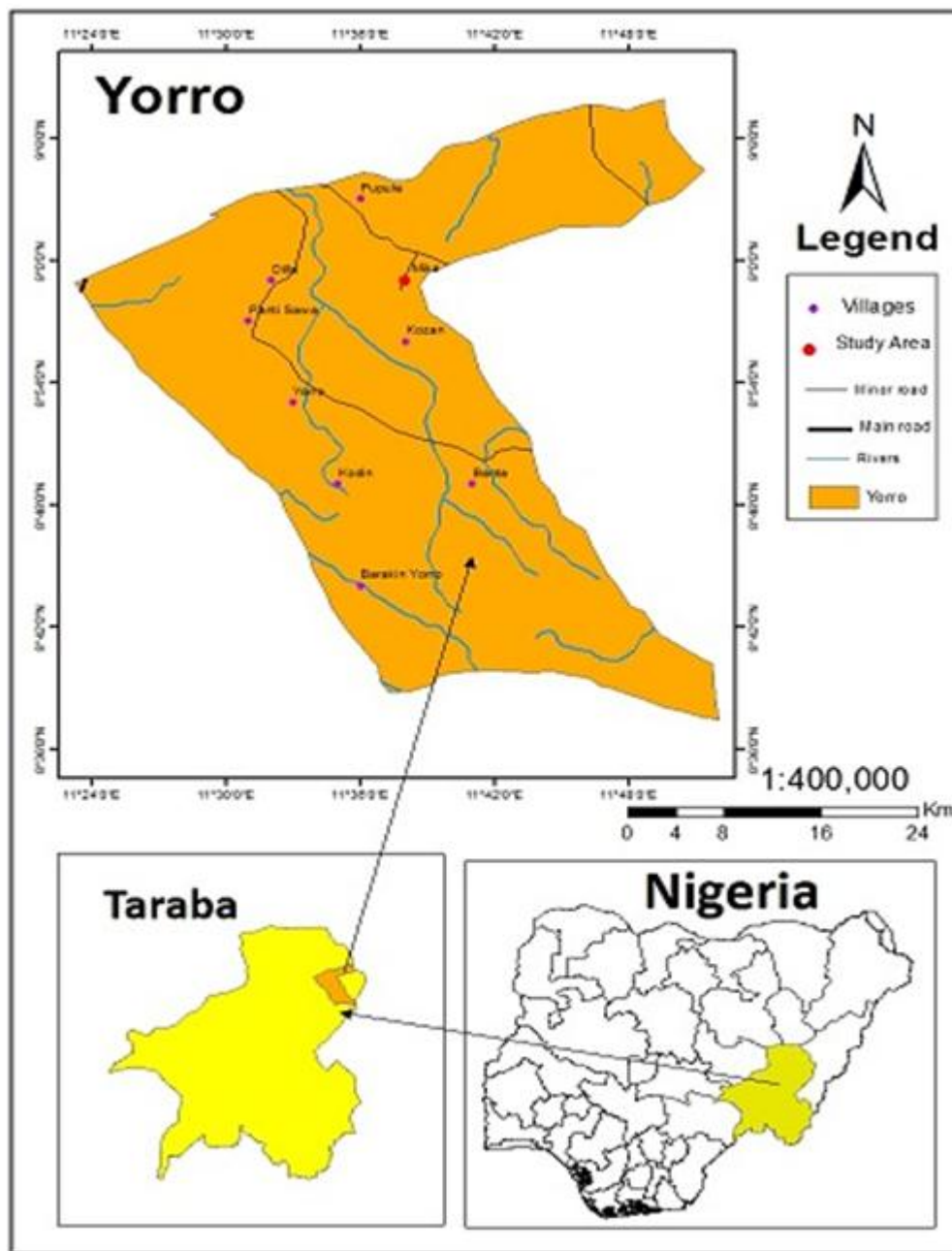


Fig-1. Political Map of Yorro LGA

Source: Fieldwork, 2017

2.2. Sources of Data and Methods of Data Collection

Desk review of existing data sources, including literatures, data bases and topographic maps prior to the initiation of field activities was employed. Field observation and measurements of abandoned uranium mine pits and related features was carried out. These features include “lotto” pits, destruction of vegetation in the area, pollution of stream channels and contamination of soil and water bodies. Measuring tape was used to measure the dimension of the lotto pit. A Garmin 12 X GPS (Global Positioning System) was used to determine the coordinates and altitude of the areas affected by the mining activities. During the fieldwork, people were interviewed especially key informants. The key informants included members of the local community and individuals who were involved in the

uranium mining in the past. This was done to eliminate people who might not have knowledge of the uranium mining activities in the area. In addition, there were interviews with officials of government agencies such as Solid Mineral Resources department, Taraba State Chamber of Commerce and Mines and other NGOs operating in the area. There were formal interviews with the chiefs and other opinion leaders in the surrounding areas. Data generated were analyzed using descriptive statistics.

3. RESULT OF FINDINGS

3.1. Characteristics of the Uranium Abandoned Mine Pits at Mika

The uranium mine site is about 3km away from Mika village. The uranium ore is found on hill top (Plate 1a and 1b). The elevation at the foot of the hill is 405masl and hilltop is 425masl. The area of the uranium mining is about 2km² allocated specifically by the Federal Government of Nigeria for uranium mining in the locality. There are many uranium open mine pits in the area. However, during the field observation, only 3 abandoned open mine pits (plate 2a and 2b) were seen with the following pit dimensions (Table 1). The mine wastes and overburden were deposited around the mine pits. Most of the overburden materials have been washed away.



Plate-1a and 1b. Mika Uranium mine site



Plates-2a and 2b. Abandoned uranium mine pits at Mika

Table-1. Dimensions of abandoned open uranium mine pits.

S/N	Pits No.	Coordinates	Depth (m)	Length (m)	Width (m)
1	X1	08° 58' 46"N, 11° 36' 23"E	5.9	9.7	7.0
2	X2	08° 58' 47"N, 11° 36' 23"E	1.3	5.5	4.4
3	X3	08° 58' 47"N, 11° 36' 23"E	5.9	12.9	7.1

Source: Fieldwork, 2017.

3.2. Mining Operation, Methods and Practices Adopted in the Study Area

The type of mining operation carried out in the site was that of small scale open surface mining. The equipments used in the mining activities include hoes, digger, shovels, spectrometer, scintilometer and geiger counter. Findings from some key informants interviewed revealed that exploration activities in the area started with the uranium areal mapping of the country and areal surveillance for radio activity using helicopter by the Federal Government some decades ago. Uranium reconnaissance survey of the area started in 1981. Real work on uranium mining in the area was done in 1987, 1988 and 1989. The first work in the uranium mine site was the scooping of materials and geochemical sampling. Findings from interviews conducted in the area revealed that scooping of uranium ore has been ongoing in Mika area before independence in 1960. The uranium mineral samples collected from the site were taking to France and subsequently to Iran. There were signs and traces of past mine activities in the area (Interview, 2017a). The uranium mining work in the area stopped under Central Nigerian Uranium Project (Interview, 2017a). Mining in the area lasted for about 15 years. Findings from the study show that mining activity in the area is not consistent. It is on and off. One of the miners interviewed claimed that the longest period he spent in the area was 2 months and his shortest stay was 3 days. Most people involved in the uranium mining die along the line (Interview, 2017a). No one stayed in the uranium mine area for long (Interview, 2017a). This made it difficult for anyone to contemplate reclamation of the abandoned uranium mine pits.

Findings from the study show that quarrying of the uranium ore was done in the early period on the site in open pit. The principal host rock of the uranium ore in the study area is feldspar. The Uranium ore deposit contains about 63.17% of uranium cake content (Interview, 2017a). There are many companies that have been involved with uranium mining in the area. They include Brooklyn Nigerian Limited (the first), Nigerian Uranium Mining Company (NUMCO) and Central Nigerian Uranium Project (CNUP). Because of the nature of Nigerian mining tenure, many prospecting companies come from time to time to request for uranium sample in the site. This request is usually granted. The individual or company end up collecting a lorry load of uranium ore in the name of sampling (Interview, 2017a). A lorry load of the uranium is about 30 tons. In this way, not less than 30 lorry loads (900 tons) of uranium ore from the Mika site have been taken out of the country (Interview, 2017a). There are so many illegal uranium mining activities that take place in the study site.

The prospective companies want to quantify the uranium ore deposit in the area but the toxic/hazards associated with uranium works would not permit because most of the people involved directly with the uranium mining have died (Interview, 2017a). A Director in the State Solid Mineral resources department claimed that the uranium deposit is not large enough to last for years. According to him, the uranium mining companies are interested in ore deposits that can be worked on for forty years or more, but the uranium ore deposits in the study area will not last more than one year if the company were to mobilize their heavy duty machines and equipments to site. The profitability of the mining operation in terms of cost is the main factor determining investment.



Plate-3a and 3b. Maize and yam cropland around Uranium Mine site

3.3. Observed Effect of Uranium Mining in the Area

The ecological effects of uranium mining in the area were observed on crops, trees and humans. The crop yield in the area is very low as a result of soil poisoning by radio activity associated with the uranium ore deposit in the area. Radio activity associated with uranium causes infertility.

One of the respondent interviewed insist that the trees and human beings found in the area don't look normal because of the effect of radio activity. The miners were badly affected with skin rashes and worn out fingers. Some of them experienced maximum internal heat generation in their body (Interview, 2017a). One of the migrant miners involved in the uranium mining claimed that at a point, hair stopped growing on his head and he can hardly see clearly at some other time. Another respondent claimed that people in the local community die young between the ages of 20 – 30years. Rivers drained the area carrying the radioactive materials into water sources.

When they villagers were asked whether they have observed any unusual health challenges in the area, they people claimed otherwise, insisting that they have not observed any strange health challenges in the area. On the issue of premature death or short lifespan of members of the communities as a result of the radioactivity associated with the uranium ore deposit, the people claimed that there was nothing of such. They insist that their people live their normal life and are hardworking farmers. Most of them are adult farmers with children. One of the key informant interviewed lived 600m away from the foothill of the uranium ore deposit. The key informant claimed that the surrounding communities depend on the water collected in the abandoned uranium mine pit for their domestic consumption (Interview, 2017b). When the water is exhausted, they move to the surrounding streams some distance away from their homes. The key informants claimed he has lived in the area for 3 years. He has a wife and two children. They cultivate the surrounding lands at the foot of the hill of the uranium ore deposit (plate 3aand 3b). Most of the people in the surrounding area are mainly migrant farmers. They move to new location as soon as the soil fertility is depleted for a more fertile land. The uranium mining activities disrupted farming activities in the area. The people initially cultivated the hilltops but with mining activities, the overburdens excavated were deposited on lands formally cultivated by local community members. They people then moved to cultivate the surrounding foothills. Crops cultivated were mainly yam, maize and guinea corn (plate 3aand 3b).

3.4. Government Response to Illegal Uranium Mining in the Area

The Federal Government responded by issuing order to staff of the Federal Ministry of Mines and Steel Development involved in the uranium exploration in the area to stop relating with any foreign company or individual making enquiry on uranium mining in the area insisting that the country need the uranium ore for its energy project. There was initial plan to fence the uranium mine site but that was not carried out. However, there is

restriction of visit to the site at the moment. In the past, anybody can visit the uranium mine site unhindered, but in recent times, members of the local communities have been witnessing increasing inflow of migrants to the area. As a result of this, the local communities with directives from the state government restrict strange visitors to the site, insisting that such person must obtain permission from the village head or local council authority before he/she can be allowed to visit the site.

3.5. Challenges

There are no bankable report on uranium deposit and their grade in Nigeria. Most of the uranium mineral were only reported from the aerial survey of the radioactivity in the country. Actual geochemical and geophysical analysis and estimate of the uranium ore grade and quantity of deposit has not been done (Interview, 2017a). The state lacks adequate records of mining activities and inventory of traded minerals and their impacts on the environment. The high level of ignorance of the local communities of the dangers and effects of radioactivity associated with the uranium ore deposits in the area is a source of concern. The local communities don't know what the miners are doing in the area or the impact of their activities. The miners themselves do not understand the full effects of their activities. They are busy mining the uranium ore in ignorant. They are carried away by the large amount of money paid to them. Uranium mining in the area is attracting inflow of migrants in the area.

The local communities attest to the fact that some white men came to the area and requested the village head to sell the uranium ore deposit at whatever cost but the village head declined.

4. DISCUSSION

The uranium mine site at Mika has been worked severally by different companies in the past and abandoned. No effort has been made to reclaim or clean up the site. This non reclamation of the abandoned mine site present environmental and health risk to local communities in the area. Abandoned uranium mines constitute great public health threat when they are left unreclaimed. The rocks extracted from the abandoned uranium mines and debris contains some quantities of radioactive materials such as radium and radon gas which are potential carcinogens.

Uranium mining has been described as one of the most dangerous type of mining activity because the radioactivity of the ore presents an intangible that cannot be chemically mitigated (Erin, 2013). The legacy of environmental impact from past uranium mining activity continues in the abandoned mine. Thus, uranium mine site requires adequate clean up to mitigate the effect of the legacies of past mining activities and practices.

The dependence of the surrounding communities on the collected water in the abandoned uranium mine pits for human consumption and domestic use is a potential source of threat to the health of the communities. This is because the collected water in the abandoned uranium mine pit may likely contain heavy metals such as iron, manganese, aluminium, copper, chromium, zinc, lead, vanadium, cobalt or nickel etc. The uranium ore deposit at Mika village is said to be stable at the moment which could be a factor to non visible health impact observed by the local communities.

5. CONCLUSION

This study has examined the potential impact of abandoned uranium mine pits in Mika village of Yororo LGA in Taraba State Nigeria. Findings from the study reveals that uranium ore has been mined for decades before it was abandoned in Mika village of Yororo LGA of Taraba state. The study shows that uranium mining is one of the most dangerous type of mining activity because the radioactivity of the ore presents serious public health challenges. One of the more significant findings to emerge from this study is that despite the risk associated with uranium ore deposit and mining activities, the local communities have not observed any strange health challenges related to radioactivity in the area. However, the non awareness of the local communities of the potential impact of the uranium ore deposit and mining in the area is a source of concern given the well known impact of uranium ore

deposit. The limitation of this study is the inability to carry out laboratory analysis of soil, water, crop and vegetation analysis of samples to determine chemical and radioactive elements present. This study has thrown up many questions in need of further investigations.

6. RECOMMENDATIONS

Based on the findings of this study, the following recommendations are suggested.

- i. The water resources, trees, agricultural crops and livestock produced in the area need to be monitored periodically to ascertain the possible effects of radioactivity associated with the uranium ore deposits in the area.
- ii. There is need for more detailed study on the physico-chemical characteristics of water sources and soil samples in the area to determine the trace elements present in the samples.
- iii. Effort should be made to educate and enlighten the local communities on the potential impact of the abandoned uranium mines on their land, soil, air and water.

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