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Environmental Pollution and Health Risks of Residents Living Near Ewekoro Cement Factory, Ewekoro, Nigeria

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***Abstract*—**Generally the natural environment is made up of air, water and soil. The release of emission of industrial waste into anyone of the components of the environment causes pollution. Industrial pollution significantly threatens the inherent right of people, to the enjoyment of a safe and secure environment. The aim of this paper is to assess the effect of environmental pollution and health risks of residents living near Ewekoro cement factory. The research made use of IKONOS imagery for Geographical Information System (GIS) to buffer and extract buildings that are less than 1km to the factory, within 1km to 5km and above 5km to the factory. Also questionnaire was used to elicit information on the socio-economic factors, effect of environmental pollution on residents and measures adopted to control industrial pollution on the residents. Findings show that most buildings that fall between less than 1km and 1km to 5km to the factory have high health risk in the study area. The study recommended total relocation for the residents of the study area to reduce health risk problems.

***Keywords*—**Environmental pollution, Ewekoro, GIS, Health risk, Satellite imagery.

I. Introduction

THE release of waste into the environment by industries is known as environmental pollution and we have been polluting systematically our land, air and water since the beginning of the industrial revolution [4]. Industrialization and increased productivity are making an unprecedented demand on natural resource. Moreover, chemical research and technologies have brought about 70,000 compounds into use. It has been estimated possibly that as many as 1,000 new ones are added each year [4]. All of these production and uses result in wastes that are discharged into the air, water and onto or into the soil.

Estimates indicate that the proportion of the global burden of disease associated with environmental pollution hazards ranges from 23 percent to 30 percent [6]. These estimates include infectious diseases related to drinking water, sanitation, and food hygiene; respiratory diseases related to severe indoor air pollution from biomass burning; and vector borne diseases with a major environmental component, such as malaria. These three types of diseases each contribute approximately 6 percent to the updated estimate of the global burden of disease [6].

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As the World Health Organization (WHO) points out, outdoor air pollution contributes as much as 0.6 to 1.4 percent of the burden of disease in developing regions especially Nigeria, and other pollution, such as lead in water, air, and soil, may contribute 0.9 percent [6]. These numbers may look small, but the contribution from most risk factors other than the "top 10" is within the 0.5 to 1.0 percent range [7].

According to the Council of Arab Ministers Responsible for Environment and the United Nations Environment Programme report, emissions from cement plants affect surrounding communities [8]. For instance, human exposure to cement dust has been shown to induce several respiratory, mutagenic and gastrointestinal disorders.

Occupational exposure to cement dust is associated with an increased risk of liver abnormalities, pulmonary disorders and carcinogenesis [2]. Similarly, cases of chest pain, cough and eye problems were prevalent among village residents that were exposed to cement dust. The population groups most exposed to cement dust and other emissions are the workers within the premises of the production plant, neighbouring communities and children studying in schools located within the pollution zone. The last two groups of people are more at risk because they lack the personal protective equipment worn by workers. Further, they may lack understanding of dust effects and the need for personal protection. Therefore, the forgoing industrial pollution is a risk to human health, and a need to address the problem [3].

Depositions and discharges from Ewekoro cement plant would have had unquantifiable negative impacts on the riparian ecosystem after over 40 years of continuous cement manufacture. Dust fall not only contaminate the soil it also form encrustations on plant leaves thereby reducing the chlorophyll content, impairing carbon dioxide exchange and ultimately the plant photosynthetic rate. The toxic elemental composition in the atmospheric deposition from the cement plant operations not only endanger the soil quality but also affect the flora and fauna composition [1].

The aim of this paper will be achieved with the following objectives:

(i) Buffer the study area using 1km and 5km radius respectively;
(ii) Assess the level of industrial pollution in Ewekoro Local Government Area from Satellite images;
(iii) Examine the effect of the industrial pollution on the physical and socio-economic on health of residents; and

(iv) Assess the various health challenges of the Industrial pollution on the adjoining settlement to Ewekoro.

II. The Study Area

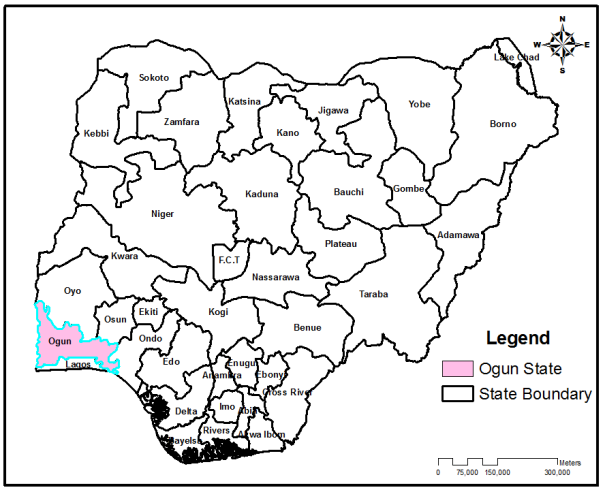

Fig. 1 Map of Nigeria showing Ogun State

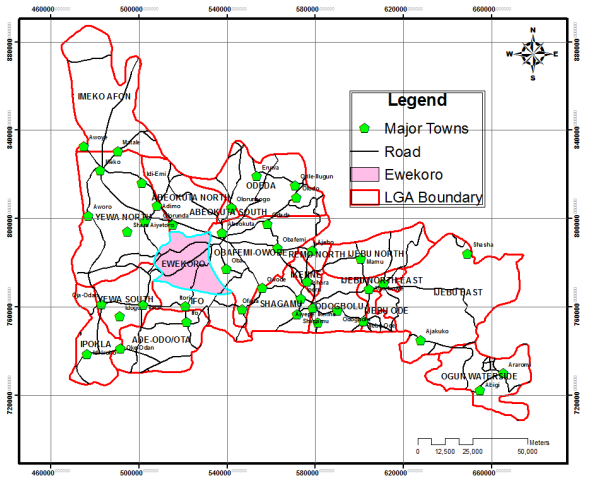

Fig. 2 Administrative Map of Ogun State Showing the Study Area

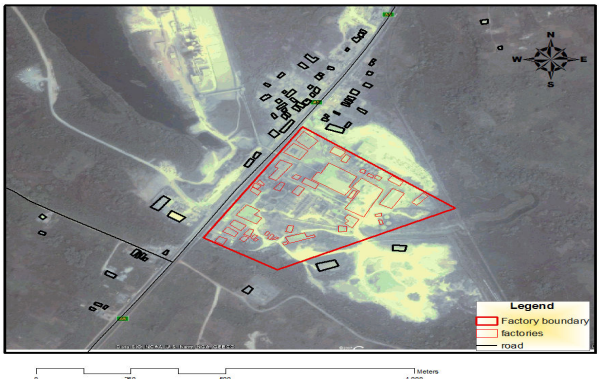

Fig. 3 IKONOS image showing Ewekoro cement factory

Ewekoro local government is one of the 21 local government Areas in Ogun State. The local government area is bounded in the North by Abeokuta Local Government, in the East by Obafemi - Owode, in the West by Yewa South Local Government and in the South by Ado-Odo Ota Local Government. Ewekoro River forms the natural boundary between Ewekoro and a few of the neighboring Local Government Areas. Ewekoro is located on latitude 6º 53'N and longitude 3º 11'N. It has a land area of about 631.5kmsq, with a population of 55,093 [5]. (See Figs. 1 and 2). Fig. 3 shows IKONOS image of Ewekoro cement factory.

III. Data Acquisition and Preparation

This study was interested in the impact of environmental pollution on the health of residents living near Ewekoro cement factory. To achieve this, data were collected using structured questionnaire which were administered on zonal basis in the study area as shown in Table I. The study area is divided into three (3) zones namely Core, Periphery and Outskirt. The Core represents area less than 1km, the Periphery represents area within 1km to 5km, while the Outskirt is that area which is above 5km. The study area has a total number of 1200 buildings. For the sake of this study 10% of the estimated total buildings of the study area which is totaled at 120 buildings were sampled. Table I shows the zones and the number of questionnaires administered per zone.

TABLE I
Questionnaire Administration

Zone	No of Buildings	Total No of Questionnaire Administered (10% of buildings)
Less Than 1km (Core)	124	12
1km to 5km (periphery)	982	98
5km and above (Outskirt)	94	10
Total	1200	120

The questionnaire was administered on household heads in the study area. The questionnaire addresses income of respondents, distance of buildings from cement factory, effects of environmental pollution on the residents and the various health challenges among others. The questionnaires were administered by trained field assistants. Also photographs of interested scenes were taken to complement the questionnaires administered. All the questions were carefully analysed and considered in addition to spatial information from GIS analysis to arrive at our conclusion.

IV. Results and Discussion

The results of the administered questionnaire and GIS output are presented below:

A. Socio-Economic Trait of the Respondents

Table II shows the age of respondents is classified into seven groups. These are between 18 to 20year, 21 – 30years, 31 - 40years, 41 - 50years and 51 to 60years respectively. These are the active age groups in the society and companies of higher education students, the working class (informal and formal) as well as entrepreneurial and managerial class. The last two groups consist of those between 61 - 70years and above 71 years of age and is predominantly made up of retires

(formal and informal) and the aged. The results shows that the predominant age groups falls between the age 18 - 20years and 21 - 30 years which accounts for 18.3% and 26.7% respectively, followed by those in the age group of 31 - 40 years and 51 - 60years which represent 17.5% each, this reveals that the younger ones is predominant among the residents residing around the factory.

TABLE II
AGE OF RESPONDENT

Age of Respondent	Frequency	Percent
18 – 20	22	18.3
21 – 30	32	26.7
31 – 40	21	17.5
41 – 50	19	15.8
51 – 60	21	17.5
61 – 70	2	1.7
71 and above	3	2.5
Total	120	100.0

TABLE III
LEVEL OF EDUCATION OF RESPONDENTS

Educational status	Frequency	Percent
No formal education	4	3.3
Incomplete primary school	5	4.2
Complete primary/standard	32	26.7
Secondary/Technical/Grade II	60	50.0
Post secondary education	17	14.2
Others	2	1.7
Total	120	100.0

Table III shows that 90% of the respondents can read and write, as can be seen in the table where 26.7% completed primary education, 50.0% secondary and 14.2% of the respondents are into the post secondary education. This implies that all the respondents understand the issue of industrial pollution.

TABLE IV
MONTHLY INCOME OF RESPONDENTS

Income Level	Frequency	Percent
below 5000	4	3.3
6000 – 10000	18	15.0
11000 – 15000	20	16.7
16000 – 20000	3	2.5
21000 – 25000	14	11.7
26000 – 30000	21	17.5
Above 30000	40	33.3
Total	120	100.0

Table IV gives a vivid analysis of the range of income generated by the respondents. 4 (3.3%) of the respondents earn below per month, 18 (15.0%) earn between N6000 - N10000 monthly, 16.7% of the respondent earn N11000 - N15000 per month, 2.5% of the respondent earn N16000 - N20000 per month, 11.7% of the respondent earn N21000 - N25000 per month, 17.5% of the respondent earn N26000 - N30000 per month while 40 respondents forming 33.3% of the total respondents earn over N30000 per month. This implies that about 50% the respondents are low income earners who cannot avoid accommodation in a standard environment, especially in urban center where the cost of accommodation is very high. These people can only afford accommodation in the industrial prone areas where accommodation is relatively low.

TABLE V
OCCUPATION OF RESPONDENTS

Occupation	Frequency	Percent
Civil service	12	10.0
Trading	41	34.2
Artisan	15	12.5
Student/Apprentice	47	39.2
Others	5	4.2
Total	120	100.0

Table V shows the occupational status of the respondents. 10.0% of the respondents are Civil Servant, 34.2% are Traders, 12.5% are Artisans, 39.2% are students and Apprentice while other people involved in other occupations are 4.2%. From this analysis it is therefore safe to say that 60% of the respondents have a source of livelihood while the remaining 40% are either students or unemployed.

B. Environmental Impact of Pollution on Residents

TABLE VI
TYPES OF POLLUTION

Type of Pollution	Frequency	Percent
Noise	15	12.5
Air	61	50.8
Water	22	18.3
Land	22	18.3
Total	120	100.0

Table VI of the respondents representing 12.5% of the total respondents experience Noise pollution, 61 of the respondents representing 50.8% of the total respondents experience Air pollution, 22 of the respondents representing 18.3% of the total respondents experience both Water and Land pollution. From this analysis it is quite obvious that air pollution is the major environmental problem experienced in Ewekoro community.

TABLE VII
LOCATION OF BUILDINGS RELATIVE TO THE EWEKORO CEMENT FACTORY

Distance(Kilometer)	Frequency	Percent
Less than 1km	43	35.8
1km to 5km	59	49.2
5km and above	18	15.0
Total	120	100.0

Table VII, 43 of the respondents lived less than 1km away from the factory, 59 of the respondents representing 49.2% of the total respondents lived 1 - 5km away from the cement factory while 18 of the respondents representing 15.0 % of the total respondents lived 5km and above away from the cement factory . From the analysis, the majority of the respondents (102) representing 85.0% of the respondents lived within 5km from the cement factory; this means they are all under the influence of pollution resulting from the operation of the industry.

TABLE VIII
RESIDENT'S OPINION ON THE EFFECT OF POLLUTION

Effects of pollution	Frequency	Percent
live with it	74	61.7
Migrate to new area	5	4.2
Complain to health authority	19	15.8
Protest	7	5.8
Others	15	12.5
Total	120	100.0

Table VIII shows that 74(61.7%) live with pollution, 5 (4.2%) of the total respondents to migrate to another area, while 19(15.8%) of the total respondents complain to health authorities and 7(5.8%) of the respondents take to protest. The implication of this is that most of the respondents would prefer to live with the pollution due to economic reasons and psychological attachment to the area in spite of pollution.

Fig. 4 High Level of Pollution Effect the residents roof which is filled with Limestone.

It is evident from Fig. 4 that most of the buildings near Ewekoro cement factory are affected by pollution. This poses serious risk to the health of people living in this building.

C. Impact of the Cement Factory on the Physical Environment

TABLE IX
POLLUTION EFFECT ON PLANT AND FARM PRODUCE

Pollution effects	Frequency	Percent
Injury to plant	22	18.3
Reduction in growth	30	25.0
Yellowing or chlorisis of the leaf	30	25.0
Contaminated farm produce	38	31.7
Total	120	100.0

Table IX shows that 18.3% of the total respondents said pollution from the factory causes injury to plant, 25.0% of the total respondents said the pollution from the Cement Factory causes reduction in growth of plants and farm produce, 25.0% of the total respondents said pollution affects plants thereby causing yellowing or chlorisis of leaf and 31.7% of the total respondents said there are other pollution effects on their plants and farm produce such as Contaminated Farm produce, Farm Waste (see Fig. 5). From the analysis it is quite obvious that air pollution and toxic waste pollution from the Factory adds to the unhealthy living of the respondents.

Fig. 5 Contaminated Farm Crops as a result of Nearness to Factory

TABLE X
POLLUTION EFFECT ON THE WATER BODIES IN THE AREA

Pollution effects	Frequency	Percent
Contaminated fish	32	26.7
Unsafe drinkable water	49	40.8
Harm algae blooms	19	15.8
Others	20	16.7
Total	120	100.0

Table X shows that 26.7% of the total respondents said pollution from the factory contaminates the fish, 40.8% of the total respondents said the pollution from the Cement Factory makes drinkable water unsafe for consumption 15.8% of the total respondents said the pollution the cement factory causes harms algae blooms.

From this analysis majority of the respondents admitted that pollution from the Cement factory make water generated from the community unsafe for drinking. Fig. 6 shows Pollution Effects of water body in the environs.

Fig. 6 Abandoned borehole due to contamination from Limestone

D. Health Challenges of the Resident due to Pollution

Factors that have contributed to poor environment at the quarry site are the rising of dust during blasting and haulaging. In this case, the health concern of the work force is at high

risk. Silica exposure is an ancient hazard which has remained a serious threat to many workers including sand blasters, stone crushers, those involved in drilling, quarrying and tunneling through the earth crust. Diseases associated with the inhalation of silica-containing dust include silicosis, chronic airways obstruction and bronchitis, tuberculosis and lung cancer. Many workers including those in high-risk settings are exposed to crystalline silica. Wetting of the site road with water is carried out to reduce only the fugitive dust.

TABLE XI
VARIOUS HEALTH CHALLENGES SUFFERED FROM DUE TO POLLUTION

Health challenges	Frequency	Percent (%)
Asthma	17	14.2
Cough/Catarrh	45	37.5
Heart diseases	12	10.0
Skin cancer	22	18.3
No response	24	20.0
Total	**120**	**100.0**

It was observed that most of the workers are protected; the residents in the community are exposed to the dust during production process. From Table XI, 14.2% reported prevalence of Asthma, 37.5% of the major respondents clamors the prevalence of cough/catarrh, 10.0% of the total respondent reported the issue of Heart diseases and 18.3% reported the prevalence of Skin cancer.

E. Buffering of the Cement Factory Using 1km and 5km Radius Respectively

The choice of 1 kilometer buffer is to show those that are vulnerable to the adverse effect of the Environmental Pollution caused by the Factory, as stated by the Code of Pollution control (NEA Singapore) that the nearest building to a Cement Factory should fall after 1km buffer. Fig. 7 shows that 124 building were outlined out to have fallen within less than 1km from the Factory.

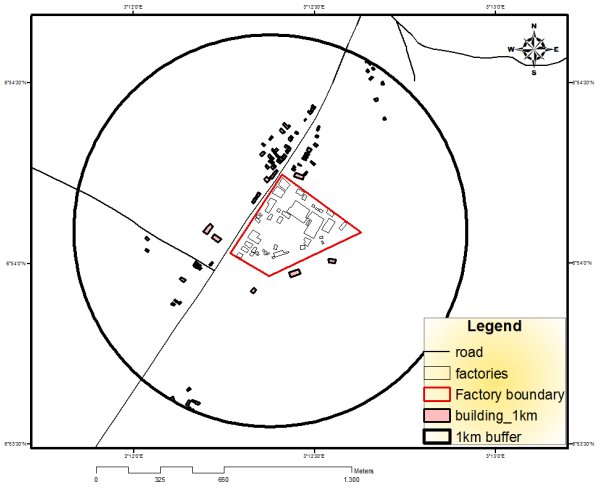

Fig. 7 Ewekoro Cement Factory Environs within 1km

It is clearly shown in Fig. 8 that areas that are less than 1km are prone to the Noise pollution effects.

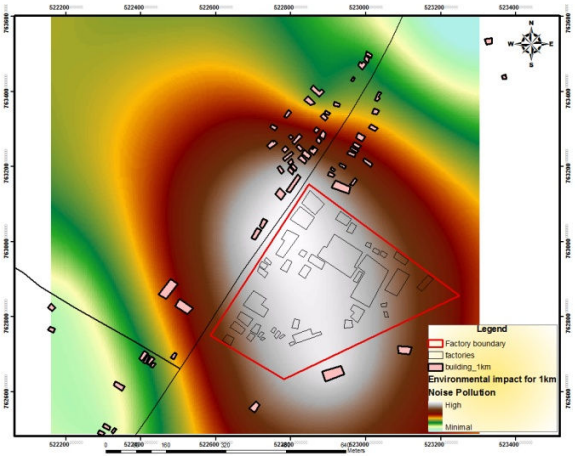

Fig. 8 IKONOS Image of Ewekoro community showing its environmental impact of pollution within 1km

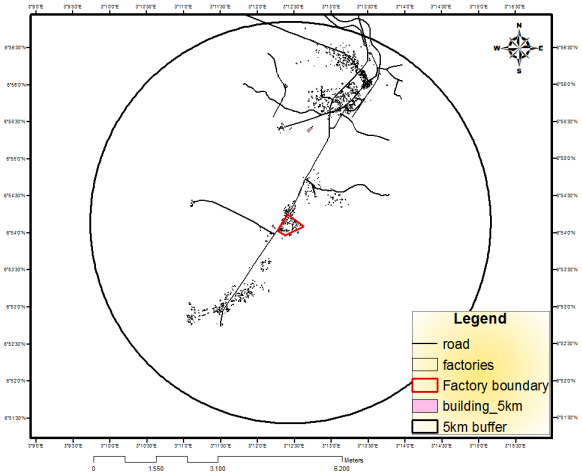

Fig. 9 Ewekoro Cement Factory Environs within 5km

Fig. 9 shows the Ewekoro Cement Factory boundary, Roads and building that falls between 1km to 5km, from the Factory's boundary. The choice of 5 kilometer buffer is to show those that are vulnerable to the adverse effect of the Air Pollution caused by the Factory [1]. The intensity of Air pollution of Ewekoro cement factory is very high at 5km radius. From Fig. 9, 984 building was outlined out to fall within 1km to 5km from the Factory.

It is clearly shown in Fig. 10 that not only areas that are less than 1km are prone to the Air pollution effects, areas that falls between 1km and 5km (on the average) are highly prone to air pollution. It also describes that the rate of air pollution depreciates with respect to distance from the factory.

Fig. 11 adequately explained the radiation of health challenges across the whole community; Cough/Catarrh is the most prevalent health challenge which is caused due to the increase in the amount of dust particles present in the atmosphere.

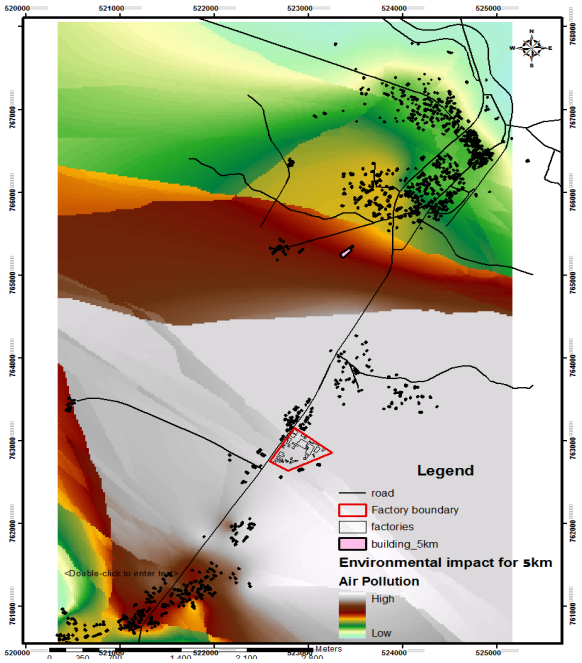

Fig. 10 Map showing the Level of Air pollution

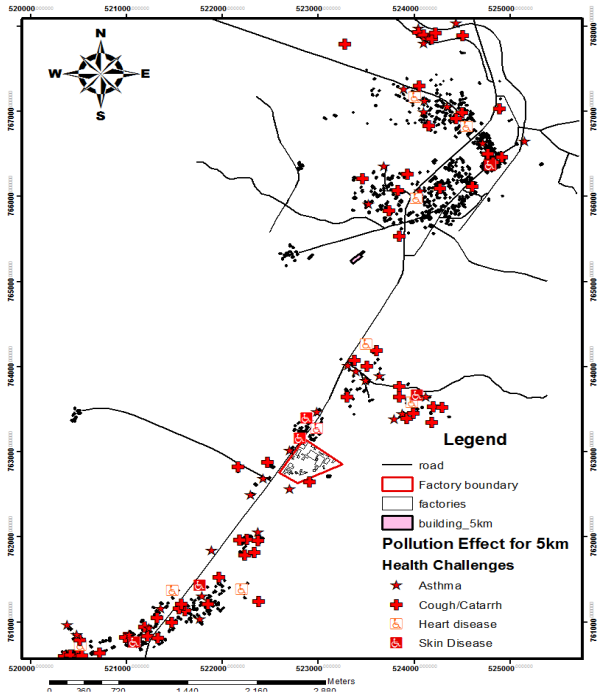

Fig. 11 Map showing the flow of Health challenges across Ewekoro cement factory

V. Conclusion

This study has highlighted the problem of environmental pollution and health risks of residents living near Ewekoro Cement factory, Ewekoro and its effect on the environment and the residents of the area. Air pollution being 45% is the major type of pollution generated in the study area, it was discovered that majority of all that are residing within jurisdiction of less than 1km from Ewekoro cement factory vulnerable to different types of pollution such as Chemical, Noise and Toxic waste pollution while those that resides between 1km to 5km from the Factory are only prone to air pollution.

This study has aligned itself with the school of thought that emphasized that the nearest residential building from a Cement Factory should range from 1km and above, In spite of this, 43.3% of respondent agreed they are not comfortable living in the study area and emphatically said with a percentage of 61.7% of the respondents that they are left with no choice than to live with the pollution. Despite being uncomfortable only 17.5% of the Total respondent are very ready to accept movement if the government decides to set up another location for the residents.

VI. Recommendations

The study has tried to evaluate the negative consequences of Ewekoro cement industry on the environment. The study reveals that though there have been efforts on the part of the management of the industry to reduce their noxious impact, more still needs to be done especially in the area of environmental monitoring so that for example the emissions of air dust enumerated earlier could be brought under control.

From the point of view of an environment management practitioner, the need to significantly and painlessly reduce the volume of carbon dioxide emissions resulting from Ewekoro cement factory cannot be over-emphasized considering the importance of carbon dioxide in the green house gas effects in global warming. Considering the quantity of carbon dioxide produced per ton of cement, the use of mineral admixtures, which would otherwise, be land filled is a must for the environment and for the cement industries.

Effort geared toward reclaiming the quarry site should be extended further by actually transforming quarry site into parks and garden for recreational purpose via such projects like afforestation, Scarification and final conversion into animal zoos and garden where people can visit and pay a token that will be used in maintaining such projects [3].

The need for Cement factory authorities to provide the workforce with less irritating means of protecting themselves from dust inhaling and the environment from dust menace by providing super active dust Control equipment is very important. The location of cement industries should be far from residential areas in order to avoid the menace of noise, vibration, dust and heavy vehicular movement.

Moreover there is the need for the government to intensify effort in the implementation of Environmental impact assessment of cement industries now and in the future considering the nature of its impact on all the facets of human life.

Aside from that the excavated area should be properly filled to forestall the contamination of surface water and aquatic lives, the original state of the excavated area should be attained.

Considerable effort must also be geared towards preventing particulates from going into the atmosphere, as its effect in unpredictable in the environment, special devices to arrest and

mop up particulates should be provided. Since lots of noise-would be generated as a result of the cement production and mining activities there is the need to find a way of muffing the noise and to shield the site. Moreover large volume of vehicles would be attracted to the cement factory and mining site resulting into soil surface compaction hence there is need to develop appropriate highway and widened to reduce hazards on the environment. Moreover the government, the industry and the community should be encouraged to be partners in progress. They can jointly be involved in monitoring environmental resources depletion, especially the compliance level of the plant to minimum standards for sustainable and pollution free society.

Lastly, the government should look into the pollution control policy and put into consideration on no occasion should any residential building be allowed for approval within 1km to any cement factory in order to reduce the rate of inhalation harmful substances by the people.

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