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Evaluation of Health and Environmental Impact of Quarry in Ikpeshi Community, Edo State

Okodugha, D.A.*[1], Ikhazuagbe, O.[1], Omenaimen, I.[1], Aligamhe, V.I.[2]

[1]Department of Civil Engineering Technology, Auchi Polytechnic, Auchi, Nigeria
[2]Department of Quantity of Surveying, Auchi Polytechnic, Auchi, Nigeria
*Corresponding author: aluyahd@gmail.com

ABSTRACT

The study was aimed at investigating the effect of quarrying activities on the environment in the Ikpeshi community, Edo State. The survey research was used in this study to sample the opinion of respondents. This method involved random selection of respondents who were administered questionnaires. The target population of the study comprised residents of selected areas in the Ikpeshi community, Edo State. The questionnaire administered was one hundred and fifty (150) copies, and one hundred and fifty copies were retrieved, which constitutes the sample size. The descriptive and analytical approach was adopted using the chi-square test to test and analyse the hypotheses earlier stated. The findings revealed there is a significant effect of quarry activities on the environment in the study area and that there is a significant relationship between quarrying activities and environmental hazards in the study area. It was therefore concluded from the findings that quarrying activity has affected the environment, mostly in a negative way, and this includes the people in the surrounding area, the quarry workers and the physical environment. It was recommended that measures should be taken into consideration in order to reduce or eliminate the negative effects of quarries in our local environments.

Keywords: Environment hazard, Quarrying activities, Effect, Ikpeshi community

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INTRODUCTION

Environmental hazards resulting from quarrying activities have gained prominence within the last decade throughout Nigeria. The main issues of concern include visual impairment, damage to landscapes, traffic, smoke, noise, dust, damage to caves, loss of land, and deterioration in water quality. The government has adopted environmental safety laws and edicts of several nations to protect the environment from hazards related to quarrying activities. However, operators of quarries, most especially in developing nations, have abused these laws either to maximise profit or simply due to a blithe attitude. Such abuse is permeating Nigeria and Africa as a whole 10;11;12]. Quarrying activity provides much of the materials used in traditional hard flooring, such as granite, limestone, marble, sandstone, slate and even just clay to make ceramic tiles. However, like many other man-made activities (anthropogenic factors), quarrying activities cause significant impact on the environment. In particular, it is often necessary to blast rocks with explosives in order to extract material for processing, but this method of extraction gives rise to noise pollution, air pollution, damage to biodiversity and habitat destruction. Dust from quarry sites is a major source of air pollution, although the severity will depend on factors like the local microclimate conditions, the concentration of dust particles in the ambient air, the size of the dust particles and their chemistry; for example, limestone quarries produce highly alkaline (and reactive) dust, whereas coal mines produce acidic dust.

The air pollution is not only a nuisance (in terms of deposition on surfaces) and possible effects on health, in particular for those with respiratory problems, but dust can also have physical effects on the surrounding plants, such as blocking and damaging their internal structures and abrasion of leaves and cuticles, as well as chemical effects which may affect long-term survival [1;4;8]. Unfortunately, quarrying involves several activities that generate significant amounts of noise. The excavation of the mineral itself involves considerable noise, particularly if blasting methods are used. Following this, the use of powered machinery to transport the materials as well as possibly processing plants to crush and grade the minerals all contribute even more noise to the environment. Such extraction of raw materials from their natural habitats by mining, drilling, harvesting and those that relate to large-scale water resources

development projects, construction, agriculture, energy, industry and development projects considerably affect the natural environment. Industries have generated a surge of interest among environmentalists and planners who are interested in the environmental impacts of industries.

According to research, the environmental impacts of the industries in the developing world have tended to be ignored [6;7]. Although the promotion of such enterprises is seen as a way to provide employment and incomes, there is little evidence available on the environmental impact and sustainability of such industries to guide decision-makers. In our investigation of the impacts of the industries, we assert 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 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 the removal of overburden, drilling, blasting and crushing of rock materials. The various impacts produced by these operations are both size- and location-dependent. Manifestations of specific impacts are in the air, water, soil, earth surface, flora and fauna, and human beings. Apart from land degradation, other negative impacts of quarrying include swamp creation, deterioration of groundwater, erosion of soil, noise and percussions from rock blasting, generation of dust, smoke and fumes, production of noxious gases and ground vibration. The main focus of the study is to identify the effect of quarrying activity on the environment with emphasis on the Ikpeshi community. The study intends to find out if the problems experienced in other areas where quarrying is taking place apply to the study area.

RESEARCH METHODOLOGY

Questionnaire survey

Research Design

A questionnaire survey was chosen as the most appropriate research method for this study, as it allows for the collection of data from a large number of respondents within a specific time frame. This method helps in obtaining primary data directly from the residents of the Ikpeshi community, which is integral to understanding their perceptions of the health and environmental impacts of the cement industry. The questionnaire survey was carried out with a sample of 54 randomly selected residents from different parts of the Ikpeshi community.

Data Collection Procedure

The data collection process involves approaching the participants at their homes or community centres and administering the questionnaires directly. The respondents were asked to provide their opinions, perceptions, and experiences regarding the health effects, environmental pollution, and socio-economic impact associated with the cement industry.

Questionnaire Design

The questionnaire consists of three sections. The first section would be the collection of demographic information about the respondents, including age, gender, education level, and occupation. The second section would focus on the health impacts of the cement industry, covering areas such as respiratory problems, skin diseases, and occupational hazards. The third section would assess the environmental impacts, including water pollution, land (soil) pollution, and habitat destruction. The questionnaire involves closed-ended questions, which provide options where respondents could choose the most appropriate answer from a given list.

Soil analysis

Sampling Design

The soil samples were collected using a stratified random sampling technique to ensure representative samples from different areas in the Ikpeshi community. The population were stratified into different zones based on their proximity to the quarry factories. Random samples were then collected from each zone (at the entrance of the quarry industry, the crushing unit in the quarry industry and in the community), resulting in a total of 3 soil samples for analysis [4;5].

Laboratory Analysis

The collected soil samples were analysed in the laboratory to evaluate the pH, sodium, calcium, and magnesium using a standard laboratory procedure. A pH meter was used to measure the acidity or alkalinity of the soil samples. The readings were recorded and analysed to determine the pH levels in different areas of the Ikpeshi community. The pH levels were then compared to the standard pH range for healthy soil to identify any potential acidic or alkaline contamination caused by the quarry industry [2;3].

Water Analysis

Sample Collection

Water samples were collected from various sources such as rivers, streams, and wells within the Ikpeshi community and stored in a sterile container. The selection of sampling locations was based on their proximity to the quarry 36 factories, ensuring water sources that were potentially affected by quarry industry activities [8].

Laboratory Analysis

The collected water samples were tested for appearance, temperature, turbidity, taste, total dissolved solids, pH and hardness using standard laboratory procedures. pH was measured using a digital pH meter. The obtained test results were compared to the permissible limits set by World Health Organisation (WHO) standards to evaluate the extent of water pollution caused by the cement industry [5;7].

Data Analysis

The collected data from the questionnaires were statistically analysed using appropriate techniques such as frequency analysis, cross-tabulations, and chi-square tests. The data analysis aimed to obtain valuable insights into the community's perception of the health and environmental impact of the quarry company. The data obtained from both soil and water analyses were compiled, organised, and entered into a computerised database [1;2;7]. Descriptive statistics, such as means, standard deviations, and ranges, were calculated to summarise the data. Comparative analysis was performed to identify any significant differences between the samples collected from different areas within the Ikpeshi community.

RESULTS AND DISCUSSION

Chi- square method used to represent the relationship between respondents' opinion (agreed or not agreed) and their status (company workers and community dwellers). The aim of the test is to calculate or state if the two variable which are the questions asked and the response given (the data collected) if they are related to each other given

Questionnaire	Agree	Disagree	Total
Q1	10	3	13
Q2	11	2	13
Q3	7	5	12
Q4	6	4	10
Q5	2	8	10
Q6	3	5	10
Q7	5	3	8
Q8	2	6	8
Q9	8	4	8
Q10	5	5	10
Q11	3	6	9
Q12	2	6	8
Q13	2	7	9
Q14	9	6	8
Q15	17	3	12
Q16	**92**	**73**	**148**

Table 2: Contingency table

Observed	Expected	(O-E)	(O-E)2	(O-E)2
10	6.7	3.3	10.9	1.6
3	6.3	-3.3	10.89	7.1
11	6.7	4.3	18.5	2.8
2	6.3	-4.3	18.5	2.9
7	6.2	0.8	0.6	0.1
5	5.8	-0.8	0.6	0.1
6	5.1	0.9	0.8	0.2
4	4.9	-0.9	0.8	0.2
2	5.1	-3.1	9.6	1.9
8	4.9	3.1	9.6	2
3	4.1	-1.1	1.2	0.3
5	3.9	1.1	1.2	0.3
5	4.1	0.9	0.8	0.2
3	3.9	-0.9	0.8	0.2
2	4.1	-2.1	4.4	1.1
6	3.9	2.1	4.4	1.1
8	6.2	1.8	3.2	0.5
4	5.8	-1.8	3.2	0.6
5	5.1	-0.1	0.01	0.002
5	4.9	0.1	0.01	0.002
3	4.6	-1.6	2.6	0.6
6	4.4	1.6	2.6	0.6
2	4.1	-2.1	4.4	1.1
6	3.9	2.1	4.4	1.1
2	4.1	-2.6	6.8	1.5
7	4.4	2.6	6.8	1.5

Table 3: Soil analysis results

Parameters	Sample 1	Sample 2	Sample 3
Ph	6.59	6.22	5.21
Sodium	1.21	1.22	1.25
Calcium	3.36	3.27	4.31
Magnesium	3.21	4.21	2.11

Table 4: Physio- Chemical test on water quality

Parameters	Sample 1	Sample 2	Sample 3	WHO
Appearance	**Colored**	**Colored**	**Colored**	**Clear**
Temperature	30	30	30	25
Turbidity (NTU)	6.5	17.78	15.25	5
Taste	Objectionable	Objectionable	Objectionable	Unobjectionable
Total dissolved solids (mg/l)	0.13	0.19	0.41	500
pH	7	7.5	6.9	6.5 - 8.5
Magnesium hardness (mg/l)	0.8	0.45	0.62	20
Calcium (mg/l)	13.5	26.48	12.73	600

Sodium Analysis: The concentration of sodium in sample 1, 2, and 3 are 1.21, 1.22 and 1.25 cmol(+)/kg respectively, with the mean value of 1.23 cmol(+)/kg. The samples collected had higher values and mean values, which may be accredited to the use of explosives in rock blasting. In The values of all the samples were within the range of the FAO classification for the very micronutrients. Calcium Analysis: The concentration of calcium in sample 1, 2, and 3, are 3.36, 3.27, and 4.31 cmol(+)/kg respectively, with the mean value of 3.65 cmol(+)/kg. Based on the FAO classification of soil macro- and micronutrients, all samples were classified as soils with high nutrients. These values indicated that the quarry activity in the study area affected calcium concentration in all samples. Magnesium Analysis: The concentration of magnesium in samples 1, 2, and 3 are 3.21,4.21, and 2.11 cmol(+)/kg, respectively, with the mean value of 3.18 cmol(+)/kg [3;6]. Based on the FAO classification of soil macro- and micronutrients, samples 1 and 2 were classified as soils with high nutrients, while samples 3 was classified as soils with medium nutrients. These values indicated that the quarry activity in the study area affected magnesium concentration in sample 1 and 2, and didn't affect that of sample 3.

Interpretation of Water analysis Results

The result of the water analysis for temperature, turbidity, pH and hardness of the water samples collected from different locations around the quarry company. Water quality is critical for the health of both ecosystems and residents. Water temperature: Surface water temperature recorded a mean value of 30°C during the period of study. The high-water temperature values recorded can be attributed to the heat from the sun, which increased the surface water temperature. Statistical analysis showed a significant difference between the dry and wet seasons temperatures. Turbidity: Turbidity values ranged from 6.50 to 15.25 NTU during the study period. Turbidity is an indication of water pollution; turbidity is caused by the presence of suspended matter like clay, silt and micro-organisms, which makes water cloudy. Water pH: The water pH values range from 6.9 to 7.5, with a mean pH of approximately 7.1. These values suggest that the water in Okpella is close to neutral, which is generally considered suitable for most aquatic life and human consumption. Water hardness: Water hardness is the total calcium and magnesium ion concentration in a water sample and is expressed as the concentration of calcium carbonate. Results for magnesium hardness (mg/l) were within regulatory recommendations. Chloride values range between (Iwaye) 0.58±2.1 - 8.34±2.8 mg/L (Idode), and none was lower than the control (0.48±3.00 mg/L). This means that quarrying increases the chloride of the surface water in the dry season. It is advantageous for the waterbody, as the chloride will kill any germ present therein [13;14]. The WHO limit of 250 mg/L was far above all the values of the chloride across locations, and there were significant differences among the chloride values across of the chloride across locations, and there were significant differences among the chloride values across locations.

CONCLUSION

Air (dust) and noise pollution are the major types of pollution generated in the study area. The pollution affects the health of the people living very close to the site, thereby making life difficult for the residents. The working conditions of the quarry workers have not been taken care of as recommended by the Occupational Safety and Health Act. This can be attributed to a lack of awareness of the protective gear by the quarry workers. Poor planning within the country has led to the rapid development of residential facilities near the protected areas, such as quarry sites. Quarry companies should be mandated to adopt modern technology of dust strapping such that a negligible quantity of dust

escapes from the various operations at the quarry site. This has affected the residents in those areas in a negative way. Therefore, quarrying and crushing activities will continue as long as man is concerned about the comforts and standards of living. The major beneficial impacts of stone quarrying are employment, community development, income opportunity, etc. Therefore, we can conclude that the quarrying activity has affected the environment, mostly in a negative way, and this includes the people in the surrounding area, the quarry workers and the physical environment.

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