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The Impacts of Mining Engineering Activities on the Survivability of Nigeria Ecosystems

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ABSTRACT: Mining Engineering in Nigeria has the capacity of providing huge economic benefits. However, the colossal effects of mining engineering activities in Olapeleke, Ewekoro suburb were investigated. A structured questionnaire and Environmental Impact analysis (EIA) conducted revealed that the alkali Oxides (K_2O and Na_2O) contaminates water consumption effluence from the Ewekoro plants. This had led to Gross unemployment, inadequate livelihood opportunities; set back in education, poor governance and legislation also had inevitably posed band-wagon effects on our other capabilities in the humanities for instance. This inadvertently present new threats to the survivability and sustainability of our marine and ecosystems Consequent upon the foregoing the paper intends to adopt mathematical and statistical approach in proffering solutions to the impending challenges.

Keywords: Mining, Ecosystems, Urbanization, EIA, Deforestation, Survivability

I. INTRODUCTION

Mining engineering is an engineering discipline that involves the practice, the theory, the science, the technology, and application of extracting and processing minerals from a naturally occurring environment. However, mining engineering is associated with many other sister department within like geology, mineral processing and metallurgy, geotechnical engineering, surveying. With the process of Mineral extraction, some amount of waste and uneconomic material are generated which are the primary source of pollution in the vicinity of mines. Mining activities by their nature cause a disturbance of the natural environment in and around which the minerals are located.

Ewekoro is one of the major mining zones in Nigeria. It is a Local Government Area in Ogun State, Nigeria. Its headquarters are in the town of Itori at 6°56′00″N 3°13′00″E / 6.93333°N 3.21667°E. It has an area of 594 km² and a population of 55,156 at the 2006 census (Fig. 1). This location, somewhat seemed to be responsive to the need and yearnings of an emerging independent nation in 1960 with the exploration of an abundantly available limestone deposits. Nigeria is endowed with abundant mineral resources, which have contributed immensely to the national wealth with associated socio-economic benefits. Immediately after the independence there was a need to for Nigeria to begin harnessing her resources for nation socio-economic development. [1] [2] observed that mineral resources are an important source of any nation's wealth but before they are harnessed, it must undergo exploration, mining and processing. Mining in a wider sense includes extraction of any non-renewable resource such as petroleum, natural gas, or even water. This over the years had been beneficial to the economic growth or precisely Growth Domestic Product, (GDP) before the oil exploration at Oloibiri at Port-Harcourt) in 1950.

The activities are expected to change the fortunes of the inhabitants and preserve the ecosystems. Unfortunately, there is a contrasting phenomenon which imposes a potential negative impact on the environment both during the mining operations and for years after the mine is closed. This impact has led most of the world's nations to adopt regulations designed to moderate the negative effects of mining operations. Safety has long been a concern as well, and modern practices have improved safety in mines significantly. This invariably affects the ecosystems which mainly consists of the study of certain processes that link the living, or biotic, components to the non-living, or abiotic, components. These plants and animals depend on each other to survive for the benefit of the residents. They are all sources of economic growth. Their extinct can be colossal and the attendant effects on human health.

Fig. 1: Location Map of Ewekoro and environ

Fig. 2: Ewekoro Cement Plants

Posted By: Olatunji OLOLADE and Kunle AKINRINADE on: September 06, 2014In: Saturday Magazine No Coutesy:http://en.wikipedia.org/wiki/ewekoro

Pix : Coutesy of The Nation, (One of the most and widely read Nigeria's Daily) Posted By: Olatunji OLOLADE and Kunle AKINRINADEon: August 16, 2014 In: Saturday Magazine Consequently, several large scale industries were built by the various levels of governments and individual that was desirous of quick industrialization. One of such industries is the Ewekoro Cement Plant in Ogun State. Olapeleke was a small community of about 20, 000 people in the Ewekoro Local Government Area of Ogun State, Nigeria. Prior to the arrival of the West African Portland Cement (WAPCO), now Lafarge-WAPCO, the township boasted of a rich endowment of natural resources and agricultural cashcrops, including cocoa, kolanut, cocoyam, cassava, rice (its fabled highly nutritious and expensive ofada rice), tomatoes, pepper, groundnut, plantain, sugar cane, maize to mention a few. However, the township's most valuable and expensive natural endowment is its abundant limestone deposits. Olapeleke sits atop limestone, the major raw material used in the production of cement. When the discovery of the natural resource in the Ewekoro Township became public in the early 1950s, residents of the community anticipated a remarkable fillip to their thriving agricultural economy. *"The few enlightened ones among our fathers thought the discovery of the raw material indicated the arrival of a more fortunate epoch for our community. They thought the community could maximize and leverage on the benefits that a massive exploration of the resource was bound to churn out,"* says Chief Akinremi. In one of the investigative journalism carried out by [3], the respondents lamented the agony of a once celebrated relief.

"I farmed palm kernel seeds and produced palm oil. I grew cocoa, ofada rice and cassava. I was enjoying my life until the cement company (WAPCO now Lafarge-WAPCO) arrived to take our land. At their arrival, I lost everything. Like most of my peers, I lost my farmland and I lost profit... Now I have lost my youth. I am 92-years old and there is nothing I can do for myself right now. I have to beg in order to eat daily,………….. But no sooner I entered than the house it started cracking; I heard some rumbling and before I could gather my wits, the walls started to give way. I screamed in fear and thus alerted those who were playing a game of Ludo at the back of the building. They scampered to safety and later returned to rescue me because I had been trapped in the house. A few seconds later, the house collapsed totally. My house collapsed because it was weakened by flying rock debris from Lafarge WAPCO's limestone quarry she claims." – The Nation, August 16, 2014, Saturday Magazine

In an attempt to maximize the benefits and cost in term of environmental crisis, governments all over the world came up with standards which industrial plants especially pollution intensive ones must comply with before such industries are approved and established. The requirement of Environmental Impact Statement before development under the Federal Environmental Protection Act of 1987 is a bold attempt at controlling such noxious effects of pollution intensive firms like Cement Plants. Several years after the promulgation of this law, many communities hosting Lafarge (WAPCO) has had to live with serious environmental problems following the operation of such industries which invariably has adverse effects on the inhabitants [4]. The results include continuous depletion of environmental resources, pollution of surface and underground water, rivers There are even instances where clothes spread outside after a major laundry is carried out become dirtier than they were before laundry from limestone dust emission in Ewekoro community. All these have considerable implication on well-being and health of communities where such industries are located.

It is on the basis of the afore-mentioned that Lafarge Africa (WAPCO Operations) commenced relocation of no fewer than 1000 people and deities in two communities in Oke-Oko Sekoni community in Ewekoro Local Government area of Ogun State over environmental hazards faced during blasting of limestone. Fifty five years after it first set up business in Ewekoro, Ogun State extracting and blasting limestone to make cement, West African Portland Cement (WAPCO), now Lafarge Cement and its host communities seem to have reached a common ground. Several years ago when WAPCO started its operations in Ewekoro, the villagers had not only thought it was merely a factory with small quarry occupying a negligible piece of land for their operation, but were also ignorant of the likely impacts the company's activities would have on their environment among others [4]. The noise (82dB -89dB) and the vibration between 0.5 mm/s and 2.1 mm/s which though fall below the FEPA regulations could still not spare the Ewekoro and its environ discomfort and economic bizzare (Plates. 1.3 and 1.4). The forest looks green from afar but was thickened and polluted with cement dust. The cocoa yam leaves, cassava plants and vanishing palm trees bear insolent marks of Lafarge WAPCO, a neighbouring cement company's waste product [3]. In a separate assessment of the health and environmental challenges of the cement company's activities on residents of the host communities in the area, however, another scholarly team, comprising [5] noted that another factor that has contributed to poor environment at Olapeleke is the rising of dust during blasting and haulaging.

From the fore-going, the Ewekoro and its environ are at risk of being exposed to Silica which has remained a serious threat to many workers, including sand blasters, stone crushers, those involved in drilling, quarrying and tunnelling through the earth crust. Diseases associated with the inhalation of silica-containing dust include silicosis, chronic airways obstruction and bronchitis, tuberculosis and lung cancer.

Pathetically, neglect and sheer insensitivity of multinational industries has become a mainstay in Nigeria with non- compliance to WHO standard at the expense of the host communities. Mining and mineral processing have the potential to generate income and promote economic development, but effects of operations on the host communities must be monitored to ensure environment integrity [4] [6].

Fig. 3: Inside the wastelands in Lapeleke

Fig. 4: A cracked and dilapidated settlement in Olapeleke

The focus of this work is to harness the negative impacts of the Mining engineering activities and its attendants problems viz a viz , health hazards, socio-economic impacts, the study of statistical approach to solve some associated problems in Ewekoro environ which is our case study. The main aim of this work is to study the negative impacts of mining engineering activities and possible remedies with the following set of objectives:

(i) Understanding the socio-economic effects on the inhabitants in Ewekoro
(ii) The efficacy of statistical methods in (i).
(iii) Suggests remedies for the survivability of ecosystems and sustainability of our environments.

II. METHODOLOGY

The study involved fieldtrip to Ewekoro and its environ namely Lapeleke where empirical study was performed on selected residents of the study area. The study covered the pregnant, the toddlers, school age (6-21), the employed and unemployed, as well as the aged. The sample population was 650 from which different sets of observations were made**.**

The questionnaires were administered on the workers (outside the factory) and residents on a systematic random sampling technique. The exercise was boosted by the assistance and voluntary response of the residents. Simple statistical analytical techniques like frequency distribution were adopted for the data analysis and appropriate charts were used to draw inferences.

III. ENVIROMENTAL IMPACT ANALYSIS (EIA)

This is a process of scoring environmental aspects, calculating an average score and individual cumulative outputs, identifying relative significance and impact significant determination for coal preparation, and determined the relative significance and considerably of the impacts.

Turbidity Measurement

The instrument is a portable, weatherproof turbidity-measuring instrument called a nephelometer. The sample is illuminated by means of light and the light scattered by the particles is measured in a direction at righ t angles to that of the incident light. The intensity of the scattered light is proportional to the turbidity. The turbidity of the sample is compared with that of a standard turbidity suspension [7].

Water depth detector

A portable, battery-operated echo sounder is used for the determination of water depth at each designated monitoring station. This is either a handheld device or affixed to the bottom of the work boat, if the same vessel is to be used throughout the monitoring programme [7].

Determination of pH

Before measuring the pH of the test sample, the electrode was thoroughly washed with distilled water and then with the sample. The temperature control was set to the temperature of the sample and th e system was allowed to stabilize before the reading was finally taken. The determination was made in unstirred solution to avoid loss of carbon dioxide or other volatile component, which would alter the pH value [7].

Water Studies

Water Consumption feasibility study was conducted. This was taken in the following order:

1. 3 water depths, namely,
2. 1m below water surface, mid-depth and
3. 1m above stream or sea bed, except where the water depth less than 6m, the mid-depth station may be omitted. Where the water depth is less than 3m, only the mid-depth station could be conducted and examined with the aim of obtaining information capable of making the community habitable.

Duplicates in-situ measurements and samples collected from each independent sampling event are required for all parameters to ensure a robust statistically interpretable dataset.

Potassium - Using a Flame photometer. A blank and potassium calibration standards are prepared, in any of the applicable ranges, 0- 100, 0-10, or 0-1 mg K/l. Emissions are measured at 766.5 nm and used to prepare a calibration curve. The potassium concentration of the sample or diluted sample is determined from the curve [7].

Calculation

mg/1 .(K) = mg/1 .(K)

This is obtainable from Calibration Curve) Dilution*

ml Sample- mlDistilledH_2O/ml Sample

Sodium - A blank and sodium calibration standards are prepared, in any of the applicable ranges, 0-100, 0-10, or 0-1 mg Na/l. The instrument is set to zero with standard containing no sodium. The emissions are measured at 589nm and used to prepare a calibration curve. The sodium concentration of the sample or diluted sample is determined from the curve [7].

mg/1 . Na = mg /1. Na *(This is obtainable from the Calibration Curve)*Dilution*

Soils, Land Use and Agriculture

There was a need to conduct the Soil studies with regards to the physical and chemical properties, which are significant to the determination of soil nutrient availability, and hence the soil fertility and productivity of the area in terms of plant growth and productivity of the Olapeleke Community.

Table 1: Physio-Chemical Parameters of Ogun River

Parameter	WS 1	WS 2	WS 3	FEPA	DPR	WHO
Temp(°C)	28.7	29.7	30.7	35.0	35.0	25.0
pH	6.78	6.61	7.53	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5
DO (mg/l)	6.0	5.5	6.0	Nil	nil	> 5.0
BOD (mg/l)	1.5	2.0	2.4	10	10	Nil
COD (mg/l)	6.9	10.4	8.0	Nil	40	Nil
Elect	21.44	21.73	11.66	Nil	nil	4000
Conductivity						
(us/cm)						
TDS (mg/l)	10.21	10.6	5.80	-	200	-

WS - water sample location (Source: WHO, 2010)

Physio-chemical characteristics of ground water

The summary of the physio-chemical characteristics of ground water in the projected area is indicated in the Table 2.

Table 2: Summary of Physio-chemical Characteristics of Ground Water

Parameters	BH 1	BH 2	BH 3
Temperature (°C)	26.50	27.20	26.80
PH	5.46	5.58	5.84
Conductivity (µS/cm)	53.50	115.70	48.20
TDS (mg/l)	27.25	56.35	24.60
Turbidity (NTU)	1.46	2.98	9.51
DO (mg/l)	3.36	3.57	3.84
Na (mg/l)	12.61	14.46	11.48
TSS (mg/l)	2.24	3.62	6.56
Oil (mg/l)	ND	ND	ND
TOC (mg/l)	4.42	5.01	1.12
Bicarbonates (mg/l)	11.61	22.14	11.51
Sulphates (mg/l)	< 1.0	< 1.0	< 1.0
Nitrates (mg/l)	< 0.1	0.21	<0.1
Ammonium (mg/l)	0.27	0.14	0.32
Cr (mg/l)	0.101	0.021	0.024

Fe (mg/l)	2.11		1.30		0.24
Ni (mg/l)	0.02		0.03		0.06

IV. DISCUSSION OF RESULTS

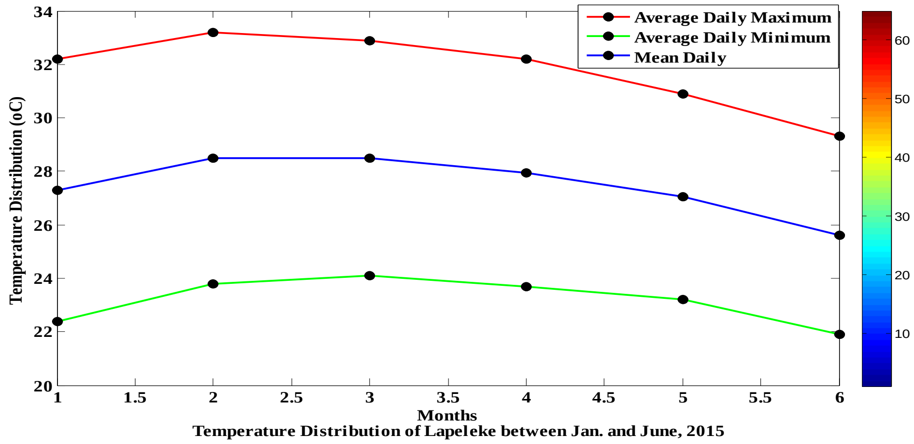

Fig. 5: Maximum, Minimum and Mean Temperatures (oC) for Olapeleke (Jan. – June, 2015)
Source: *Federal Department of Meteorological Services, Oshodi (2015)*

Table 3: Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation	Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
Average daily maximum	6	3.90	29.30	33.20	31.7833	1.45247	.715	1.741
Average daily minimum	6	2.20	21.90	24.10	23.1833	.86583	-1.254	1.741
Mean daily	6	2.90	25.60	28.50	27.4833	1.10030	.819	1.741
Valid N (listwise)	6							

The average maximum temperature noted in table 3 indicates high intensity of heat and its imbalance effect of fauna life of the ecosystem in the area. From the descriptive statistics, there is wide variation in the climatic conditions of the area which is an indication that the area is likely to face little climatic and environmental challenges like ozone layer depletion, pollution etc. which can affect the economic, commercial and agricultural activities of the area. During the field monitoring, daily relative humidity of 62-84% was recorded for wet season and 48-69% for dry season as shown in fig. 6. Maximum relative humidity values generally occurred between 0700h and 0900h while minimum relative humidity values were recorded between 1000h and 1600h.`

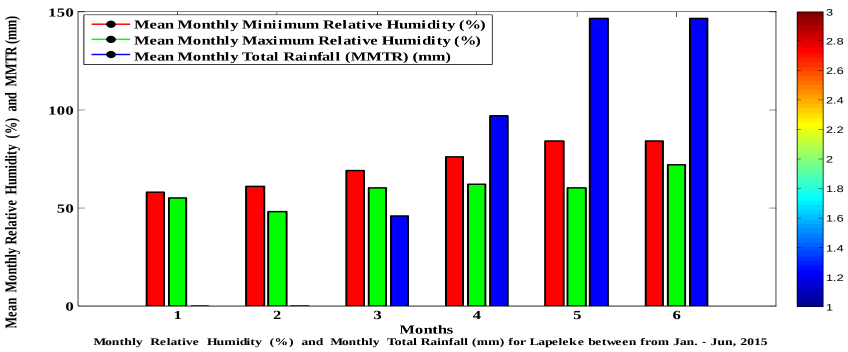

Fig. 6: Mean Monthly Relative Humidity (%) and Mean Monthly Total Rainfall (mm) for Olapeleke Village (between January and June, 2015)
Source: *Federal Department of Meteorological Services, Oshodi (2015)*

Table 4.: Occupational Distribution of Respondents in the Study Area

S/N	Occupation	Number Before Jan. 2015	Percentage (%)	Number After June 2015	Percentage (%)
1	Farming	224	36.72	130	21.31
2	Civil Service	15	2.46	15	2.46
3	Business	50	8.20	70	11.48
4	Crafts/Arts	56	9.18	56	9.18
5	Fishing	30	4.92	15	2.46
6	Hunting	95	15.57	65	10.66
7	Others	64	10.49	139	22.78
8	Unemployed	76	12.46	120	19.67
Total		**610**	**100.00**	**610**	**100.00**

Source: Field Survey (July, 2015).

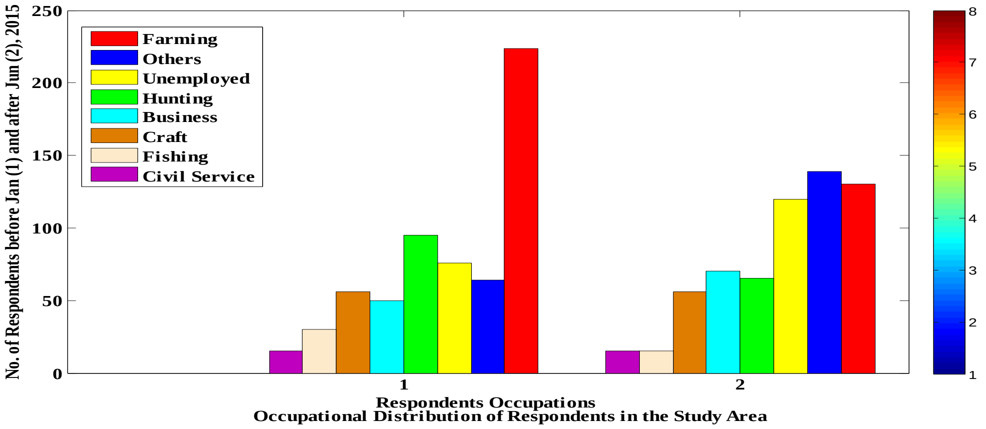

Table 5: Demographic Characteristics of the Study Area

S/N	Age Distribution	Number	Percentage Distribution (%)
1	0-5	40	8.16
2	6-10	46	9.39
3	11-15	64	13.06
4	16-20	48	9.80
5	21-25	30	6.12
6	26-30	26	5.31
7	31-35	120	24.49
8	36-40	44	8.98
9	Above 40	72	14.69
Total		**490**	**100.00**

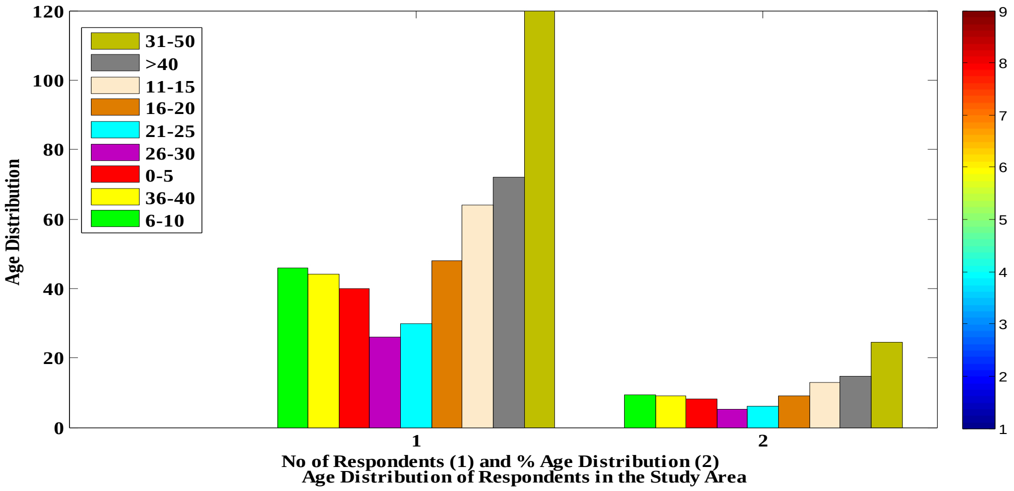

Table 6: Mean Estimated Income of the Respondents in the Study Area from Jan.-June, 2015

S/N	Income (₦)	Number	Percentage (%)

1	0.00 -20,000.00	244	40.00
2	20,001.00 - 40,000.00	190	31.15
3	40,001.00 - 60,000.00	86	14.10
4	60,001.00 - 80,000.00	75	12.30
5	>80,000.00	15	2.45
Total		**610**	**100.00**

Table 7: Diseases associated with the factory

S/N	Disease	Frequency	Percentage
1	Asthma	67	13.67
2	Heart disease	32	06.53
3	Skin cancer	38	07.76
4	Diarrhea	27	05.51
5	No disease	306	62.45
6	No Response	20	04.08
Total		490	100.00

V. CONCLUSIONS

Limestone blasting/mining may be low in the hierarchy of notable environmental hazards as compared to flood, earthquakes, hurricane and other natural disasters, its effects on the living and health conditions of people who reside in its vicinity can lead to migration or relocation. Mining and mineral processing have the potential to generate income and promote economic development, but effects of operations on the host communities and factory workers must be monitored to ensure environment integrity [8]. There must be an adherent legislation on environments and the re-quisites be complied with by mining investors whatever the level of hazards. This will enhance socio-economic development and growth.

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