PHYSICAL IMPACT OF MINING ON THE ENVIRONMENT: A CASE STUDY OF IRON ORE MINING ITAKPE, KOGI STATE

BY

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DECLARATION

I hereby certify that this project is an original work undertaken by me and has been prepared in accordance with the regulations governing the preparation and presentation of project in the School of Postgraduate Study, Federal University of Technology, Minna.

Hau9 23/12/04

Opaluwa Hauwa

CERTIFICATION

This is to certify that this project was carried out and written by me, Opaluwa Hauwa that it has been read and approved by the internal and external supervisors and by the Head of Department Geography for the award of Postgraduate Diploma in Environmental Management.

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DEDICATION

This project is specially dedicated to my beloved husband Mallam Y. D. Opaluwa and my dear daughter Queen Amina Opaluwa.

ACKNOWLEDGEMENT

My foremost gratitude goes to Allah Subahanahu Wata-Allah for making it possible for me to see the successful completion of this programme (P.G.D. Environmental management) and for all his mercy, love, care, provision and favour over my life, which is indeed beyond human imagination, in all, I give him all the honour, glory and adoration.

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ABSTRACT

Mining activities constitute a serious problem in the strive for environmental conservation, therefore assessment of it impacts on environment need to be carryout at regular time interval. In order to do this, the nature of the impacts must be first identified, that is why the primary aim of this project is to identify the physical impact of mining on the environment.

In order to achieve this aim, iron ore mining project, Itakpe in Kogi State was selected as a case study. Direct personal observations are carried out during, which eight mining sites were visited.

Oral interview was also conducted amongst the staff of the company and the inhabitant of the Itakpe community. The company's handbook and other journals, textbooks and magazines were also consulted.

From the results, it was concluded that mining has a lot of adverse physical impacts on the environment such as erosion, land degradation, pollution etc.

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INTRODUCTION

1.1.1. BACKGROUND

Mining can be defined as a deep excavation in the earth by underground working to extract minerals-metals and metallic ores Clark (1992). This could be achieved by either underground mining method or surface, strip or open cast mining method, depending on the nature of deposit. Mining being and ancient industry has been one of the major traditional occupation since early human history, However the traditional occupational techniques of those days given way for the contemporary techniques involving the use of heavy duty equipment for excavation, drilling and processing. In short, this operations is not limited to the Solid earth surface alone as the marine environment are also greatly affected due to submarine drilling for oil minerals exploitation and exploitation.

Mineral resources are of high economic values especially the high class minerals like Gold, Diamond, and Gemstones, even the less precious minerals also have a significant economic values.

Nigeria is a nation blessed with abundant mineral deposit and predominant among these minerals are:-

i. Hydrocarbons such as petroleum, gas, coal uranium e.t.c

ii. Metallic minerals such as Iron Ore, tantalite, gold e.t.c.

iii. Industrial minerals such as marble, limestone gypsum etc.

These are widely spread across the length and breadth of Nigeria and thus explain why mining activities take place virtually in every part of this country today. Sequel to this, it is worth mentioning that Nigeria government dives into the industry slightly in the 1960's

and with all seriousness in the early 1970s starting with oil minerals, then solid minerals which gave birth to the Iron Ore mining company at Itakpe among others due to the expected high revenue generation both locally and at international level. Therefore, the mining Sector has greatly contributed to the Socio-economic and infrastructural development in Nigeria.

In view of this great economic potentials in the Industry, several private individuals and Co-operate organizations are seriously involve in mining activities so much that they are found almost in every part of Nigeria; where some are legally certified others are illegal. However, no matter what method of mining adopted by them or the kind of machines in use, whether legal or illegal, there is usually a great adverse impact on the environment. Unfortunately, most of these organizations including the government owned agencies in the mining industries are not so mindful of the damage caused to the environment.

Some of these impacts include:

- Pollution of Surface and ground water
- Destruction of the natural land scope and terrestrial habitat
- Air pollution (Particulate and gaseous erosion causing \green house effect.
- Underground water depletion.
- Destruction of Bio-diversity
- Hazardous waste management problems
- Ecological disaster e.q. Erosion.

Nevertheless, the fact the hazards of mining to the physical environment are known and recognized in most developing countries like Nigeria not withstanding. There is lack

of Co-ordinating effort to assess the environment impact of mining. Neither is there any proper guidelines to enable government and mining companies adopt a good environmental habit. Hence, the need for this research cannot be over emphasized.

1.2.0. AIMS AND OBJECTIVES

The aims of the study are to identify/ascertain the physical impact of mining on the environment.

The objectives therefore were:-

1. To closely examine the mining methods adopted in the study area.
2. To examine the possible environmental impact on both man and his environment.

1.3.0. STATEMENT OF RESEARCH PROBLEMS

The study area is faced with serious envirmental problems such as structural deformation, ecological problems, land, water and air pollution as well as reduction in land availability for agricultural and other uses etc.

In view of these predicaments there is need for the extent of the impacts and their sources to be identified and ascertained. This, therefore forms the basis and in short the cardinal problems for this research.

1.4.0. SCOPE AND LIMITATION

The Scope of the study is limited to identifying and ascertaining only the adverse physical impact of mining and the extent of such impacts on the environment. Proper environmental impact assessment of the study area shall not be conducted, as analysis of impact parameters shall be left out in this work.

However the limitations of this study lies in the lack of adequate literature and materials, which make the entire exercise tedious and cumbersome. Also the

management and staff of the Iron - Ore mining company were so reserved in letting out information.

1.5.0. JUSTIFICATION

The fact that mining constitute a major problem to the environment is not an over statement as it has caused and is still causing much deformation to the environment. Some of the peculiar environmental problems which necessitate this research work include, water pollution as a result of in flow of sediment from the mining activities. Air pollution due to dust, erosion menace, reduction of agricultural land due to the mining activities and other numerous problem arising from mining in the study area. Unfortunately. Mining activities cannot be totally taken out of our system. However, the act of sustainable development encourages the use of land without jeopardizing the further use of such land for future generations.

In view of these, there is need to develop a proper conservation policy, hence the justification of this study.

In addition, the research is hoped to:-

i. Assist decision makers in taking decision as to the effective use of our mineral resources without causing damage to the environment.

ii. Serve as an aid to environmental impact assessment of the study area.

iii. Enables the stakeholders in mining industry to be environmental consciousin their operations.

1.6.0. DESCRIPTION OF THE STUDY AREA

1.6.1. LOCATION:

The study area Itakpe is located in latitude 07" 42'N and longitude 06"20'E at a distance of about 50km South-West of Lokoja the kOgi State Capital. The settlements selected for this study included the Itakpe Camp I and Camp II which host the staffs and Abobo village which is one of the host communities, all of which are located along – Okene express way. Their selection is due to their proximity to the mining sites. See Fig I for locational map of the study area.

1.6.2. CLIMATE & RAINFALL

Because of the proximity of the study area to Okene, the rainfall figures for Okene was adopted for the study area. This is said to be about 1225 – 1230m^3 per annum. However, the double maximum regime which is so prominent in the south Western Nigeria while its intensity reduces north and eastwards in vertically not noticed in Okene and hence in the study area.

The rainy Season range between late march and September (the wettest month as rainfall figures stand at over 8 inches). Nevertheless, the dry season usually commences from November to early March, during which the area is characterized with high temperature of about 98° f, during this period rivers and streams dry up and water for domestic and other used become problematic.

1.6.3. VEGETATION

The climate and Soil conditions are favourable for dense Savana woodland, but long years of human influence has rendered it an open Savanna woodland. Through high

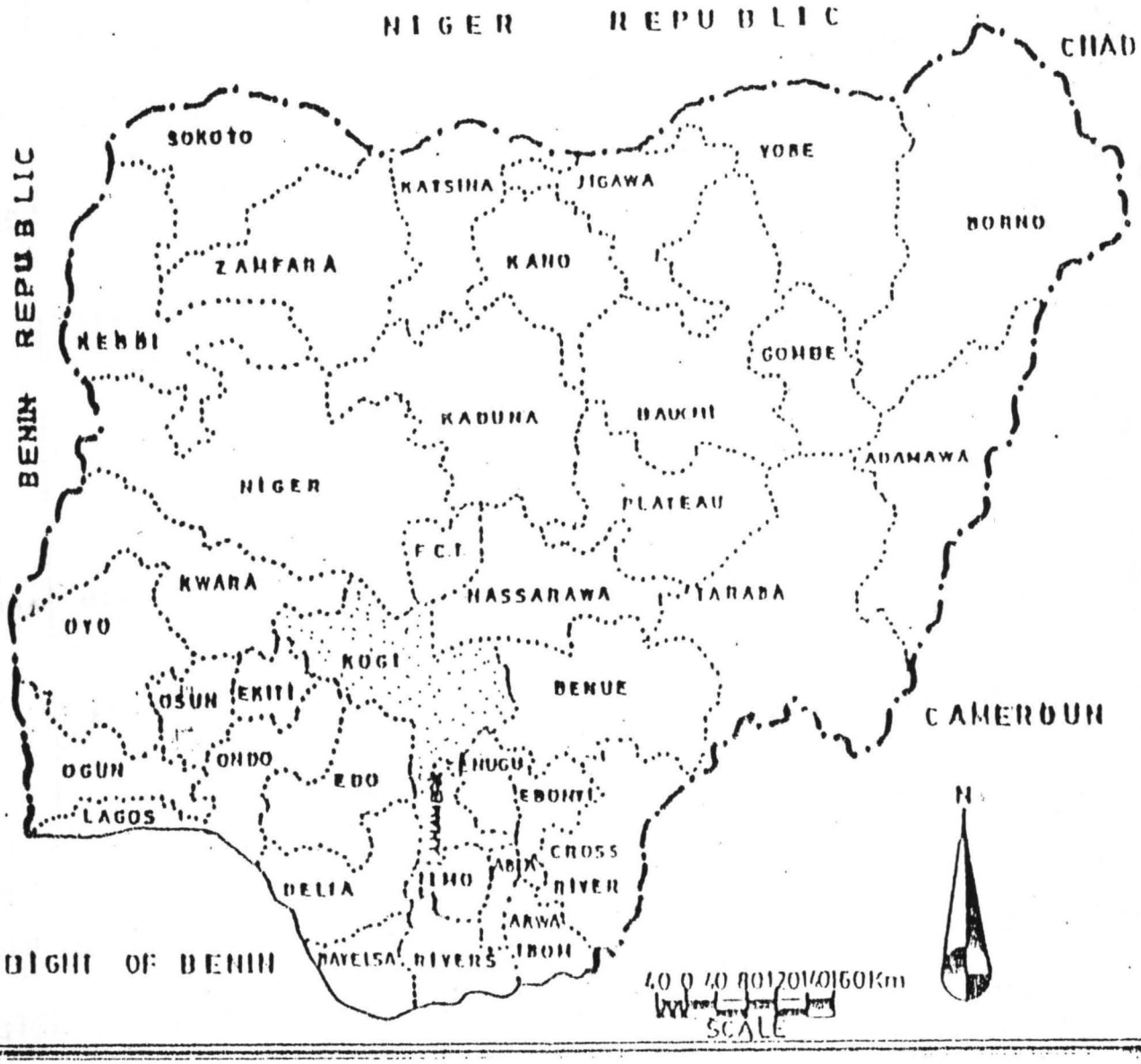

Fig. I MAP OF NIGERIA SHOWING THE STUDY AREA

forested type of vegetation are found around stream, valleys, tall grasses and trees with crooked stems are predominant in the area.

1.6.4. TOPOGRAPHY OF THE AREA

The terrain topography is of characteristic massive ridges and hills combined relatively plane terrain with average elevation of about 1,200ft and the peaks rising as high as above 200ft and the peaks rising as high as above 2000ft. However, the aesthetic rights of the hilly terrain is drastically giving way for the mining activities leaving behind an open difficult terrain; taken over with different forms of erosion channels. Although there is a good road Network linking the study area to other part of the country, but the feeder roads linking villages to villages and one mines pit to another are two difficult to come by.

1.6.5. GEOLOGY OF THE AREA

The geology for the study area indicates that the Itakpe Iron Ore deposit is of a pre cambia Iron formation of migmatite-gneiss of the basement complex of Nigeria. This comprises of over twenty five (25) individual ore bodies.

Fourteen (14) of which are most prominent and these are all inter banded with migmatites gneisses, Schist. Amphibolites, quartzite and in some places. Intruded by granites, pegmatite's and appetites. All these form a ridge stretching over four kilometers (4km) long and trending in a east-west direction and dipping South wards. Although the are bodies outcropped on the surface in some places, while it is covered by over burden that could be as much as 3 meters in other places.

1.7 0. HISTORICAL BACKGROUND OF ITAKPE

The Itakpe hill which host the bulk of Iron-Ore deposit was named after an Ebira traditional priest called "Itakpe". It was discovered as a great source of Iron Ore since 1905, before this time, however the indigenes were already involved in the mining of the Ore locally using it to produce iron implements in their small local furnaces. This was by direct reduction process using charcoal as reducing agent. The mud of the hill was removed in 1982 to give way for mining development. Also remains of clay pipes, Iron Slag's, round quartzite and quartz pebbles probably used for grinding are still seen around all the ore sites as artifacts.

The Federal government conceived the idea of setting up an Iron-Ore mining Company following the positive result obtained in 1963 from the interpretation of aerial photographs by the Federal surveys of Nigeria as 1:250,000 series, Topographic sheet No.246 (Kabba South East). Sequel to the foregoing development, the federal government promulgated the decreee No.19 of April 14th 1971, establishing the Nigeria steel development authority (NSDA) to plan, operate and maintain iron and steel plants in the country as well as to carry out steel raw material surveys, suitability tests and mining operations to guarantee adequate raw materials feed to the Nigeria Steel industry.

In trying to achieve these goals a combined team of geo scientists from the NSDA and TIAJPROMEXPORT (TPE) of the former USSR embarked on the mineral exploration of Itakpe hill ferruginous quartzite deposit between 1971-1978.

However, on the 19th – December 1979, decree No.60 was again promulgated, dissolving the NSDA and establishing six companies among which was Associated Ores

Mining company limited (AOMC). It's responsibilities was in the field of mining and production of Iron Ore and other mineral raw materials needed for steel making.

In order to minimize overlap in functions, the parent ministry of power, mines and steel rationalizes the roles and responsibility of its parastatals in February 1987, during which AOMC was renamed as national Iron Ore Mining Company limited (NIOMCO).

Nevertheless, in order to enhance adequate finding of the company at the stage it was then, and to facilitate its speedy completion NIOMCO's, Board of directors were dissolved by the Ministry and renamed the Company as National Iron, Ore Mining Project (NIOMP) in March, 1992. However, it was finally return to us status quo (NIOMCO) during the commissioning in December, 1992 after completing the Beneficiation/Mineral processing plant.

The original indigenes of the study area are the Ebiras, they are predominantly farmers, traders and they also engage in illegal mining activities.

CHAPTER TWO

2.0. LITERATURE REVIEW

Mining as an occupation is so detrimental to man and the entire environment, no matter, the mining method adopted or the equipment use for the operations. It therefore, implies that man, being a key player in the environment must fast to see to the measures that could be most appropriate to minimize or prevent the furtherance of this devastating situation.

Rzhevsky (1985) in his books "Open Cast Mining" defines open Cast mining as the totality of open pit operations which are aimed at extracting various rocks from the earth and creating pits and excavations. Depending on the working site, open cast mining of a mineral deposit he said, includes stripping mining proper and development work. He further added that the sequence in which the operations involved in open cast mining are accomplished within the limits of a quarry field or its districts is known as the mining System The mining system adopted at a quarry must ensure safe, systematic and efficient execution of mining work, the required quarry production utilization of all mineral resources and environmental control.

In view of the foregoing assertions, open cast mining is no less detrimental to the environment than any other mining techniques. This is the mining method adopted for exploitation of the iron ore deposit at Itakpe due to its occurrence close to the surface. Consequently, the extensive landscape destruction and coverage of mining spoils and tailings which characterized the environment of the study areas, speaks for itself, much of the submissions of Rzhevsky. Therefore, in line with the author's observations. It will be of great benefit to the society, if the organization (NIOMCO) could ensure

environmental control as they go about ensuring complete extraction of the iron-ore deposit at Itakpe.

Furthermore, in the work of Ajeagbu (1981), greater part of the plateau region was classified as either unsuitable for cultivation or as areas with limitation on cultivation or even as land with few agricultural development programmes. This he said was due to existence of too many rock outcrops and mining waste on lands. Especially from tin mining in Jos. This is therefore, an indication that there is limited available agricultural a land due to encroachment from mining activities in the region as is the case in Itakpe.

Also, in conformity with Ajeagbu (1981) assertions, NEST (1991) in its work, Nigeria's threatened environment observed that land degradation is pronounced in some mining regions like the Jos Plateau where open cast mining of tin has been going on for several decades and in several Areas. On the Jos plateau in particular was said to be characterized with tremendous amount of scarification of land surface due to existence of numerous mine pits of various sizes abandoned, many of which contain permanent water bodies which are a veritable breeding ground for mosquitoes that cause malaria and yellow fever, hence they constitute permanent physical damages for both man and livestock. Stressing further, it was affirmed that apart from the abandoned pits and ponds, there are hill formed by excavated materials during mining operations and these greatly disturb the movement of people and livestock as well as rendering the land where they occur unsuitable for agriculture, settlement, industrial development etc.

The foregoing presentation gives a clear insight into the present problems in Itakpe, although the actual mining operation in the study area commenced in just about two decades ago, but the level of damage done to the environment so far is not much less than

that of Jos as described above, it is therefore an indication that the situation of Itakpe shall be worst than that of Jos if it is left unattended to for as long as the case of the tin mining in Jos.

Similarly, in the pioneer survey of the black country, Beavers (1984) described a degraded land as derelict land which he defined as land damage by extraction or other industrial processes or other form of urban development which is faulty of special action. In view of this definition by Beavers (1984), the land in the study area could best be described as derelict land especially as the activities of the mining company did not seen to take the provision of mineral act of 1946 which control mining and reclamation of derelict land in Nigeria serious.

Also, in the publication of food and Agricultural Organization (FAO) in 1982, it was stressed that greater parts of tropical land are cleared of their natural cover and a significant number of plants and animal species are in extinction. This is exactly the situation in Itakpe as very large areas of land are cleared to remove over burden and enhance complete extraction of material.

According to Strahler (1975), atmospheric pollutants, are of both natural and artificial origin and that man's activities can supplement the quantities of natural pollutants, present. He further asserted that mining and quarrying operations send mineral dust into the air, during which he said countless thread like minerals particles are sent into the air and that these particle travel widely and are inhaled by humans, lodging permanently in the lung tissue which indeed brings about serious health hazard on the victims.

Considering the magnitude of dust generated in the study area during mining operations especially in the dry season, it will not be out of place to say that the inhabitant of Itakpe are under serious threat of a similar health hazard as cited above.

Going by the submissions of the various literature cited above, especially as in two previous works cited (FAO and Strahler) above, it is in the best interest of man to conserve whatever species of plants and animals that are presently yet untouched. Unfortunately the search for means of sustenance have left this great dream unrealistic just it could be clearly seen in the study area. Also, unlike other mining environment (like Jos) where much work on the impacts of mining on the environment has taken place, not much of such similar work is known to have been done in the study area. This indeed, is the motivation for this research.

CHAPTER THREE

METHODOLOGY

3.1 DATA SOURCES:

In order to ensure collection of reliable data for the purpose of this study the two basic methods of data acquisition were employed these are primary and secondary methods.

3.2 PRIMARY DATA COLLECTION AND TREATMENT

This involves various approaches, however in the course of this work, direct personal observation and oral interview were used since emphasis is on the physical impacts.

3.2.1 Direct Personal Observation

This is otherwise refers to as reconnaissance survey: it was done to obtain first hand information and on the spot assessment of the physical situation of the environment. During this research the following parts of the study area were visited for observation.

- Various mining pits at the east and west sites of the company
- Beneficiation/mineral processing plant
- The company's waste dump
- Erosion Sites
- Streams
- The company offices and other factory premises
- The staff quarters and the village settlements (i.e Abobo and Ajabanoko village) etc.
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This afforded me the opportunity of having Snapshots of some visible phenomena in the area as could be seen in the plates annexed to this work.

3.2.2 Oral interview:- This went hand in hand with the reconnaissance survey. A lot of question was put across to the management and staff of the organization as well as the inhabitants of the host communities. The interrogation and discussions also reveal much problems affecting them to me.

3.3 SECONDARY DATA COLLECTION AND TREATMENT

At this stage of the research work, use was made of previous literature on similar problem conducted in other parts of the country. To this end some related texts and journals were consulted.

CHAPTER FOUR

RESULTS ANALYSIS

4.1.0 ANALYSIS OF FINDINGS

In the course of this research, various information were gathered at various stages of data collection, some of these information are as follows:

- It was observed that, the massive rocks of ore and waste are usually fragmented using explosive (blasting).
- That bulldozers are normally used to clean the surface at the initial stage of mining.
- The company has only two functional loaders and four functional dumpers. Therefore, loading and dumping of both waste and concentrates is usually by those few types of equipment supported by human labour.
- It was gathered that about seven million tones (7MT) of iron are produced per annum and
- That the waste over burden of about twenty eight million tones (28MT) are removed per annum, while the waste dump is designed to stock pile over nine million tones (9MT) of waste.
- River pompomi located behind the beneficiation plant of the company is one of the basic source of water supply to the villagers.
- Erosion channels were also a common scenes. See plate **1**.
- Mined pits were seen. See plate **2**.
- Land fillings is the reclamation technique adopted by the organization.

All these were some of the data acquired for analysis of environmental situation of the study area.

4.2.0 ANALYSIS OF RESULTS

From the foregoing findings, the analysis of impacts of some of the basic operation techniques on the environment of the study are as follows:-

TABLE 1: SHOWING VARIOUS PROCESS OF OPERATION TECHNIQUES AND ITS IMPACT ON THE ENVIRONMENT.

S NO	OPERATION TECHNIQUES	AFTER EFFECT	ENVIRONMENTAL IMPACT OBSERVED
1.	Surface clearing	Disappearance of floral and fauna, dust is release into the air etc.	Deforestation distortion, erosion, aesthetic of natural habitat, air pollution etc.
2.	Over burden removal.	Artificial steepy hills formed from dumping, dust also release.	Erosion channels of various types, aesthetic displeasure, etc.
3.	Drilling	Mining pits of various sizes, forming ponds of mosquito breeding.	Serious terrain deformation and danger of ill-health to man.
4.	Blasting	Severe vibration and sound produced.	Cracked walls, dilapidated buildings etc were the evidence of structural deformation seen. See plate 3, noise pollution from blasting, sound nuisance was said to be one of the impact testify by the inhabitant.

In addition to the above analysis, it was also gathered from the finding that in every seven million tones of iron ore produced per annum 28 million tones of waste over burden are removed. But the waste dump was designed to stockpile only over 9 million tones of waste, this is grossly inadequate because, the balance of 19 MT waste is too large a volume to overlook and this might be one of the basic reasons why mine dumps from artificial hills in some of the mining site which indeed has greatly change the landscape of the study area from that of a gently undulating topography to an open bare land with steep hills which encourages erosion and can even lead to flooding of the lower part of the area.

Other problems in the study area that were also carefully looked into in the course of this study are further discussed below.

4.2.1 POLLUTION PROBLEMS

As shown in summary of finding above (table 1) almost every stage of mining involve dust generation into the air, although water sprinklers are sometimes use to minimize the level of dust discharged but this cannot take care of the total discharge of dust and even smoke from machineries, this process is enough to infer that air is not free of being polluted.

In addition, the littered mining spoil waste discharge from the washing off of dumped overburden by rain led to the spreading of the iron particle, the black iron sediments are seen during raining season all over the places and even the bed of the stream of river (pompomi) and wells even the tap water as inhabitant of Itakpe complain bitterly that the water is hard, has taste and does not form lather easily with soap. In addition it reduces the life span of their storage materials. The severe noise pollution

PLATE 1: EROSION MENACE

PLATE 2: MINING PIT.

from blasting and vibration affect human hearing as much as it affects structure. See plate 3.

From the foregoing finding it could be inferred that air, water and land pollution are also faced by the physical impacts of mining.

4.2.2 EROSION PROBLEMS

This is another prominent problem in Itakpe. Erosion channels in the area is devastating as it is common to see rill or gully erosion(see plate 1), they were believe to become problematic as their source was traced to the mining project going on in the area. And which occurs as a result of clearing land before prospecting or removal of overburden. It could also be traced to steepy hills of the mine dumps.

4.2.3 FARMING PROBLEM (AGRICULTURE)

Large portion of agricultural land are capture as a result of this open cast mining.

During reconnaissance survey, large hectares of viable land for farming are reduced due to associated problem of mining like erosion discussed above. Soil nutrient are being washed away, living the top soil barren hence not suitable for agriculture see plate 5. Farmers were left with small portion of land and not fertile, hence this bring about the shortage of food stuff in the area for the workers and inhabitant, the implication is that the little food produced cannot go round and most people are force to travel to other places to buy food stuff. The migration of people to Itakpe in search of greener pasture also account for the high cost of living and feeding being experience in the study area.

PLATE 3: CRACKED WALL DUE TO VIBRATION FROM BLASTING

PLATE 4: HILLS FORMED BY EXCAVATED MATERIALS DURING MINING

PLATE 5: POOR VEGETATION DUE TO LOSS OF SOIL NUTRIENTS

4.2.4 HEALTH PROBLEMS

Occupational health hazards is one of the serious problems lamented by the mine workers, it was specifically revealed that the land filling adopted by the company to reform the mined areas is not properly implemented as tremendous amount of scarification of the land surface were seen, resulting in the existence of numerous mine pits of various sizes. Some of these pits, now abandoned are more than 10 metres deep and are over 50 metres wide. Many of them contain permanent water body which are a veritable breeding ground for mosquitoes that cause malaria and yellow few. All of them constitute a permanent physical danger for both human being and livestock.

Among these pits and ponds are hills formed by the materials excavated during mining operation, these hills greatly disturb the movement of people and livestock and, more important, make the places where they occur unsuitable for agriculture, settlement, industrial development. In conclusion, it affects all the realms of the environment.

See plates for some of the problems discussed above although restriction from the company as regards where to and where not to snap denied me of having pictures of some important scened discussed above.

In view of the above analysis of findings, it is evident that environmental pollution, ecological problems etc are prominent in the study area.

It is my belief that if the above recommendations are adhered and put into practice they would go along way towards improving the situation of the study area.

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