

Environmental Challenges of Quarry Activities in Part of Ikere-Ekiti, Ekiti state, Nigeria

Adetiloye Adeola¹, Nenuwa Olushola B.²

Department of Minerals & Petroleum Resources Engineering, Federal Polytechnic, P.M.B. 5351, Ado-Ekiti, Ekiti state, Nigeria

Abstract: *This paper examined the environmental challenges of quarry activities in part of Ikere-Ekiti, Ekiti state on the workers, community residents and the environment. Two different locations were visited within the study area for the purpose of this work. One hundred and thirty (130) structured questionnaires were equally administered within the two locations randomly on the workers and community residents to collect relevant data and information, out of which one hundred and five (105) were returned. The results were presented on tables and the data were analyzed using percentage distribution. It was observed that the effects of noise from the quarry operations and vibrations from rock blasting were serious and of major concern as about 70% of the respondents attested to this. The impact of air pollution/dust generation and destruction of biodiversity are relatively less serious as only between 20 – 35% of the respondents rated these issues as serious. The other environmental issues which are river siltation/farm flooding, pollution of water sources and degradation of farm land and roads were perceived to be absent or insignificant as more than 60% of the total respondents confirmed this. The workers in the quarries were the most affected by noise, vibrations from rock blasting and air pollution/dust generation; other environmental issues majorly affected the residents of the communities in the study area. In order to ensure full compliance to acceptable standards, the quarry owners, community residents and Government should jointly be involved in regularly monitoring the activities of the quarries.*

Keywords: Environmental challenges, Quarry, Blasting, Noise, Pollution, Ground vibration

1. Introduction

Industries have generated a surge of interest among environmentalists and planners who are interested in the environmental impacts of industries. In recent years, scholars such as Scott (1998) and Pallen (1996) have tried to analyze the correlation between environmental damage and the growth of industries particularly in developing countries where the growth has been phenomenal. According to Scott (1998), the environmental impacts of the industries in the developing world have tended to be ignored. Although the promotion of such enterprises is seen as a way to provide employment and incomes, there is little evidence available on environmental impact and sustainability of such industries to guide decision makers. In his investigation of impacts of the industries in urban environment in India, Pallen (1996) asserts that although many firms are resourceful in many respects they can also be very environmentally problematic. When engaged in industrial activity they create more pollution per unit of investment because they operate in poorer, more populous neighbourhoods, this pollution can have more disastrous consequences (Aribigbola *et al*, 2012).

Quarrying products are increasingly demanded for industrial, domestic, agricultural and other purposes so as to satisfy the needs of the rapidly growing population. Quarrying operations generally involve removal of overburden, drilling, blasting and crushing of rock materials. The various impacts produced by these operations are both size and locations dependent. Manifestations of specific impacts are on the air, water, soil, earth surface, flora and fauna, and human beings (Areola, 1991). Apart from land degradation, other negative impacts of quarrying includes swamp creation, deterioration of ground water, erosion of soil, noise and percussions from rock blasting, generation of dust, smoke and fumes; production of noxious gases and ground vibration. Suspended particulate matter is quite outstanding

among all pollutants emanating from quarrying operations (United States Environmental Protection Agency, 2008).

Quarrying activities dates back to 1890's. The issues of concern include visual intrusion, damage to landscapes, traffic, smoke, noise, dust, damage to caves, loss of land, and deterioration in water quality. Of major concern is blasting which is necessary to break down the rocks from the ground for subsequent processing into aggregates. Environmental safety laws and edicts have been adopted by Governments of nations in order to protect the environment from such hazards. However, operators of quarries have abused these laws in order to maximize profit; the abuse is paramount in Nigeria and Africa (Omosanya and Ajibade, 2011). Solid materials in the form of smoke, dust and also vapour generated during quarrying operations are usually suspended over a long period in the air. Moreover, particulate matters in the air are capable of being transported from the point of generation to areas far remote (United Nations Environment Programme, 1991b). Once particles of varying chemical compositions are inhaled, they lodge in human lungs; thereby causing lung damages and respiratory problems (Last, 1998). According to Deborah (1996) and National Industrial Sand Association (1997), dusts generated from granite quarrying contain 71 percent silica. Inhaling such dust results in silicosis which is capable of disabling an exposed person and subsequently, leads to death. Apart from silicosis, sandblasters, miners and quarry workers also suffer from pneumoconiosis (www.gulfink.osd.ml). Suspended particulate matter may be affecting more people globally than any other pollutant on a continuous basis (Richard *et al*, 2002). Granite quarrying has been shown as a human activity that generates particulates pollution in the environment. The high level of particulates generated at the drilling and crushing areas depicts them as hazard zones. Moreover, exposure of quarry workers to particulate pollution, coupled with the general non-use of protection gadgets predispose them to several respiratory ailments

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similar to health problems found prevalent among residents living near quarry sites (Oguntoke *et al*, 2009).

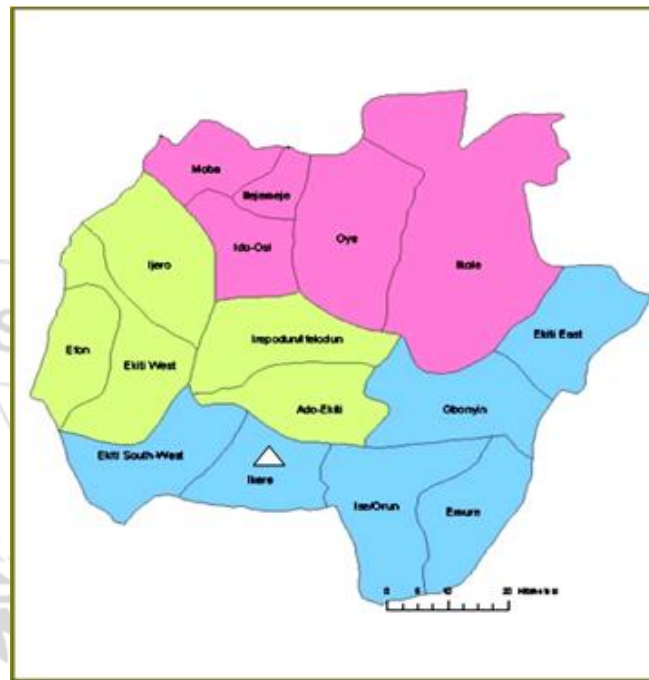
A survey of the communities and the quarries in the Lower Manya Krobo District in the Eastern region of Ghana revealed worrying issues concerning the impacts of the mining activity on the environment which included impact on buildings, farmlands, crops and water systems. Several buildings were observed to have developed different degrees of cracks with some near collapse. These cracks were basically due to strong vibrations coming from rock blasting. Farmlands are usually lost to flood waters which are water pumped from the quarry pits and run-offs. Dust from rock processing and unpaved (dusty) roads have settled on crops and other plants as a result of sedimentation. High concentrations of dust on the plants result in poor plant performance and yield (Vincent *et al*, 2012). Local communities can potentially be affected by dust up to 1 km from the source, although concerns about dust are most likely within 100 meters. Deposited dust gives rise to the greatest number of complaints to quarries from local communities, particularly for contrasting colours that are more noticeable on deposition. Settled particles may show up particularly on clean or polished surfaces such as cars, windows and window ledges, or surfaces that are usually expected to remain free from dust.

The concept of environmental sustainability is a fairly new formulation in the development thought. The most widely used definitions of the concept of sustainable development, comes from the United Nations World Commission on Environment and Development, which defined it as the “development that meets the needs of the present without compromising the ability of the future generation to meet their own needs (United Nations Office, 1996). According to Rowan-Robinson *et al* (1995) sustainable development has no precise legal meaning. It is a policy goal. The essence of sustainability is that the future should not be sacrificed for short-term advantages. To quote the UN Brundtland Report (2008), all our needs should be met in a way which does not compromise the ability of future generations to meet their own needs. This view emphasizes how decisions and actions today can affect the future especially in relation to natural resources availability, environmental health, and destruction of local and global ecosystems and most importantly the sustainability of our cities. The main objective of this study is to assess the environmental challenges of granite quarrying on the workers and residents of host communities, the results of this study will help environmental scientists and Government in policy formulation.

2. Description of the Study Area

The study area is Ikere-Ekiti, two different locations where quarry companies are sited were visited. Location A is the site around Kopek Construction Limited, situated at Km5, Ise road in Ikere-Ekiti, Ekiti state and location B is the site around Mac Engineering Construction Limited, situated at Km20, Ado-Akure road, Ikere-Ekiti. Ikere-Ekiti is underlain by the Pan-African older granite series (Nigerian Geological Survey Agency, 2006) of the Precambrian Basement Complex rocks of Southwestern Nigeria (Figure 1 shows the map of Ekiti state indicating the study area). Field

observations at the survey site revealed that the lithology is the coarse porphyritic granite and the undifferentiated porphyritic granite and granite, gneiss and migmatite rock types. A characteristic feature of the Basement Complex tectonics is the widespread occurrence of fractures (Oluyide, 1988). Thus, varieties of structural features such as foliations, folds, faults, joints, fractures and fissures exist in the Basement Complex environment. Ikere Local Government area lies within latitudes $6^{\circ} 18'N$ and $6^{\circ} 29'N$ and longitudes $5^{\circ} 20'E$ and $5^{\circ} 30'E$.



KEY: \triangle Ikere-Ekiti (Study Area)

Figure 1: Map of Ekiti state showing the location of the study area (Ikere-Ekiti)

3. Methodology

The study involves site visit, empirical investigation, observation and interview of selected residents of the study area. Primary data were obtained by means of questionnaire administration, focus group discussion, participant observation and informal surveys. Secondary data sources included relevant journals, textbooks, other published materials relevant to the study and map of the study area. One hundred and thirty (130) structured questionnaires was administered and equally distributed between the two locations in the study area. The questionnaires were administered on the workers in the quarries and residents of the communities within the study area on a systematic random sampling technique which was adopted for questionnaire administration. One hundred and five (105) questionnaires were completed and returned; forty five (45) questionnaires were received from location A, while sixty (60) questionnaires were received from location B. Items for which responses were sought included demographic characteristics of the respondents, perception of the environmental impacts of the quarry operations and the responses of the quarry owners and residents to the environmental challenges.

In this study, a check list of seven environmental concerns was investigated; respondents were asked to elect the extent of the impact by these environmental issues on them. The severity of the environmental concerns was gauged on a scale that ranged from absent, insignificant, moderate to serious. The environmental issues considered include: degradation of farmland and roads, river siltation/farm flooding, pollution of water sources, noise from quarry operations, vibrations from rock blasting, dust generation and destruction of biodiversity. Frequency and percentage distribution were adopted for the data analysis.

4. Results and Discussion

1) Socio-demographic Characteristics of the Respondents

The socio-demographic characteristics of the respondents are shown in Table 1. The table indicated that 60% of the total respondents are male while 40% are female. This showed that more male participated in this study than female. 66.7% of the respondents fall between 18 - 34 years while 33.3% of the respondents are above 35 years, this revealed that most of the respondents in this study are youthful and active. About 13.3% of the respondents are civil servants while 26.7% are engaged in mining and

quarry-related activities, 26.7% of the respondents are either artisans or traders, 15.6% are either farmers or rearing livestock, 11.1% are students and 6.7% of the respondents are either unemployed or engaged in other occupations. On educational status, about half (54.3%) of the respondents had post-secondary education while 29.5% had secondary education, 8.6% had primary education and just 7.6% of the respondents had no formal education, this indicated that majority of the respondents are literate and enlightened. 72.4% of the respondents had been residents in the study area for more than 6years while 27.6% had lived in the area between 1 - 5years, this means that majority of the respondents are well-informed about the environment. 20% of the respondents reside less than 1km away from the quarry, 11.1% reside 1 - 2km away from the quarry, 26.7% reside 2 - 3km away from the quarry, while 42.2% of the total respondents lived 3km and above away from the quarry. From this analysis, more than half of the respondents lived within 3km away from the quarry, this group of people are more likely to be under the influence of the environmental problems resulting from the operation of the quarries, 20% of the respondents who live less than 1km away from the quarry will be more affected by the activities of the quarry than others.

Table 1: Socio-demographic characteristics of the respondents in the study

S/N	Characteristics		Percentage (%)
1	Sex	Male	60
		Female	40
2	Age	18 – 34years	66.7
		Above 35years	33.3
3	Occupation	Civil servants	13.3
		Mining and Quarry-related	26.7
		Artisans/Trading	26.7
		Farming and livestock rearing	15.6
		Students	11.1
		Unemployed and others	6.7
4	Education	No formal education	7.6
		Primary education	8.6
		Secondary education	29.5
		Post-secondary education	54.3
5	Relationship of Respondents to the quarry	Workers	44.5
		Non-workers	55.5
6	Residency duration	1 – 5years	27.6
		6 – 10years	31.4
		11 – 20years	26.7
		Above 20years	14.3
7	Distance of respondents to the quarry	Less than 1km away	20
		1 – 2km away	11.1
		2- 3km away	26.7
		3km and above	42.2

2) Environmental Challenges as Observed by the Respondents

The results of the assessment of the impact of the environmental challenges arising from the operation of the quarries by the respondents are presented in Table 2. Noise is the most outstanding environmental problem as identified by the respondents, 72.4% of the respondents agreed that noise from the quarry operations is serious while the rest

said it is absent or insignificant or moderate. Quarrying has many noise-generating activities which include: the use of bulldozers and excavators, drilling and blasting of rocks, vehicular movements, operation of the crushing plants and grinding mills, screening of aggregates, all of these combine to upset both the physical and social environment (Njoku, 2013). The World Health Organization observed that noise affect human health and well-being in the following ways: creating feelings of annoyance, sleep disturbance, interference with communication particularly listening, interference with learning, it causes anti-social or aggressive behaviour and hearing loss (WHO, 1992).

The other major environmental problem identified is vibrations from rock blasting, 66.7% of the respondents said this is a serious challenge. 27.6% said the problem is moderate and others believed that vibration is insignificant or absent. Blasting is a major operation in the quarry that gives rise to vibration, vibration transmitted through the ground and pressure waves through the air can shake buildings and people and may cause nuisance. It can also cause psychological problem to residents within the vicinity, damage to properties and fracturing of structures in the surrounding like bridges, houses e.t.c.

35.2% of the respondents agreed that dust generation and air pollution is another serious challenge associated with the quarry, while 41% said the effect is moderate and others believed air pollution effect is insignificant or absent. As in the case of noise, most of the activities that generate noise in the quarry also generate dust and pollute the air. Residents living close to the quarry can potentially be affected by dust up to 0.5km from the source, although continual or severe concerns about dust are most likely to be experienced within about 100m of the dust source. Since about 80% of the respondents live 1km and above away from the quarry site, this group of people will not be seriously affected by the dust and polluted air generated from the quarry. The main

potential impacts of dust and air pollution are visual impacts, coating or soiling of properties (including houses and cars), coating of vegetation, contamination of soils, water pollution, change in plant species composition, loss of sensitive plant species, increased inputs in mineral nutrients and altered PH balances (Department of the Environment, Heritage and Local Government, 2004).

Only 20% of the respondents agreed that destruction of biodiversity is a serious issue, 21.9% said the impact of the challenge is moderate, 24.8% and 33.3% agreed that the impact is insignificant and absent respectively. Destruction of biodiversity is related primarily to the loss of habitat, when the habitats are disturbed, the useful wildlife will be lost, sedimentation and erosion from construction activities can be expected. Hence, quarry operations can lead to loss of flora and fauna.

The physical and chemical quality of surface and ground waters may be affected by quarrying activities; flows can also be contaminated by run-off or dust from the quarry, the fish in rivers can be contaminated. The removal of topsoil overburden and aggregates may however affect the quality of water recharging of an aquifer thus, drinkable water will become unsafe for consumption. The pollution of water sources by the operations of the quarry is said to be absent by 40% of the respondents, while about half of the respondents (52.4%) rated it as insignificant or moderate. 7.6% which is a small fraction of the respondent agreed that water source pollution is serious and this category of people are those who lived less than 1km from the quarry sites. It is important to note that individual or group perception about the quality of water sources may not always reflect objective reality, it is impossible to fully know the quality of water by visual examination, tasting or by other quick tests except comprehensive physiochemical tests of the water are conducted in the laboratory. Water pollution within the communities poses a strong threat to the health and well-being of those affected.

Degradation of farmland and roads is also not a major occurrence in the area, as only 7.6% agreed that this is serious, some of the respondents (46.7%) believed this occurrence is absent while 45.7% said it is either insignificant or moderate. Wherever farmland is degraded, the farmers are more vulnerable as they will experience poor crops yield due to contamination of soil composition and coating of vegetation by dust. Road degradation will lead to poor traffic flow, vehicular breakdown and road accidents.

43.8% of the respondents said river siltation and farm flooding is absent while 45.7% agreed that the challenge is insignificant or moderate in the study area, only 10.5% of the respondents representing a small ratio of the total respondents said this occurrence is serious. These environmental issues if present, may however, lead to destruction of habitats, plants, animals and even displacement of human beings and properties. Excavation of sand during quarry operations has resulted in large heaps of sand in the quarry sites and adjoining farms. These heaps of sand occasionally cause river siltation and reduce availability of land for farming activities and have significantly destroyed the landscape.

Table 2: Checklist assessment of environmental issues as observed by the respondents

S/N	Environmental issues	Percentage %
1.	Pollution of water sources	
	Absent	40
	Insignificant	20
	Moderate	32.4
2.	Degradation of farm land and roads	
	Absent	46.7
	Insignificant	21
	Moderate	24.7
3.	River siltation/Farm flooding	
	Absent	43.8
	Insignificant	20
	Moderate	25.7
4.	Destruction of biodiversity	
	Absent	33.3
	Insignificant	24.8
	Moderate	21.9
5.	Air pollution/Dust generation	
	Absent	10.5
	Insignificant	13.3
	Moderate	41
6.	Vibrations from rock blasting	
	Absent	1.9
	Insignificant	3.8
	Moderate	27.6
7.	Noise from quarry operations	
	Absent	1.9
	Insignificant	9.5
	Moderate	16.2
	Serious	72.4

3) Responses to the Environmental Challenges

Table 3 presents the responses of the quarry owners and community residents to the environmental challenges caused by the quarry operations and the suggestions of the respondents on how to control the environmental challenges. On the efforts of the quarries in mitigating the effects of the environmental problems, 42.2% of the respondents said the quarry owners are doing something about the challenges, 24.5% said they are doing nothing while 33.3% said they do not know what is being done about the problems. More than half of the respondents seem not to feel the impact of the quarry owners in mitigating the environmental problems.

On the efforts of the quarries to compensate for the damages, 2.2% said the quarries are providing water supply, 15.6% said they are providing good roads, 35.5% agreed that a form of compensation is being paid, while 46.7% said nothing will ever compensate them for the damages done to the environment.

On how residents cope with the effects of the environmental problems, 62.2% of the total respondents prefer to live with the effects of the pollution, 6.7% of the respondents said they would migrate to another area, 17.8% of the respondents would prefer to complain to health authorities while none of the respondents would want to take to protest

and 13.3% of the respondents have decided to take actions that are personal to them. From this analysis, majority of the respondents would prefer to live with the problems due to various reasons. Some may be due to economic reasons and psychological attachment to the area.

The respondents gave various suggestions for controlling the environmental problems, 2.2% of the respondents said the quarries should be relocated, 35.6% said the quarries should

be compelled to increase compensation while 28.9% of the respondents are of the opinion that stringent environmental standard should be adopted and enforced by Government. 33.3% gave various other suggestions. Generally, the respondents are strongly against the quarries being relocated; this may be due to the economic benefits of the quarries to the communities.

Table 3: Responses to the environmental challenges caused by the quarry operations

S/N	Description	Percentage %
1.	Efforts of the quarries in mitigating the problems	
	The quarry is doing something	42.2
	The quarry is doing nothing	24.5
	Do not know what is being done	33.3
2.	Efforts of the quarries to compensate for the damage	
	Providing water supply	2.2
	Providing good roads	15.6
	Paying compensation	35.5
	Nothing will ever compensate	46.7
3.	How residents cope with the effects of the challenges	
	Live with the effects of the pollution	62.2
	Migrate to other area	6.7
	Complain to health authorities	17.8
	Protest	-
	Others	13.3
4.	Suggestions on controlling the environmental problems	
	Relocate the quarries	2.2
	Quarries should be compelled to increase compensation	35.6
	Adopt stringent environmental standard	28.9
	Others	33.3

5. Conclusions

From this study, the effects of some environmental issues are of more concern to the quarry workers and community residents while the impacts of others are insignificant. The effects of noise from the quarry operations and vibrations from rock blasting were serious and of major concern as the results indicated that about 70% of the respondents agreed to this. The impact of air pollution/dust generation and destruction of biodiversity is relatively less serious compared to the earlier issues mentioned as only between 20 – 35% of the respondents rated these issues as serious. The other environmental issues which are river siltation/farm flooding, pollution of water sources and degradation of farm land and roads were perceived to be absent or insignificant as more than 60% of the total respondents confirmed this. The quarry workers are the most affected by noise, vibrations from rock blasting and air pollution/dust generation since they are very close to the sources of these problems. Continuous exposure of quarry workers to this type of environment and the non-use of personal protective equipment (PPE) will predispose them to several hazards and even health problems. Other environmental issues examined in this study majorly affected the residents of the communities in the study area.

The study revealed that the management of the quarries usually pay compensation as a form of succour; more still needs to be done to minimize the impact of their operations.

Particulates release from the quarry should be controlled with scrubbers, precipitators, filters and other modern dust strapping equipment. Water spraying of conveyors/conveyor transfer points, stockpiles and roads should be carried out, vehicles and machinery should also be maintained appropriately. Conveyor belts and crushing/screening equipment can be housed to provide acoustic screening. It is however important that sound reduction equipment fitted to machinery be used and maintained properly. Blasting operations should also be designed so that blasts are directed away from sensitive dwellings around the quarry site; the use of delayed blasting technique should be adopted. Quarry operators should provide advance notification of blasting to nearby residents based on agreed arrangements. Haul roads within the site should have as low a gradient as possible and paving should be considered if practicable where noise-sensitive receptors are likely to be affected. The use of personal protective equipment (PPE) by workers at the quarry site should be strictly enforced by the management of the quarry companies as some of the workers consider wearing protective gadgets while at work an unnecessary burden. Effort must be made to reclaim the quarry sites in order to control the contamination of groundwater, surface water and degradation of farm land. Government should ensure Environmental impact assessment of quarries on the host communities are conducted before siting of quarries.

Quarry companies need to be sensitized on the need to pay attention to environmental safeguards and needs of their host communities including the discharge of their corporate social responsibility. Government however, should put in place and enforce more comprehensive environmental policies and laws that will protect quarry workers, residents and the communities. The quarry owners, the community residents and Government should jointly be involved in regularly monitoring the operations of the quarries in order to ensure full compliance to acceptable standards.

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