Health and Environmental Impacts of Industrialization (A case study of Dangote Cement Factory on Obajana Community, Kogi state, Nigeria)

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***Abstract*— The impacts of industrialization on socio-economic development can't be over emphasized, but so are the negative consequences. This paper examines the health and environmental impacts of Dangote Cement Industry on the physical environment of the encompassing settlement of Obajana, Kogi State. this is often with a view to providing sustainable solution to the negative impact of huge scale industries in an emerging economy like Nigeria. The study involved empirical observation and interview of residents of the world. About 150 questionnaires were administered randomly on workers and residents, out of which 137 were returned. These were analyzed using simple tables. The study confirms extensive incidence of land, air, and sound pollution, asthma, carcinoma and Heart diseases over and above recommended minimum limits. It also discovers lack of considerable compliance with the principle of environmental integrity sustainability and National Environmental Standard Regulation Authority (NESRA) in terms of environmental resource protection. The study recommends that, for Nigeria to maximize benefits of industrialization and minimize its negative effects, a tripartite arrangement that involves the industry, the community and therefore the government must be involved in environmental monitoring and protection.**

***Keywords*— Cement factory, Dangote, Environmental impact, Helth implication, Obajana community, Pollution.**

I. INTRODUCTION

One of the usually touted solutions to the issues impeding development within the Third World countries is that the emphasis on industrial enterprises. The intention behind the encouragement of industries, consistent with (Ofori-Cudjoe, 2009), (Endashaw, 2009) and (Boakye, 2010) lies within the development of a diversified economy that would propel the achievement of stable and sustainable societies, since the agricultural sector, the most economic activity in Sub-saharan African countries cannot provide enough employment and income to the growing population. Few years after Nigeria's Independence; the main policy emanating from the new government was that important substitution (Oyebanji, 1983). The policy emphasized local production of hitherto imported consumers' goods by importing semi and unfinished goods that are fully processed into the country. Consequently, several large scale industries were built by the varied levels of governments and person who was desirous of quick industrialization. one among such industries is that the Dangote Cement Plant (DCP) in Kogi state. However, industrialization like every phenomenon a bit like it's benefits it also has negative consequences. In an effort to maximize the advantages and price in terms of environmental crisis and minimize the value, governments everywhere the planet have come up with standards which industrial plants especially pollution intensive ones must suits before such industries are approved and established. the need of Environmental Impact Statement before development under the Federal Environmental Protection Act of 1987 may be a bold attempt at controlling such noxious effects of pollution intensive firms like Cement Plants. However, several years after the promulgation of this law, many communities hosting large cement plants like Obajana in Kogi State has had to measure with serious environmental problems following the operation of such industries. The results of this anomaly are many: they include continuous depletion of environmental resources, pollution of surface and underground water, and visual ugliness among others. of these have considerable implication on well-being and health of communities where such industries are located. it's on the idea of the above that this research investigates the general consequences of DANGOTE CEMENT PLANT (Subsidiary of Dangote Industries Limited) on the Obajana environment. it's also meant to work out residents' perception of the consequences of the industry on the environment.

1.1. Background of the study.

it's impossible to envisage a contemporary life without cement. Cement is a particularly important construction material used for housing and infrastructure development and a key to economic process. Cement demand is directly associated to economic process and lots of growing economies are striving for rapid infrastructure development which underlines the tremendous growth in cement production (WBCSD 2014). The cement industry plays a serious role in improving living standard everywhere the planet by creating direct employment and providing multiple cascading economic benefits to associated industries. Despite its popularity and profitability, the cement industry faces many

challenges thanks to environmental concerns and sustainability issues (Potgieter Johannes, 2012).

The cement industry is an energy intensive and significant contributor to global climate change. the main environmental health and questions of safety related to cement production are emissions to air and energy use. Cement manufacturing requires huge amount of nonrenewable resources like staple and fossil fuels. it's estimated that 5-6% of all CO_2 greenhouse gases generated by human activities originates from cement production (Potgieter Johannes, 2012). staple and Energy consumption end in emissions to air which include dust and gases. The exhaust gases from a cement kiln contains nitrogen oxides (NO_x), CO_2, water, oxygen and little quantities of dust, chlorides, fluorides, sulphur dioxide, carbon monoxide gas, and still smaller quantities of organic compounds and heavy metals (Marlowe Ian and Mansfield David, 2002). Toxic metals and organic compounds are released when industrial waste is burnt in cement kiln. Other sources of dust emissions include the clinker cooler, crushers, grinders, and materials-handling equipment. These emissions aren't only deteriorating air quality but also degrading human health. Emissions have local and global environmental impact leading to heating, ozone depletion, acid rain, biodiversity loss, reduced crop productivity etc PariyarSuman et al, (2013). Scientific evidence indicates that pollution from the combustion of fossil fuels causes a spectrum of health effects from allergy to death, Marchwinska-Wyrwal et al (2011) .The results of several studies showed that these emissions are adversely affecting human health during a sort of ways, like itchy eyes, respiratory diseases like tuberculosis, chest discomfort, bronchitis, asthma attacks, cardio-vascular diseases and even premature death Mehraj.S, (2013).

1.2. Problem Statement

The Dangote Cement plant in Obajana, Kogi , is that the largest in Sub-Saharan Africa. The firm was incorporated in 1992 and commenced operation in 2012. The plant has 13.25mt of capacity across four lines. Its newest line was constructed in 2014. It relies on Gas, Coal and LPFO for power. In November 2014, a coal mill was commissioned to serve Line 3. The plant is supported by a fleet of two,370 trucks. Recent studies indicated that the dust emitted from the factory affects the physicochemical properties of the soils within the surrounding area (Estifanos and Degefa, 2012). Moreover, the encompassing communities are complaining about health and environmental impacts of the factory. Though, the factory showed readiness to simply accept the complaints about the impacts of the factory from the encompassing community and therefore the environment, it fully targeting satisfying the country's cement demands. This was thanks to lack of documented evidence on all environmental impacts of the factory. thus far no research has been done on the importance of environmental impacts of the factory. This research gap initiated me to conduct this research, which is meant to spot and analyze the importance of the prevailing local health and environmental impacts and to propose workable recommendations on pollution control and waste management of the factory.

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1.3. Significance of the study

Cement manufacture causes environmental impacts in the least stages of the method. These include emissions of airborne pollution within the sort of dust, gases, noise and vibration when operating machinery and through blasting in quarries and damage to countryside from quarrying. Equipment to scale back dust emissions during quarrying and manufacture of cement is widely used and equipment to trap and separate exhaust gases are coming into increased use. Environmental protection also includes the re-integration of quarries into the countryside after returning them to nature or re-cultivating them has closed the down.

1.3.1. *Climate*: Cement manufacture contributes greenhouse gases both, directly through the assembly of CO_2 when carbonate is heated, producing lime and CO_2 and indirectly through the utilization of energy, particularly if the energy is sourced from fossil fuels. The cement industry produces about 5% of worldwide man-made CO_2 emissions, of which 50% is from the chemical change, and 40% from burning fuel. the quantity of CO_2 emitted by the cement industry is almost 900kg of CO_2 for each 1000kg of cement produced. Newly developed cement types from Novacem and Eco-cement can absorb CO_2 from ambient air during hardening.

1.3.2. *Fuels and raw materials*: A cement plant consumes 3–6GJ of fuel per tonneof clinker produced, counting on the raw materials and therefore the process used. Most cement kilns today use coal and petroleum coke as primary fuels and, to a lesser extent, gas and heating oil. Selected waste and by-products with recoverable calorific value are often used as fuels during a cement kiln, replacing some of conventional fossil fuels, like coal, if they meet strict specifications. Selected waste and by-products containing useful minerals like calcium, silica, alumina and iron are often used as raw materials within the kiln, replacing raw materials like clay, shale and limestone. Because some materials have both useful mineral content and recoverable calorific

value, the excellence between alternative fuels and raw materials isn't always clear. for instance, sewage sludge features a low but significant calorific value and burns to offer ash-containing minerals useful within the clinker matrix.

*1.3.3. Local impacts***:** Producing cement has significant positive and negative impacts at an area level. On the positive side, the cement industry may create employment and business opportunities for local people, particularly in remote locations in developing countries where there are few other opportunities for economic development. Negative impacts include disturbance to the landscape, dust and noise and disruption to local biodiversity from quarrying limestone (the staple for cement).

II. LITERATURE REVIEW

2.1. Over view of Obajana community

Obajana Community is found at Kotonkar, along the Okene-Kabba Road, in Kabba/Bunu local government Area of Kogi State. it's about 200 kilometres from Abuja and about 45 kilometres from Kabba. it's about 35 kilometres from Lokoja. Obajana's traditional leadership lies with the Oba (Engr.) Joseph Idowu Isenibi JP- The Bajana III of Obajana kingdom. The ethnos of this community comprises of mainly the Okun and Oworo. Obajana is one among the fastest growing rural communities in Nigeria following the commissioning of the Dangote Cement plant within the community. The growing profile of Obajana community is clear by sprawling new buildings reflective of a contemporary community. there's a growing volume of vehicular movement between Lokoja and Obajana, as several people from different parts of the country have now settled here. Obajana indigenes live mostly round the Oba's Palace and during a settlement along Ejiniwon Street. The residential district of the town is situated a few kilometres far away from the cement plant on a land originally belonging to Oyo-Iwa community.

2.2. Dangote cement PLC.

Dangote Cement Plc may be a Nigerian multinational publicly traded cement manufacturer headquartered in Lagos. the corporate is engaged within the manufacture, preparation, import, packaging, and distribution of cement and related products across the African continent. Dangote Cement Plc was formerly referred to as Obajana Cement Plc and altered its name to Dangote Cement Plc in July 2010. Obajana Cement Plc was incorporated in 1992. Dangote Cement Plc may be a subsidiary of Dangote Industries Limited and is that the largest company traded on the Nigerian stock market. In 2013, the corporate produced and sold 13.3 million metric tonnes of cement, with revenues of US$2.4 billion. (Dangote Cement Forbes Global 2000). As of 2014, Dangote Cement had a market capitalisation of $20 billion. In 2012, Forbes Africa named Dangote Cement together of the highest five listed companies in West Africa. (Forbes list of W/African companies" 2012).

2.3. Criteria Air Contaminants (CAC)

Particulate matter (Suspended and Respirable), Nitrogen oxides, Sulphur oxides, carbon monoxide gas, Volatile organic compounds (VOC) and Green House Gases (GHG). Other substances include: Acidic compounds, Heavy metals – Cadmium, Lead, Mercury and Nickel. it's thanks to emission of such and other lethal pollutants that the cement industry finds place within the red category club i.e. the foremost polluting industry (Ministry of Environment and Forest, Government of India and Central Pollution Control Board). Blooming of cement factories has resulted within the environmental deterioration and successively degrades the human health status in whole world. Studies have shown adverse respiratory health effects within the people exposed to cement dust, exemplified in increased frequency of respiratory problems, (Al-Neaimi et al., 2001). it's also been revealed that folks of cement dust zone are badly suffering from respiratory problems, gastro intestinal diseases etc. (Adak et al., 2007). Several studies have also demonstrated linkages between cement dust exposure, chronic impairment of lung function and respiratory symptoms in human population. Cement dust irritates the skin, (Ikli et al., 2003). Its deposition within the tract causes a basic reaction resulting in increased pH values that irritates the exposed mucous membranes, (Zeleke et al., 2010). Numerous studies and therefore the lack of effective policies reveal that pollution continues to threaten public health. Studies of long – term exposure to pollution (especially particles) suggest an increased risk of chronic respiratory disease, (Schwartz, 1994) and (Sivicommar et al., 2001). Besides health, cement factories are deteriorating environment as shown by studies. The exhaust gases and particulate matters of the dust exhausted from cement plants are released to air and degrading air quality and thus creates considerable environmental pollution, (Adak et al., 2007). Since early 1980s, it's become clear that pollution affects the health of citizenry and animals, (Parada et al., 1987), damages vegetation, soils and deteriorates materials and usually affects not only the massive metropolitan areas but also the medium sized urban areas. pollution features a great impact on human health, global climate change, agriculture and natural ecosystem, (Molina et al., 2004). The impacts of cement industry are countless and it even didn't spare humans from its deteriorating impacts and have adversely impacted human health within the area. Exposure to cement pollution has been linked to variety of various health outcomes, ranging from modest transient changes within the tract and impaired pulmonary function, continuing to restricted activity/reduced performance, ER visits and hospital admissions and to mortality, (Schuhmacher et al., 2000); (Aydin et al., 2010); (Zeleke et al., 2010); (Vestbo et al., 1900). there's also increasing evidence for adverse effects of cement pollution not only on the system respiratory, but also on the circulatory system, (Dockery, 1993). the foremost severe effects in terms of the general health burden include a big reduction in

anticipation of the typical population by a month or more, (Samet et al., 2000), which is linked to the long term exposure to high levels of pollution with PM from these cement industries, (Sheppard, 1990); (Pope and Dockey., 2006); (Grau, 2009). Besides human health air pollutants have shown more adverse impacts on livestock (Schwabe, 1984) effecting gross domestic product (GDP) of the valuable wealth of livestock in sort of cattle-buffalo, sheep, goats, poultry etc. The cattle and poultry amongst all the livestock are considered the foremost important tool for the event of the agricultural economy. the varied diseases like respiratory infections and various other pollution related problems are arising among livestock at an alarming rate within the areas.

2.4. Pollutants from cement factory

Three criteria air pollutants are released to the air during cement manufacturing which incorporates particulate (PM), nitrogen oxides (NO_x) and sulphur dioxide (SO_2) which may be categorised into two headings:

1) *Particulates.*
2) *Gaseous pollutants.*

2.4.1. Particulates

Particulate pollution may be a complex mixture of small and enormous particles of varying origin and chemical composition. Larger particles, starting from about 2.5 microns to 100 microns in diameter, usually comprise smoke and mud from industrial processes, agriculture, construction, and road traffic, also as plant pollen and other natural sources. Smaller particles those but 2.5 microns in diameter generally come from combustion of fossil fuels. These particles include soot from vehicle exhaust, which is usually coated with various chemical contaminants or metals, and fine sulfate and nitrate aerosols that form when SO_2 and nitrogen oxides condense within the atmosphere. the most important source of fine particles is industries, but auto and diesel exhaust also are prime contributors, especially along busy transportation corridors.

The health effects of particulates are strongly linked to particle size. Small particles, like those from fuel combustion, are likely to be most dangerous, because they will be inhaled deeply into the lungs, settling in areas where the body's natural clearance mechanisms can't remove them. The constituents in small particulates also tend to be more chemically active and should be acidic also and thus more damaging. Numerous studies associate particulate pollution with acute changes in lung function and respiratory disease, (Douglas et.al, 1996)., (USEPA, 1996), leading to increased hospital admissions for respiratory illness and heart condition, school and job absences from respiratory infections, or aggravation of chronic conditions like asthma and bronchitis, (Deborah, 1996)

Numerous studies suggest that health effects can occur at particulate levels that are at or below the amount permitted under national and international air quality standards. In fact, consistent with the WHO and other organizations, no evidence thus far shows there's a threshold below which particle pollution doesn't induce any adverse health effects, especially for the more susceptible populations.

2.4.2. Gaseous pollutants

Gaseous pollutants have major negative impacts on health. They also play a crucial role in environmental changes in atmospheric chemistry. CO_2 and CO_2 form acids through different chemical reactions within the atmosphere, and these acids are subsequently deposited ashore and ocean surfaces as acid precipitation. it's anticipated that the increasing load of atmosphere sulphur dioxide (SO_2), dioxide (NO_2), CO_2 (CO_2), carbon monoxide gas (CO), and ozone (O_3) will contribute to global climate change, consequently, it's necessary to quantify the emission within the very near future. The combustion of fuels at high temperatures in cement kilns leads to the discharge of NO_x emissions, which causes various health adverse health effects. In SO_2 emissions from cement plants result from the combustion of sulfur-bearing compounds in coal, oil, and petroleum coke, and from the processing of pyrite and sulfur in raw materials. Cement manufacturing releases CO_2 (greenhouse gas) within the atmosphere both directly when carbonate is heated, producing lime and CO_2, and also indirectly through the utilization of energy if its production involves the emission of CO_2. The cement industry is that the second largest CO_2 emitting industry behind power generation. The cement industry produces about 5% of worldwide artificial CO_2 emissions, of which 50% is from the chemical change, and 40% from burning fuel. the quantity of CO_2 emitted by the cement industry is almost 900kg of CO_2 for every1000 kg of cement produced. The high proposition of CO_2 produced within the chemical reactions results in large decrease in mass within the conservation from lime stone to cement. So, to scale back the transport of heavier raw materials and to attenuate the associated costs, it's more economical for cement plants to be closer to the lime stone quarries instead of to the buyer centres. Besides particulates and gaseous pollutants many other pollutants also are released from cement factories which include toxic heavy metals.

2.5. Emissions from cement manufacturing

the foremost significant environment health and safety issue of cement manufacturing is emission, (Babatunde Saheed Bada, et al, 2013). Cement industry is potential anthropogenic source of pollution. it's estimated that cement production originates about 5% of worldwide manmade CO_2 emissions. the standard gaseous emissions to air from cement production include NO_x, SO_x, CO, CO_2, H_2S, VOCs, dioxins, furans and particulate matters, (Bashar Al Smadi, et al, 2009). These major pollutants are often classified in two categories-gaseous and particulates. Fuel combustion process is that the source of gaseous emissions which include oxides of nitrogen, oxides of sulfur, oxides of carbon and volatile organic compounds and sulfide. Quarrying, drilling, blasting, hauling, Cement mill, fuel preparation, packaging, road cleaning and

stacks are sources of particulate within the sort of dust and carbon particle, (Babatunde Saheed Bada, et al, 2013).

There are many other sources of emissions from cement manufacturing, like emissions from transportation equipment utilized in the mining and transporting raw and finished material, fuel used for electricity production for operating other process in cement manufacturing. sorts of fuel utilized in cement industries for few selected countries, (Madlool N.A, et al, 2011*).*

2.6. Environmental and Health Impact of emissions

pollution from Cement manufacturing is becoming an environmental problem worldwide. Recent studies determine relationship between cement pollution and human health diseases. Pollutants from cement plants are causing harmful effects on human health and environment, (RaiPriyanka, et al, 2013).

2.6.1. Sulphur Oxide (SO_x): Oxides of sulphur are formed from the combustion of fuels which contain sulphur and oxidation of sulphur containing staple. Sulfur is present altogether cement raw materials. SO_2 Emissions generated from sulphur within the raw materials are lesser than SO_2 emissions generated from sulfur within the fuel, (Hesham Ibrahim, et al, 2012). In rotary kiln staple oxidized to make SO_2 and SO_3 at temperature between 370^{o}C and 420^{o}C prevailing within the kiln preheater, (Babatunde Saheed Bada et al, 2013). sulphur dioxide (SO_2) is made by thermal decomposition of calcium sulphate in clinker. SO_3 is present as anhydrite and may easily be decomposed to SO_2 and O_2. But the highly alkaline condition within the kiln can absorb 90% of the sulphur oxides. SO_x emission are often controlled by using low slphur fuel and staple. The sulfur oxides react with water vapour and other chemicals high within the atmosphere within the presence of sunlight to make sulfuric acids. The acids formed usually dissolve within the suspended water droplets, which may be washed from the air on to the soil by rain or snow. this is often referred to as acid precipitation. it's liable for such a lot damage to life and health. Respiratory illnesses like bronchitis are seen to extend with sulphur oxide levels, (Yousef Najjar, 2011). Increased level of SO_x in the atmosphere also can degrade agricultural productivity and death of some plants.

2.6.2. Nitrogen Oxide (NO_x): Nitrogen oxides are produced within the combustion flame of a rotary kiln, which enter the atmosphere with the exit gases, and undergo many reactions within the atmosphere. Majorly NO_x are formed by thermal oxidation, which happens in temperature range between 1,200-1,600°C. thanks to heat significant amounts of thermal NO are generated within the Kiln. Combustion of nitrogen-bearing fuels like certain coals also produces N_2, or NO. (Hesham Ibrahim, et al, 2012).

$N_2 + O \rightarrow NO + N$

$N + O_2 \rightarrow NO + O$

As temperature increases, NO formation also increases. About 90% of the nitrogen oxides are produced within the sort of gas (NO) and therefore the remaining 10% are within the sort of dioxide (NO_2), (Yousef Najjar, 2011). Produced NO converts to NO_2 at the exit of the stack at atmospheric conditions and appears in brown-yellow color.

$NO + 1/2O_2 \rightarrow NO_2$ *(Hesham Ibrahim, et al, 2012).*

NO_x causes a good sort of health and environmental impacts due to various compounds and derivatives within the family of nitrogen oxides, including dioxide, aqua fortis, laughing gas, nitrates, and gas. almost like sulfur dioxide, NO_x react with water and other compounds to make various acidic compounds. When these acidic compounds that are deposited to the earth's surface, they will impair the water quality of various water bodies and acidify lakes and streams. Acidification (low pH) and therefore the chemical changes end in making it difficult for a few fish and other aquatic species to survive, grow, and reproduce. acid precipitation also can harm forest ecosystems by directly damaging plant tissues. laughing gas may be a greenhouse emission and it accumulates within the atmosphere with other greenhouse gasses causing a gradual rise within the earth's temperature. this may cause heating and global climate change. NO_x and volatile organic compounds react within the atmosphere within the presence of sunlight to make ground-level ozone, which causes smog in cities and rural areas. This ground level ozone when breathed, it causes respiratory illness and other health problems, (http://www.epa.gov/captrade/documents/power.pdf) . dioxide affects body functions like difficulty in breathing, chronic lung diseases, like chronic inflammation and irreversible structural changes within the lungs, which with repeated exposure, can cause premature aging of the lungs and other respiratory disease. Studies indicate positive relation between dioxide concentrations and heart condition and cancer cases**.**

2.6.3. Carbon dioxide (CO_2) & CO: CO_2 (CO_2) & CO: Cement industry may be a major source of CO2 emission. CO_2 is emitted from the calcinations process of limestone and from combustion of fuels in kiln. It estimates that half the CO_2 is generated from fuel combustion and half originates from decarbonisation of staple. An indirect source of CO_2 and other pollutant in cement production is from

consumption of electricity, assuming that the electricity is generated from fossil fuels**.**

$CaCO_3 \rightarrow Cao + CO_2$
1 kg 0.56 kg + 0.44 kg)
$MgCO_3 \rightarrow MgO + CO_2$

The amount of CO_2 released in calcination are often calculated from the component formula weight ratios for of limestone, (Hendrik G. van Oss and Amy Padovani, 2003). CO_2 emissions from different fuels combustion are often calculated from emission factors of fuels defined by the Inter Government Panel on global climate change (IPCC). the quantity of CO_2 emission during this process is directly associated with the sort of fuel used like coal, fuel oil, pet coke, gas, alternate fuel. Typically, kiln is fuelled with coal as other fossil fuels are too expensive to be utilized in cement production. However, carbon based waste like tires are commonly utilized in cement kiln to use its energy content, (EPA, 2010).

Process-related CO_2 emissions from cement production are the second largest source of commercial CO_2 emissions within the us. variety of studies have suggested that, the cement industry contributes about 5% of total anthropogenic CO_2 emissions, worldwide. it's long been known that CO_2 emissions contribute to global climate change. Constantly increasing CO_2 emissions are liable for a rise in temperatures, which is predicted to continue over the approaching decades reaching up to +1.4˚ to +5.8˚C globally by the year 2100. Increasing temperature can cause severe droughts in some parts of the planet, extreme weather, the loss of ecosystems and potentially hazardous health effects for people, (Cristian Dincă, et al, 2013). Recent study details the impact of increase of temperature by CO_2, the resulting pollution would lead annually to a few thousand additional deaths and lots of more cases of respiratory disease and asthma within the us. It also shows that fuel CO_2 increases surface ozone, carcinogens and particulate matters leading to increased cases of asthma, death, hospitalization and cancer cases. CO can cause harmful health effects by reducing oxygen delivery to the body's organs and tissues, also as adverse effects on the cardiovascular and central nervous systems. CO also can contribute to the formation of smog (ground-level ozone), which may cause respiratory problems. Emissions of CO_2 from the cement manufacturing sector are often reduced by improving the energy efficiency of the method, adopting more efficient process, switching to low carbon fuel from high carbon fuels, using alternate fuels like biomass, reducing clinker to cement ratio, removing CO2 from the flue gases, (EPA, 2010).

2.6.4. Particulate matters (PM10, PM 2.5): Particulate matters are emitted from quarrying, hauling, crushing, grinding of staple and clinker, fuel preparation, clinker grinding and cement packing. particulate is consisting of fine particles which will remain suspended within the air which include dust, soot, and liquid droplets, (Hesham Ibrahim, et al, 2012).

The main environmental problem resulting from dust emission is reduced visibility and deteriorated ambient air quality. When the dust is washed with rain, it also can pollute water bodies, (Aribigbola Afolabi, et al, 2012). Particulate emissions contain potentially harmful toxic metals and compound like lead, chromium, nickel, barium, which may pose serious health impact on human health. These emissions are toxic because it carries carcinogens, mutagens, immunotoxins, respiratory toxins, neurological toxins etc. Physical properties of such particles decide the degree of their effect on human health. Coarse particulate (>PM10) are considered to cause local nuisance than creating hazard and fine particles (<PM_{10}- $PM_{2.5}$) are majorly big concern for health hazard due to their repairable nature.

The main route of entry of dust particles within the body is that the tract or the alimentary canal or both by inhalation or swallowing, (Manjula, et al, 2014). When PM (diameter but 10µm) are inhaled, they penetrate deep into the systema respiratorium and Pm but 2.5 µm continue to the lungs and pass into the blood stream. it's determined that short term exposure to Particulate matters (PM2.5) significantly increases the danger for cardiovascular and respiratory diseases. PM also can cause eye and throat irritation, bronchitis, lung damage, increased mortality rates, increased heart ailments, (http://www.groundwork.org.za/Cement), Some studies show that cement dust can cause respiratory and non-respiratory diseases. Cement dust also affects plant productivity thanks to reduced chlorophyll content of the leaves which obstruct the photosynthesis process. it's adverse impact on agriculture in nearby areas.

2.6.5. VOCs, dioxins, heavy metals and other pollutants: Other cement related emissions in trace quantity include VOCs, dioxins, furans, methane, heavy metals etc. the most source of VOC emission from cement kiln is organic matter present in staple. Occurrence of VOCs is additionally related to incomplete combustion. Heavy metal emission depends on content of those trace elements in fuel and staple, which is of course present in low concentration. In cement manufacturing dioxins also are formed within the combustion system when chlorine and organic compounds are present. Choice of staple and fuel with low organic matter, with low content of volatile and semi-volatile heavy metals can reduce these emissions. VOCs are precursor to ozone formation, which may also contaminate soil and spring water. it's been identified that VOCs can cause retardation of plant growth, chlorosis and

necrosis in broad leaves plants. VOCs can cause potential hazard like irritations in tract and eyes, headache, nausea, damage to liver, kidney and central systema nervosum. it's also referred to as potential carcinogen. Heavy metals and dioxins also can contaminate soil and water. Heavy metals can adversely affect plant functions and cell structure. Bioaccumulation of heavy metal can cause poising in aquatic and terrestrial life through biomagnifications. Heavy metals can cause damage to brain and systema nervosum, increased vital sign, effect on gastrointestinal functions and reproduction. Dioxins and furans also can cause health impact like Skin rashes, liver damage, weight loss, reduction in immunity, (USAID, 2005).

2.7. Consequences of Cement pollution

The aerodynamic diameter of cement particles makes it a possible hazard, as these are respirable in size and reaches in internal organs particularly lungs resulting in occupational lung diseases. This size distribution would make the trachea-bronchial respiratory zone, the first target of cement deposition. the most route of entry of cement dust particles within the body is that the tract and/ or the alimentary canal by inhalation or swallowing respectively, (Green, 1970). Both routes, especially the tract are exposed to numerous potentially harmful substances within the cement mill environment. Besides cement dust various gaseous pollutants also are contributed by cement factories which cause pollution and ultimately affect human health. the varied organ systems which get affected due to cement factories include.

Respiratory system: In systema respiratorium, these causes lungs cough and phlegm production, chest tightness, impairment of lung function, obstructive and restrictive lung diseases, Pleural thickening, fibrosis, emphysema, lung nodulation, pneumoconiosis and carcinoma of lung.

Gastro intestinal system: mouth, mechanical trauma, mucosal inflammation, loss of tooth surface, periodontal diseases, cavity, dental abrasion, liver diffuse, swelling and proliferation of sinusoidal (hepatic) lining cells, sarcoid type granulomas, peri sinusoidal and portal fibrosis and hepatic lesions is caused within the gastro intestinal system.

Stomach: In stomach it causes stomach ache and cancer.

Central nervous system (brain): Usually causes headache and fatigue. **Lymphatic system**: Spleen diminished lymphoid tissue and splenic lesions. Other affects include affect in eyes, skin and bones. Irritation in eyes, running eyes and conjunctivitis, skin irritation, itching, skin boil and burn, osteonecrosis, lesion of humerus, thinning of the cortex and reduction of epiphyseal cartilage.

Allergic reactions that interfere with breathing: allergies which create many breathing problems, from simple runny noses to life-threatening respiratory arrest. The immune system's abnormal response to harmless allergens unleashes histamines and other substances that employment to revive equilibrium. The side effects of this process end in respiratory and other allergy symptoms. Complications can occur in people with extreme sensitivities to the allergenic proteins in some pollen, foods, household pollutants, animal secretions and other substances. Pre-existing respiratory conditions also contribute to the severity of allergic effects on the systema respiratorium.

Chronic bronchitis: Bronchitis is an infection of the bronchial tree. The bronchial tree is formed from the tubes that carry air into the lungs. When these tubes get infected, they swell and mucus forms. This makes it hard for an individual to breathe. The person may cough up mucus and lots of wheeze. **Asthma**: Asthma (AZ-ma) may be a condition during which the airflow in and out of the lungs could also be partially blocked by swelling, muscle squeezing, and mucus within the lower airways. These episodes of partial blockage, called asthma "fares" or "attacks," are often triggered by dust, pollutants, smoke, allergies, cold air, or infections.

Emphysema: In emphysema the alveolar tissue is partially destroyed and therefore the remaining alveoli are weakened and enlarge. The bronchioles collapse on exhalation, trapping air within the alveoli. Over time this process impairs the power to exchange particulate oxygen and CO2 with the cardiovascular system, resulting in breathing difficulties; Emphysema may be a non-contiguous disease that results from multiple factors, including a genetic predisposition to the condition, smog, cigarette smoke, and infection.

Lung cancer: Studies of the American Cancer Society cohort directly link the particulate exposure to with carcinoma. for instance, if the concentration of particles within the air increases by just one, the danger of developing a carcinoma increases by 14%, (Pope et al, 2002) and (Kweskhi et al, 2004). Further, it's been established that particle size matters, as ultrafine particles penetrate further into the lungs, (Valavinidis, 2008).

Pneumonia: Pneumonia is an inflammation and infection of the lungs. Although pneumonia is special concern for older people and people with chronic illnesses, it also can strike young, healthy people also. In infectious pneumonia, bacteria, viruses, fungi or other organisms attack the lungs, resulting in inflammation that creates it hard to breathe. Pneumonia can affect one or both lungs. Infection of both lungs is mentioned as lobar pneumonia.

Tuberculosis: Tuberculosis is caused by a bacterium that attacks the lungs and sometimes other body tissues also. If infections within the lungs are left un-treated, the disease destroys lung tissue. within the past, antibiotics have con-trolled tuberculosis, but recently, new antibiotic-resistant strains of the tuberculosis bacterium have evolved. These new strains now pose a big public ill health.

Cough: A cough may be a sudden and sometimes repetitively occurring reflex which helps to clear the massive breathing

passages from secretions, irritants, foreign particles and microbes. The cough reflex consists of three phases: an inhalation, a forced exhalation against a closed glottis, and a violent release of air from the lungs following opening of the glottis, usually amid a particular sound, (Chung and Pavord, 2008). Coughing can happen voluntarily also as involuntarily. Coughing could also be caused by pollution including tobacco smoke, particulate, irritant gases, and dampness within the home, (Goldsobel and Chipps, 2010). The human health effects of poor air quality are far reaching, but principally affect the body's systema respiratorium and therefore the circulatory system.

Wheezing: Wheezing may be a high-pitched whistling sound during breathing. It occurs when air flows through narrowed breathing tubes. There could also be various causes of wheezing like asthma, bronchitis, breathing of any foreign substance or dust etc, (David et.al, 2010). Besides humans, cement affects directly the standard of soil, because it adds number of harmful substances thereto. Although, the essential constituents of cement dust are calcium ($CaCO_3$), silicon (SiO_2), aluminium ($Al2O_3$), ferric and manganese oxides, (Akpan et al., 2011) its production produces known toxic, carcinogenic and mutagenic substances, like particulate matters, sulphur dioxide, dioxide, volatile compounds, long lived dioxins and heavy metals, (Davidovits, 1994). The calcinations and burning processes of cement production produce poisonous gases that cause injuries to plants and animals, (Abimbola et al., 2007); (Gbadebo and Bankole 2007). Cement dust causes numerous hazards to the biotic environment, which have adverse effects and toxicological risks for vegetation, animal health and ecosystems, (Shukla et al., 1990); (Armolaitis et al., 1996); (Sivicommar et al., 2001); (Schwartz, 1994); (Adak et al., 2007) Plant growth parameters, yield and yield components of crops are often considerably influenced by excessive metal accumulation in soil, (Lerman, 1972). The particles of cement deposits are quite alkaline making soils of neighbourhood alkaline and changing its other properties which successively affects vegetation growth, decreases chlorophyll content thus decreasing photosynthesis rate as chlorophyll pigments are essential component for photosynthesis, decreasing respiration rate, reducing transpiration and thus rate of growth, (Borka et al., 1978); (Sai et al., 1987); (Shukla et al., 1990); (Asubiojo et al., 1991); (Iqbal and Shafiq, 2001); (Ade-Ademilua and Umebese, 2007); (Nanos et al., 2007). (Jan and Bhat, 2006); (Rafiq et al., 2008); (Jan, 2009) studied the impacts of cement pollution on morphology of Saffron plant and its productivity. one among the important aspects is decrease in chlorophyll content. A decrease in chlorophyll has been used as an indicator of a pollution injury, (Gibbert, 1968). Decrease in chlorophyll „a" chlorophyll „b" and Total chlorophyll content in fresh tissues of affected leaves could be thanks to chloroplast damage by incorporation of cement dust into foliar tissue. Similar observation has also been made by (Pandey et al. 1998, 1999) with stone crusher dust and by (Lerman 1972); (Singh and Rao 1968); (Pandey and Singh 1990) and by (Pandey et al. 1998) with cement dust. (Agarwal and Tiwari 1997) are of the opinion that the alkaline conditions caused by solubilisation of dust in cell cap could also be liable for chlorophyll degradation vis–a-vis photosynthetic efficiency. However, (Mengel and Kirby 1983); (Hewitt 1983) indicated that decrease in chlorophyll is thanks to induced Iron deficiency caused in more than Calcium supply. variety of workers have reported the similar results, (Borka, 1980); (Lerman, 1972) has suggested that continuous application of cement clogs the stomata, and thus interfering with gaseous exchange. this might cause increased leaf temperatures which can retard the chlorophyll synthesis, (Mark, 1963); (Singh and Rao, 1981). Chlorophyll could also be destroyed in cells under cement cover, (Bredemann, 1992); (Panjenkemp, 1961); (Samdor, 1973); (Klinesek, 1970); (Borka, 1978). Reduction in chlorophyll content within the cement affected plants and within the leaves are often attributed to the effect of Nitrogen oxides and sulfur dioxide released from the factory because the pollutants. The appreciable reduction in chlorophyll contents in sulfur dioxide treated plants were also noticed by another worker like, (Chand and Kumar, 1987); (Kumar and Pandey, 1985).

Besides morphological and physiological changes in plants there also occur biochemical changes due to cement dust like decrease in protein contents, change in proline level, total free amino acids, reducing sugars, abnormality during mitosis, chromosomal breakages etc (Kaushik, 1996). Besides gaseous and particulate pollutants there also are enhanced levels of other elements (metals and non- metals) in cement dust which cause numerous effects on plant which incorporates decrease in yield, seed germination, leaf area and water content of the leaves, (Hasan et al., 2011). Among the weather most toxic are heavy metals, as cement dust contains variety of heavy metals like Mercury, lead, nickel, chromium etc. These cause cytogenic also as mutagenic effects like decrease in plant growth, low pollen fertility decrease in seed yield, decrease in total protein levels, chromosomal stickness in meiosis phase, c-mitosis, chromosomal bridge, chromosome fragmentation, vagrant chromosomes, binucleus chromosomes and multi-polar anaphase and DNA fragmentation, (Abdul, 2010); (Ritambhara et al., 2010); (Yahaya et al., 2012). Among heavy metals Mercury plays an important role. Mercury may be a typical toxic metal pollutant. Bioaccumulation of mercury in plants and its entry into the organic phenomenon leading to future health hazards is of major concern. Since the start of the economic era, anthropogenic adulteration of the atmosphere, increased mining, high rate containing mercury within the industries are a number of the sources of mercury, creating a vitiated environment. The uptake and accumulation of chemicals by plants may convince be the foremost important aspect of chemical pollution dynamics, (Mohapatra, 1989). it's interesting to notice that the weather like mercury are easily absorbed by the plants than the opposite elements, (Pendias and Pendias, 1989). the upper concentration of mercury is thanks to the mercury released from the factory kiln and preheating/ pre-calcining operations which gets

accumulated within the nearest area of the factory. Mercury is introduced into the kiln with raw materials (90% of the fabric input) and to a minor extent with fuels, like coal and oil which are wont to provide energy for calcinations.

It is additionally reported that the hypogeal parts accumulated comparatively lesser amounts of mercury than the epigeal parts in plant, (Jan and Bhat, 2008). Mobility of heavy metal mercury has been demonstrated by a members of workers, (Furgusson, 1984) correlated the transportation through the xylem and phloem and transpiration intensity which significantly influence its accumulation. Mercury mobility to (Peterson, 1984) seemed to be greater when it entered the plant through the stem or leaf. The metal entry into plants through the leaves is more significant for pollution elements due to aerosol deposits, (Furgusson, 1984). variety of reports revealed that the accumulated levels in plants are influenced by their distance from the source of the metal, (Steinnes, 1987) and also seasonal effect, (Chaney et al., 1984).Cement dust causes numerous hazards to the biotic environment, which have adverse effects and toxicological risks for vegetation, animal health and ecosystems, (Shukla et al., 1990); (Armolaitis et al., 1996); (Sivicommar et al., 2001); (Schwartz, 1994); (Adak et al., 2007) Plant growth parameters, yield and yield components of crops are often considerably influenced by excessive metal accumulation in soil, (Lerman, 1972)..

III. RESEARCH METHODOLOGY

The study involves fieldtrip to site, empirical investigation, observation and interview of selected residents of the study area. This, primary and secondary data sources as well as reconnaissance survey were employed. The primary source consists of one hundred and fifty (150) structured questionnaires that were administered on both the workers and the residents of the area. The questionnaires were administered on the workers (outside the factory) and the residents. A systematic random sampling technique was adopted for questionnaire administration (one out of ten houses), targeting the heads of households. Simple statistical analytical techniques like frequency distribution was adopted for the data analysis.

3.1. Interview Questions asked to workers

- Name
- Age
- Working as
- Do you smoke?
- If yes, how many packs per day?
- For how many years have you been working in the cement factory?
- Do you think cement industry is causing any health problem?
- Are you suffering from any health problem?
- If, yes what?
- Have you ever consulted a doctor for your problems?
- Which specialist do you visit most frequently?
- Which medicines do you take most frequently?
- Do you use any safety devices such as masks, respirator etc
- If, yes what?
- If, no why?
- Does the owner provide you with safety devices?
- Do you think cement industry is causing any kind of pollution or problem in area?
- Are there any pollution control devices installed?
- If, yes, are they functional?
- Do you have any family history for any diseases?

3.2. Calculations

The calculations were carried out using the formula

$$\textbf{Percentage \%} = \frac{\text{Number of respondents (frequency)} \times 100}{\text{Number of respondents' questionnaire}} \quad 1$$

Frequency: This was obtained by counting the number of times they responded to a particular question.

IV. RESULTS AND DISCUSSIONS

Out of 150 structured questionnaires that were administered on both the workers and therefore the residents of community, 137 questionnaires were completed and returned.

4.1. Discussions

4.1.1. Effects on natural environment

Limestone mining in Obajana has resulted in conversion of farmlands into quarry sites. The house types on the location are mainly the make shift ones built to be used on no permanent basis. the homes are mainly used as shops and stores for the products of the factory. These houses were built without recourse to planning regulations then could pose health hazards to occupants. One vital impact of the quarry is deforestation. This simply means the loss of vegetation cover that's necessitated by the necessity to maneuver equipment to the location, removal of the topsoil or (overburden) stemming of explosives and removal of blasted limestone's. These effects are normally reduced by appropriate mitigating actions like massive reclamation of the mined areas using new overburden materials and a forestation programme that involve planting of sorts of trees that have ornamental values, can hold the soil structure well and will cover the exposed land well. Limestone mining in Obajana had resulted into the conversion of the many farmlands and settlements into quarry sites. The house types on the location are mainly the makeshift type built to be used on no permanent basis. The few landowners on the factory site are resident on site to participate in cement business and not to farm because it was already. The Dangote cement consistent with the management made frantic effort at re-settling the landowners within the estate built very on the brink of the factory. But since this was rejected, a programme of gradual takeover of the old farm site had started. within the course of using the quarry, farmers had been stopped from the location and therefore the

cutting/felling of the trees continued, resulting into an outsized Expanse of land exposed to rain water and wind. The lake created as a results of blasting of limestone and release of water from within the Limestone deposit ordinarily should function habitat to water fish, this has however not been developed. The ammonium compound washed into the lake from its primary source (explosive materials) may function manure and should encourage the expansion of plankton, algae and aid the liming of the lake and encourage fish production. However, the likelihood of getting an excess quantity of the ammonium compound washed into the lake may pose a significant hazard on the lives of the aquatic animals. Apart from this the extent of vibration and noise by earthmovers at quarries are alleged to be kept in check a minimum of to fall within the limit allowed by Federal Environmental Protection Agency (FEPA). These factors are monitored using vibrogram while keeping the vibration level at but 50 mm per second and therefore the noise at below 120 dB (decibel). Proper stemming of the explosives which are dangerous in themselves, within the dug holes is meant to be encouraged to avoid surface stemming. Proper and burying of the explosives at the acceptable depth ensures reduced noise and controlled blasting. The empirical investigation reveals that there has not been substantial compliance with this guideline thereby exposing residents to avoidable inconveniences.

Another factor that has contributed to poor environment at the quarry site is that the rising of dust during blasting and haulaging. during this case, the health concerns of the manpower come to the fore. Silica exposure is an ancient hazard which has remained a significant threat to several workers including sand blasters, stone crushers, those involved in drilling, quarrying and tunnelling through the world crust. Diseases related to the inhalation of silica containing dust include silicosis, chronic airways obstruction and bronchitis, tuberculosis and carcinoma. Many workers including those in high-risk settings are exposed to crystalline silica. Wetting of the location road with water is administered to scale back only the fugitive dust. Empirical observation reveals that while most of the workers are protected, the residents within the community are exposed to the dust during production process. Out of the 137 people interviewed 28 or 20.44% reported prevalence of asthma, while 14or 10.22% reported exposure to heart diseases (Table 4.1).

Table 4.1: Diseases associated with the factory

Disease	Frequency	Percentage
Asthma	2	20.44
Heart disease	14	10.22
Skin cancer	20	14.60
Diarrhoea	6	14.38
No disease	44	32.12
No response	25	18.23
Total	137	100

Water is generated in great quantity within the process of drilling and blasting within the quarry resulting in erosion and therefore the washing of the left-over of the explosives mainly ammonium nitrate into the pool formed thanks to the erosion. Many farmers have had their farmlands washed away by erosion and flooding during rainfall. In Obajana works, a man-made dam has been constructed to carry the water generated from the blasted limestone. The body of water is employed for fish farming and therefore the water is additionally pumped into the factory after treatment as processed water and for cooling purposes within the new plant that's located within the quarry. Good as this is often, it also poses health problems. Stagnant water may be a breeding spot for pathogens like mosquito, which causes malaria. More over soil compaction has resulted from hauling equipment's like the drilling machine, scrapper, pay loader, bulldozer, dumper etc utilized in quarry, making forestation in such area very difficult. Blasted areas that are refilled and regenerated are allowed to fallow for a minimum of 5 years for full yield (agriculturally) to be achievable on such soil but shortage of land for agriculture among the populace are forcing people to re-cultivate such areas before they might fallow, thereby worsening the matter of erosion. Compacted areas are alleged to be blasted when not in use as tracks and later regenerated for fast recovery. Empirical observation has not revealed this.

Another important impact of the activity is oil spillage. This comes from such sources because the primary and secondary crushers, mobile plant workshop and sites, oil drum and tank sites in stores, kiln sites, compressor houses and sites, through leakages and spillage this will have quite impact if it finds its way into water drainage within and out of doors the factory. It also can cause quite ugly site if allowed to accumulate on a given site. Such measures as checking the oil seals regularly and following a well guided disposal programme for such oil would have prevented such impacts as loss of the fauna and flora population in lakes and drains within and out of doors the factory. one among the main problems of cement industry within the world over is noise generation by various machineries like grinding mill, fans blowers, compressors and conveyors. The noise levels emitted in cement plants are known to vary from 70 to 118db (decibels). the quality of background level prescribed for Nigeria's industries are 90 to 115db.it is worthy to understand that 90db is that the maximum background level citizenry can tolerate. Hence in cement plants the utilization of ear muffle of varied sizes and kinds are enforced to stop damage to eardrums. While this is often substantially complied with within the cement mill for the workers, the background level remains above the minimum for the inhabitants of the village. The exposure of man to dust can cause a good sort of respiratory diseases. Particles can cause irritation to the eyes, nose and throat. the dimensions of the particles largely determine the scopes of its effects thanks to ability of being transported. the character of the particles is additionally important in determining its health or environmental impacts. Dust are often considered fugitive if its source is that the cement mill, packinghouse, house and

road cleaning, while beginning dust is generated from kiln stack. Nose masks are provided to hide the nose and mouth while industrial goggles reduce the exposure of eyes to dust particles. It must be noted that this wont to constitute a serious problem to the community within the past, but with the replacement of the kiln to modern type the incidence of dust pollution has substantially reduced.

Another important problem that results from production process is production of sludge. Sludge is generated in raw mill operation thanks to mill over feeding and consequent flow back and leakages along the pump line. The sludge is skilled the desilting pit where the particles within the water are allowed to settle before being passed into drains / canal. Water from other sources is additionally passed out of the factory through the drain canal. Samples of the water is taken regularly and checked for conformity with FEPA standards before being passed out of the factory. However empirical investigation reveals that a number of the sludge still gets to topsoil thereby polluting topsoil and underground water. apart from these, Greenhouse gases like CO_2, NO_2, CH_4, etc. are generated through the stack into the environment and intrinsically contribute to the atmospheric phenomenon by increasing the temperature of the world by trapping ultra violet rays to supply heat. how of manufacturing CO_2 in cement plant is by reducing the number of clinker utilized in cement production and this is often achieved by adding such additives as slag, limestone, etc thereby reducing the number of linker normally required to supply cement thereby CO_2 released into the atmosphere, CH_4 quantity released into atmosphere is controlled by ensuring complete combustion of gas.

4.2. Residents' perception of the environmental impacts of the cement plant operation:

Form of pollution: far and away the foremost important environmental problems resulting from the operation of the industry within the perception of residents of Obajana, Papalanto and its environs is that the dust from pollution sometimes not only affect visibility but agriculture. Polluting water bodies within the aesthetic nature of the communities and posing a robust threat to the health and wellbeing of the residents. From Table 4.2, 15 of the respondents representing 10.95% of the entire respondents' experience land pollution. 16 of the respondents representing 11.68% of the entire respondents' experience pollution while 104 of the respondents representing 75.91% of the entire respondents experienced air pollution; and lastly 2 of the respondents representing 1.46% of the entire respondents haven't any specific experience of pollution. From the analysis it's quite obvious that pollution is that the major environmental problem experienced in Obajana community. this is often not unexpected, being in mind that majority of the respondents live within but 2km to the factory site which the cement factory has noxious effect in Obajana as validated by the respondents within the questionnaire administered

Table 4.2: Common form of Pollution

Form of pollution	Frequency	Percentage
Water	15	10.95
Land	16	11.68
Air	104	75.91
Noise	2	1.46
Total	137	100

Distance of residence to the cement factory: From investigations conducted, 49 of the respondents lived but 1km faraway from the factory, 53 of the respondents representing 38.69% of the entire respondents lived 1-2km faraway from the cement factory, 28 of the respondents representing 20.44% of the entire respondents lived 2-3km faraway from the cement factory, while 7 of the respondents representing 5.11% of the entire respondents lived 3km faraway from the cement factory (Table 4.3). From the analysis, the bulk of the respondents (102) representing 74.45% of the respondents lived within 2km faraway from the cement factory; this suggests they're all under the influence of pollution resulting from the operation of the industry.

Table 4.3: Distance between individual house and factory

Distance (km)	Frequency	Percentage
Less than 1	49	35.77
1-3	53	38.69
2-3	28	20.44
Above 3	7	5.11
Total	137	100

From the analysis of the questionnaires, four common diseases were identified as diseases related to the world (see table 4.1). 28 of the respondents, representing 20.44% of the entire respondents admitted having asthma as a results of the siting of the factory in their location, 14 0f the respondents representing 10.22% of the entire respondents admitted having heart condition as a results of the siting of the cement factory in their location. 20 of the respondents representing 14.60% of the entire respondents suffer from carcinoma as a results of siting the cement factory in their location, 6 of the respondents representing 4.38% of the entire respondents admitted having diarrhoea as a results of siting the cement factory in their location while 68 0f the respondents representing 50% of the entire respondents admitted not having any of the above named diseases as a results of siting the cement factory in their location.

4.3 How residents cope with effects of the pollution

From the questionnaire table 4.4, 117 of the respondent, representing 85.40% of the entire respondents like better to accept the consequences of the pollution, 5 of the respondents representing 3.65% of the entire respondents would like to migrate to a different area, while 7 of the respondents representing 5.11% of the entire respondents would like to

complain to health authorities and lastly, 4 of the respondents representing 2.92% of the entire respondents would like to require to protest. From the above analysis majority (85.40%) of the respondents would like to measure with the pollution thanks to various reasons. it'd likely flow from to economic reasons and psychological attachment to their area in spite of pollution.

Table 4.4: How residents cope with the effect of the Pollution

Effect of pollution	Frequency	Percentage
Live with it	117	85.40
Migrate to new area	5	3.65
Complain to health authority	7	5.11
protest	4	2.92
Others, specify	4	2.92
Total	137	100

4.4 Efforts of the factory in mitigating the effects of pollution

The questionnaire table reveals that 24 of the respondents, representing 19.71% of the entire respondents agreed that the factory is doing something to mitigate the consequences of pollution. While 102 of the respondents representing 74.45% of the entire respondents disagreed.

Lastly, 9 of the respondents representing 6.57% of the group claimed they don't know if the factory is doing anything to mitigate the consequences of pollution. From the analysis, majority of the respondents put the blame squarely on the factory management of not doing much to deal with the pollution problem. From this investigation it's clear that 67.88% of the respondents representing 93 of the respondents believed that nothing will ever be done to compensate them for the pollution while 32.12% of the respondents representing 44 of the respondents believed provision of 1 social amenity or the opposite can compensate them for the pollution (Table 4.5).

Table 4.5: Development efforts of the industry to compensate for the damage

Developmental effort	Frequency	Percentage
Providing electricity	4	5.84
Migrate to new area	20	14.60
Complain to health authority	7	5.11
Protest	9	6.57
Others, specify	9.3	67.88
Total	137	100

Similarly, the analysis revealed that 78 of the respondents, representing 56.93% of the entire respondents which represent the bulk are of the strong opinion that stringent environmental standard should be adopted, while they're strongly against the factory being relocated. this might not be unconnected with the economic benefits the factory is providing them. Response from the worker (outside the factory) and therefore the residents showed that there exist issues bothering on environmental pollution.

All the buildings (residential, workshops, eating houses and therefore the factory itself) roofs and adjoining camp or village houses are thickly dusty. The waste management is during a deplorable condition and there's generally lukewarm attitude towards environmental sanitation.

Table 4.6: Suggestions of Respondents on how to improve development effort

Community Developmental effort	Frequency	Percentage
Relocate the factory	5	3.65
The factory shall be compelled to increase compensation	29	21.8
Adapt stringent environmental laws	78	56.93
I don't know	25	18.25
Total	137	100

4.5 Response to interviews

The workers responded alright to the interview and replied that they were mostly affected by skin, respiratory and eye irritations. They weren't given any safety devices during work. The workers generally received treatment by the health care centre of the factories. During summers the health related problems increased.

V. CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

The study has tried to gauge the negative consequences of Dangote cement industry on the environment. The study reveals that though there are substantial efforts on a part of the management of the industry to scale back their noxious impact, more still must be done especially within the area of environmental monitoring in order that for instance the vibration and other emissions enumerated earlier might be brought in check.

5.2 Recommendations

From the purpose of view of an environment management practitioner, the necessity to significantly and painlessly reduce the quantity of CO_2 emissions resulting from Dangote cement can't be over-emphasized considering the importance of CO_2 within the greenhouse emission effects in heating. Considering the number of CO_2 produced per ton of cement, the utilization of mineral admixtures, which might otherwise, be land filled may be 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 which will be utilized in maintaining such projects.

The necessity for Cement factory authorities to supply the workforce with less irritating means of protecting themselves from dust inhaling and therefore the environment from dust menace by providing super active dust Control equipment is extremely important.

The citing of cement industries should be strictly controlled such the menace of noise, vibrations, dust, and heavy vehicles movement are going to be brought in check and much from towns and cities.

Moreover, there's the necessity for the government to intensity effort within the implementation of Environmental impact assessment of cement industries now and within the future considering the character of its impact on all the facets of human life apart from that the excavated area should be properly filled to forestall the contamination of groundwater, surface water and aquatic lives, the first state of the excavated area should be attained.

Considerable effort must even be geared towards preventing particulates from going into the atmosphere, as its effect in unpredictable within the environment, special devices to arrest and mop up particulates should be provided.

Since many noise- would be generated as a results of the cement production and mining activities there's the necessity to seek out how of muffing the noise and to shield the location.

Moreover, large volume of vehicles would be interested in the cement factory and mining site resulting into soil surface compaction hence there's got to develop appropriate highway and widened to scale back hazards on the environment.

The communities should be jointly being involved in monitoring environmental resources depletion, especially the compliance level of the plant to minimum standards for sustainable and pollution free society.

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