

Environmental and Health Impacts of Mining in Nigeria: A Review

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Abstract: Mining is an important source of revenue of the economy in many developed countries. Nigeria is dependent on mineral exploitation for the diversification of her revenue from oil. Which diversification caused the mining sector to flourish. At the same time mining had serious environmental, health and social costs to the country that may increase dramatically in the next few years. The gap that must be addressed is the demand for solid minerals may lead to exploiting them without considering consequences and the absence of strict regulations to manage the sector. This paper notes that mining effects are destroying environment and threatening workers health in Nigeria. Deforestation, soil erosion, water and air pollution play significant roles in the threat to the health of workers and communities in close proximity to mines. Dust, noise, vibration and radiations have caused a number of respiratory diseases, hearing loss, high blood pressure, in several parts of the country. This paper concludes that Nigerian Government must implement firm regulations regarding mining safety and health practices in order to protect workers and the environment surrounding mining sites. These regulations should include standards that influence and develop risk management practices, establish requirements for site inspections, and positively impact worker health and safety.

Keywords: Mining, Economy, Environment, Health, Safety, Nigeria.

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I. INTRODUCTION

Natural resources are an important source of national wealth, which enhance the country's potential for economic growth around the globe. Mainly, solid minerals, play a significant role in developing the economy of a country. Solid minerals can be a source of raising the national income and earning foreign exchange, can provide employment and is an economic driver for other industries which increase sources of revenue. Nigeria is endowed with a large reserve of solid minerals, including, but not limited to, precious metals, stone, and industrial minerals (KPMG, 2014). There are over 40 different types of minerals spread across the country, including gold, coal, barite, bentonite, bitumen, limestone, tantalite/columbite, iron ore, lead/zinc, gemstones, marble, granite, gypsum, lithium, talc, silver, etc. Uriah Alexander (2018), stated that less than 5% of these minerals are currently being mined, processed and marketed. These include coal, kaolin, barite, limestone, dolomite, gypsum, feldspar, gold, iron ore, lead-zinc, tin, and niobium and tantalum ores. The remaining 95% of mineral ores, though in demand are untapped. Obaje (2009) stated that all the states of the federation have a share of the nation's mineral inventory. Nwachukwu and Agom-eze, (2017) submitted that the government of Nigeria has affirmed consequently its commitment to the exploration and development of solid minerals and metals by approving a N30 billion financial intervention, and prioritized for exploitation seven strategic minerals of vital importance to the economy, i.e., coal, bitumen, iron ore, barites, gold and lead/zinc which are available in ample qualities to sustain mining activities. Mineral resources are an important source of wealth for a nation, but before they are harnessed, they have to pass through the stages of exploration, mining and processing (Brooks 1974). These processes have impacts on the environment and on health of workers and people leaving surrounding mining areas. Ndinwa and Ohwona (2014), stated that the degradation of the environment have in turn affected agriculture, vegetation, wild life and even pose a threat to the health conditions of mine or quarry workers and every other persons living within the surrounding environment. This paper attempts to review the above mentioned impacts of mining in Nigeria.

II. MINING PROCESSES

Mining or exploiting minerals is the extraction of ore minerals through mining. As it is defined in the Indian and Northern Affairs Canada (2007), mining is the extraction and concentration of minerals of economic value from a mineral deposit. The extraction can be done with two different methods as was submitted by Hartman and Mutmanky (2002), that traditional exploitation methods fall into two broad categories based on locale: surface or underground. Surface mining includes mechanical excavation methods such as open pit and open cast (strip mining). Underground mining is usually classified in three categories of methods: unsupported,

supported, and caving. The selection and implementation of a particular mine plan should always have the aim of mining a mineral deposit with a maximum profit and taking in consideration the unique characteristics of the deposit and its location, prices of the mineral in the international market, and the restrictions enforced by safety, economy, and the environment. Each of many mining methods have varying impacts on the environment and health.

2.1 Surface Mining

Younger et al., (2002), submitted that 80% of the global production is performed by surface mining methods. It can be divided into mechanical excavation and aqueous excavation. The mechanical excavation class consists of open pit mining, quarrying and open-cast mining (Hartman & Mutmanský 2002). Surface mining is usually employed to exploit a near-surface deposit or one that has a low stripping ratio. It often necessitates a large capital investment but generally results in high productivity, low operating cost, and good safety conditions.

2.2 Underground Mining

Underground mining is the process of extracting minerals and ores that are buried too far underground to be mined using surface mining methods. The primary objective of underground mining is to extract ore from underground as safely and economically as possible while producing as little waste or tailings as possible.

III. ENVIRONMENTAL IMPACTS OF MINING

3.1. Deforestation

Many of the minerals that are currently mined are located in forests. Mining these deposits causes deforestation, according to the Global Forest Atlas, mining is responsible for seven percent of the deforestation in the sub-tropics. It was recorded in many countries in the world that thousands of square kilometres of forests were lost because of mining. According to Global Forest Atlas, Seven-hundred fifty-thousand hectares of Canadian boreal forests have been lost since 2000 due to tar sand production. There are other studies in the developed countries that give the exact number of the land lost because of mining every year. In Nigeria there are no exact numbers but some studies observed that deforestation is obvious in some areas where mining or quarrying takes place, most likely establishing cause and effect. Ogunwale (2015), submitted that Mineral/Oil exploration activities in Nigeria are major causes of deforestation, especially in the Niger Delta region. Ndinwa and Ohwona (2014), observed in a study that was done in Northern Edo State that large areas of land have been cleared, consequently destroying the forest that many animal species depend on for food and habitation. And they emphasised that it disrupts the balance in the ecosystem and many species known to inhabit this environment may have migrated away or are exterminated.

3.2 Erosion

Strip mining is a particular type of mining that is responsible for soil erosion all over the world. But in Nigeria the excavation of sand for building purposes is the most common cause of soil erosion, as Ndinwa and Ohwona (2014) observed, that in the area underlain by sedimentary rocks such as Afowa, Ayoguri, Fugar and Apana, sand excavation has caused considerable damage to the land. Also Ako et al. (2014) submitted that mining of sand and gravel in Luku area, Niger State, resulted in destruction of vegetation thereby destroying the natural habitats of some animals. Some very important plant species are also destroyed and the soil is exposed to erosion.

3.3 Agriculture and Water Pollution

Agriculture and water are the two most important necessities in human life. Food security is based on agriculture and water. Arokoyo (2012), stated that Nigeria is a vast agricultural country “endowed with substantial natural resources” which include: 68 million hectares of arable land; fresh water resources covering about 12 million hectares, 960 kilometres of coastline and an ecological diversity which enables the country to produce a wide variety of crops and livestock, forestry and fisheries products. But the two important necessities in people’s life are threatened by mining operations in Nigeria. Jibiri et al. (2007) and Jibiri and Agomuo (2007) observed that the traditional farming system of the indigenes in Jos-Plateau, has become distorted today as a result of shortage of land caused by mining operations, so that the agricultural yield of communities neighbouring mining sites has been reported to be very poor. Adegboye (2012), stated that the Jos-Plateau area has experienced varying degrees of farm land reduction by tin mining activities ranging from soil erosion problems, swampy nature of neglected mined excavation, mine dump, pits and industrial use of the arable land. He also concluded that these activities, in turn result in low productivity in crop farming. The agricultural sector in some parts of Nigeria is affected by mining directly as discussed earlier and is affected indirectly by affecting water used by farmers. Unfortunately people surrounding mining areas use the contaminated water not only for

farming but also for every other activity including drinking. Ako et al., (2014) stated that sediments from mines transported into rivers and wetlands are significant source of water pollution in Nigeria. Both surface and ground water quality are affected through contamination with suspended and dissolved minerals.

3.4 Air Pollution

Air pollution is one of the results of mining that accompany every mining stage from planning to the closure. The associated dust generated by mining makes a major impact on the environment and worker's health. Dust results from almost all mining operations from drilling to blasting and crushing, fine particles of dust are released and spread by wind, which affects not only humans but also animals and vegetation. Ndinwa and Ohwona (2014), observed the air pollution's role in Auchi, Edo state, on the poor quality of nearby vegetable garden grown around factories or mining sites. Besides the adverse effects of dust generated by mining, the burning of the fuels used by generators and heavy-duty vehicles in quarries and processing sites has contributed tremendously to the increase in carbon dioxide in the environment. The increase in carbon dioxide production is significant because of its potential for raising the temperature of the earth through the process known as the "greenhouse effect" Dzigdodi-Adjimah, (1996). This was corroborated by Adiuku-Brown (1999) when he reported that Carbon dioxide in the atmosphere prevents the escape of outgoing long-wave radiation from the earth to outer space; as more heat is produced and less escape, the temperature of the earth increases. Air pollution has a huge effect on the environment and people's health. The generation of dust by mining clearly impacts people's health without mitigating measures.

IV. IMPACTS OF MINING ON HUMAN HEALTH

According to Stephens and Ahern (2000), mining remains one of the most hazardous occupations in the world, both in terms of short-term injury and loss of life, but also due to long-term impacts such as cancers and respiratory conditions, including silicosis, asbestosis and pneumoconiosis. Hermanus (2007), submitted that major health risks encountered in mining include airborne pollutants such as silica dust and coal dust, noise, heat and vibration. Other significant health risks include chemical risks, which are not related to underground air pollutants or gases, skin disorders, ergonomic stresses, ionizing radiation and, in the diamond sector on the west coast of the country, decompression illness associated with diving. The majority of these health risks are a result of air pollution in mines mainly dust.

4.1 Dust

According to Hartman et al. (2012), dust consists of solid particulate matter suspended in a gas. Dusts constitute the most common aerosol problem in the mineral industries and are usually formed by fragmentation processes such as drilling, crushing, and grinding but can also result from re-suspension due to equipment operation or air movement. Dusts particles vary from 1 to 100 μm (micrometre) in diameter, but the size range is normally 1-20 μm . A dusty mine atmosphere may overload the respiratory system, resulting in an inadequate capability to handle all the dust that is deposited in the lungs. It is then that lung diseases normally develop (Hartman et al., 2012). Depending on the type of minerals that are excavated miners are exposed to different types of dusts, and each type of dust causes a different disease. Merchant (1986), listed some of the more prevalent mineral-related diseases and the dusts believed to be the cause of them:

- ❖ Silicosis (dusts of quartz, tridymite, and cristobalite)
- ❖ Silicate pneumoconiosis (dusts of silicate minerals such as kaolin, talc, tremolite, actinolite, and anthophyllite)
- ❖ Asbestosis (asbestiform dusts such as dusts of amosite, chrysotile, and crocidolite)
- ❖ Coal workers' pneumoconiosis (coal dust)
- ❖ Beryllium disease (dusts of beryllium compounds including ores)
- ❖ Siderosis (dusts of iron including ores).

Out of these diseases, silicosis and coal worker's pneumoconiosis are of most importance and common in mines. In Nigeria, Akabzaa and Darimani (2001), reported that gold mining activities are, no doubt, the major cause of silicosis and silico-tuberculosis that has been reported in mining areas in Zamfara, Oyo, Ishiagu and Enyigba, where dust from gold mining sites has high silica content. Moreover, Aigbedion (2005), stated that in Sagamu and Ewekoro, Ogun state, records of people living with eye pain, asthma and respiratory attack of all kinds have since emanated from adjacent communities owing to the activities of industries (cement factories) and mining operations. Individual workers or people living close to mine sites cannot know ahead of time whether they are predisposed to develop lung disease. Hence, it is important for the company to protect its workers and for the workers to protect themselves. To do so, it is a must to control the dust, which cannot be done without identifying the source of dust. The use of water is one of the most common and effective methods

of controlling dust in mining operations. But there are many dust control technologies, including, prevention, removal, suppression, isolation and dilution (Hartman et al., 2012).

4.2 Noise

Noise is one of the major environmental hazards that results from the quarrying of rocks in many parts of Nigeria. Noise is generated during mining processes such as excavation, drilling and blasting of the crystalline rocks with explosives. Noise is also generated through the movement of heavy-duty trucks, as well as mineral processing machines and power generated by diesel generators. All these operate for several hours a day. The noise emanating from these activities constitute a nuisance not only to the mine workers, but also to the inhabitants living around the quarry sites. According to World Health Organization (2004), noise in the workplace is responsible for the most prevalent occupational impairment, hearing loss or permanent deafness. The International Coordination of Environmental and Occupational Control activities, which is guided by WHO carried out studies in several parts of the world with similar problems. Their findings showed that exposures of mine workers and the inhabitants of the mining areas to high noise levels enhance the development of psychological problems among a few people, increased irritability among many and resulted in slow reaction time and general fatigue among most inhabitants of the area.

4.3 Vibration

Exposure to high amplitude whole-body vibration has been identified as a significant risk factor in the development of musculoskeletal disorders and associated health problems (Griffin 1990). including loss of visual acuity, loss of postural stability and manual control, low-back pain, early spinal degeneration and disc herniation (Bernard, 1997). Donoghue (2004), observed that whole body vibration is commonly experienced whilst operating mobile equipment, such as load-haul-dump units, trucks, scrapers and diggers. This can cause or exacerbate pre-existing spinal disorders. Poorly maintained roads and vehicles contribute to the problem. Hand-arm vibration syndrome is also encountered with the use of vibrating tools such as air leg rock drills (Dasgupta and Harrison, 1996). In Nigeria, Melodi (2017), conducted a study about a quarry operation in Ogun State and observed that vibration can affect not only the mine workers but also the people surrounding the mine in terms of health and properties. This assertion is supported by observations that the vibration and air blast produced by the quarry caused cracks to form in buildings of the indigenes and that buildings that are very close to the quarries suffered much from breaking of glasses and other glass wares in their homes.

4.4 Radiation

Mining activity can cause environmental pollution through most of the accessories minerals which are harmful even in low concentrations to human beings and to animals. The mining of mineral resources also facilitates the release of radioactive materials from the host minerals into the environment (Eisenbud and Gesell 1997). Mining some minerals that are radioactive involves the removal of large amount of soil which contain radioactive materials, the possibility of their intake by humans through the food chain is understandable. Following the build-up of these chemical agents in the biosphere (air, water and soil) against biotic life, their radiation effects are said to be concentration dependent (Ademola, 2008). Aigbedion and Iyayi (2007), reported that exposure to natural radiation emitted by some radioactive minerals is a major source of health hazards. The radiation intensity increases when the minerals are concentrated. Aliyu and Ramli (2015) opined that the emitted radiation induces change in immunology, physiology, point mutation and increase in disease frequency. In Nigeria, it has been established that some minerals such as monazite, pyrochlore and xenotime, which are obtained as by-products of tin mining in the Jos Plateau, are radioactive. Because of lack of market, most of these minerals, which were in the form of concentrate, are abandoned in many previous mining sites on the Plateau. Some of these sites had mining communities, which developed into villages where a high level of radiation has been recorded. A few of such villages have been abandoned or nearly deserted because of the death of many people under mysterious circumstances. The mysterious deaths are now attributed to a high level of radiation released by monazite-rich sand used for building the houses the deceased lived in (Aigbedion, 2005).

V. CONCLUSION AND RECOMMENDATIONS

The exploitation of solid minerals in developing countries including Nigeria is associated with high environmental and health impacts during all its stages. Mining operation from planning stage to construction to extraction and processing till charging and hauling, it all contribute in the degradation of environment and have, in turn, affected agriculture, vegetation, wild life and even pose a threat to the health conditions of the mine or quarry workers and every other persons living within the surrounding areas. This is perceptible in the environmental damage of those areas which vary from deforestation, soil erosion, water and air pollution and significantly impact the health of workers and people who live in communities nearby mines through dust,

noise, vibration, and radiation. Such impacts include a number of respiratory diseases, hearing loss, high blood pressure, and intensive noise all of which can lead to death. This paper concludes that Nigerian Government must implement a system of strict regulations regarding mining impacts in order to protect workers and the environment surrounding mining sites. These regulations should establish standards that influence and develop risk management, site inspections, increase health and safety of workers. Mining companies should be aware of the consequences of workers health and safety and its impacts on their productivity which, hopefully, will encourage them to train workers and help them in protecting themselves from work risks.

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