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Physical, Chemical and Biological Factors as Occupational Health and Safety Hazards Among Site Workers in Cement Industries in The South-South Region of Nigeria

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ABSTRACT: *Hazard in the workplace can cause illness or injury to the mental, physical and social wellbeing and thereby cause loss of production or working time. Safety is a state of being free from danger which can lead to injury, death, loss or damage to property. Site workers in cement factories may not be fully aware of the factors responsible for health and safety hazards in their workplace, hence this study in order to find out if physical, chemical and biological factors are responsible for occupational health and safety hazards among workers in cement industries in the South-South region of Nigeria. Consequently, the population for the study consisted of all the site workers in all the cement industries in the South-South geopolitical zone of Nigeria. The sampled size is 1,000, (850 male (85%) and 150 female (15%). A total of 1000 questionnaire forms were administered and used for the study. The study adopted a multi-stage sampling procedure and Taro Yamane formula to draw the samples. The reliability of the instrument was determined through the Crombach Alpha, which gave a value of r = 0.89. Data collected was analyzed with the descriptive statistics of simple percentages and inferential statics of Chi-square. The study revealed that physical, chemical and biological factors were responsible for occupational health and safety hazards among site workers. Recommendations were thereby made that the personal protective equipment against physical, chemical and biological foreign bodies should be provided and the use should be enforced at all times in cement industries, health promotion programs should be integrated by management to help improve workers awareness, knowledge, attitude and practices regarding safety measures in the cement factory, while periodic medical examination policy should be adopted by management to help reduce cases of health problems among workers.*

KEYWORDS: physical, chemical, biological, occupational health and safety hazards, cement industries.

INTRODUCTION

Hazard is anything (e.g. condition, situation, practice, behaviour) that has the potential to cause harm, including injury, disease, death, environmental, property and equipment damage, while occupational hazards are conditions that have the potential of causing injury or ill health in the workplace. Occupational hazards include attacks by pesticides, insecticides and herbicides poisoning, ultraviolet radiation from sunlight, noise from machinery, dust and fumes, puncture, cuts, backaches, snake bite, rodent bites and other animal attacks, accidents due to falling tree,

tractors accidents among others (Achalu, 2019). Hazard is a condition in the workplace that can cause illness or injury in any way and which do not improve the mental, physical and social wellbeing of a worker and thereby cause loss of production or working time (Azuzu, 1997).

Identifying and eliminating or controlling hazards as early as possible, helps to prevent injuries and illnesses in the workplace. Occupational hazards are potential risks to life or functioning of an individual that is inherently associated with his occupation or work environment. In the cement industry, workers are exposed to various hazards at various manufacturing and production processes, such as quarrying, handling of raw materials, grinding clinker, blending, packing and shipping of the finished products. In two decades ago, two disastrous accidents occurred in Bhopal (India) and Chernobyl (Ukraine) which had a death toll of an estimated 4,000 and 10,000 persons respectively in the year 2000. In addition, there were around 5,200 workplace fatalities and 3.9 million workers suffered disabling injuries in the United States (Hamdy, 2015). This clearly demonstrates that the problem of workplace accidents and safety is a pressing issue.

Hazards in the cement industry can be grouped into physical, chemical, biological, ergonomic and psychosocial hazards. As stated by the World Health Organization (WHO) "occupational health deals with all aspects of health and safety in the workplace and has a strong focus on primary prevention of hazards". Hamdy, (2015*)*, stated that Health has been defined as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. Health has been defined as it contrasts, for example, with the promotion of health and safety at work, which is concerned with preventing harm from any hazard, arising in the workplace. When work is associated with health hazards, it may cause occupational disease, which may be one of the multiple causes of other diseases or may aggravate existing ill-health of non-occupational origin. In developing countries, such as Nigeria where work is becoming increasingly mechanized, a number of work processes have been developed that treat workers as tools in production, putting their health and lives at risk. The occupational health lessons learned during the Industrial Revolution should be borne in mind in planning for health if such problems are to be avoided. It has been observed that 20,000 working people are being injured and 200 deaths occurs every year because of having occupational accidents within a formal sector industrial workforce of 0.4 million and total workforce of 11.2 million. Generally, causes of accidents can be mentioned as unsafe working conditions, lack of supervision and training, use of old machinery and equipment, lack of sufficient maintenance, bad house-keeping practices, violation of safety rules, and overcrowded production units with very congested space (Nahyan, 2010; Merenu et al., 2011; Gautam & Prasain, 2011). A workplace injury can have a huge effect on worker's whole life. For the people working in a processing factory, some of their body parts mostly affected by injury are the hands, finger and thumbs. Wrist and shoulder injuries are also very common (Gautam & Prasain, 2011). Safety is a state of being free from danger which can lead to injury, death, loss or damage to property. According to Ekenedo (2010), safety is concerned with removing dangers that cannot be removed. Also

Omikiri (2012), defined safety as people's attitude, habits and activities in the provision and maintenance of accident, and incident free safe working and living environment.

Over the century, many cement companies, factories and industries have spent valuable time, efforts, and resources improving occupational health and safety in their workplace without much achievement. The increasing health and safety hazards in industries have resulted to incessant health problems, such as; harm, slow productivity, absenteeism and even death etc., among the workers. It was observed that most establishments are not fully aware of the factors responsible for health and safety hazards among their personnel. Hence, this study attempted to find out if physical, chemical and biological factors are responsible for occupational health and safety hazards among workers in cement industries in the South-South region of Nigeria in order to be able to suggest, recommend ways to avert or proffer solutions to the incessant occurrence of health and safety hazards among site workers in cement industries.

METHODOLOGY

The population for this study consisted of all the site workers in all the cement industries in the South-South geopolitical zone of Nigeria. South-South geopolitical zone consists of six (6) states which include; Akwa Ibom, Bayelsa, Cross River, Delta, Edo and Rivers States. The sampled states in this study were Edo State and Cross River State respectively, in which two cement industries, tagged Company "A and B" were selected from each of them. Company A is located in Edo State with its capital in Benin City. The 2014 estimated population of Edo State was about 6 million people. It is made up of 4 major ethnic groups; namely the Bini, Esan, Owan, and Etsako. However the state has a high presence of residents from across the country and the world because of its cosmopolitan tendencies. Benin City, the capital has a history of being one of the foremost destinations of Europeans during their exploration of the African continent several centuries ago which has made it to remain as a flash point for tourist attractions for the state. Edo State consists of 18 local government areas which are also controlled and represented by elected local government chairmen. Their major means of survival for the good people of the State is farming.

The Cement Company; "A" is situated in Okpella in Etsako East Local Government Area of Edo State, which is the 3rd largest autonomous town in Edo State after Benin City and Uromi. Okpella is known for its natural sedimentary rock based mineral resources, such as; limestone, calcium, granite, clay, marble, talc, feldspar etc. It is home to several granite and marble making industries giving the host community a vibrant industrial viewpoint. While Company "B" which is the Mfamosing plant is a modern production facility with an annual cement production capacity of 5 million metric tonnes per annum is located in Mfamosing L.G.A of Cross River State. Cross River State borders Cameroon to the east and has a population of about 3,737,517 which is 2.042% of the total population of Nigeria and its capital is Calabar. The local tribes of Cross River state consist largely of the Efik and Ekoi people. Its food crops include; yams, cassava, rice and corn. Deep sea fishing and shrimping along the coast are their

major means of survival. Cross River State consists of 18 Local Government Areas which are controlled by elected local government chairmen who represent the L.G.A respectively.

The sampled workers include those in the department of quarry, production, maintenance, research & development, technical and administrative/non-technical, which were classified into two broad sections called "operational and administrative" sections respectively. Majority of the workers are blue collared, while just a few of them are white collared jobbers. The sampled size is 1,000, which consisted of 850 male workers which represent 85% and 150 female workers representing 15% of the total sample size. A total of 1000 questionnaire forms were administered, retrieved and utilized for the study. The administrative unit comprised mainly of personnel, marketing, clerical, security, clinical and other logistic staff, while the operational section was broadly classified into production, manufacturing and maintenance units. However, the workers that are directly exposed to chemicals include; workers in the bagging, crushing and packing, loaders, mechanical engineers, technicians, and other support staff.

The study adopted the Taro Yamane formula, a multi-stage (proportionate, stratified random and accidental) sampling procedure to draw the samples for the study. The reliability of the instrument was determined through the use of Crombach Alpha, which gave a value of r = 0.89. The data collected was analyzed with the use of the descriptive statistics of simple percentages and the inferential statics of Chi-square.

RESULTS AND DISCUSSIONS

The data analysis and discussion of findings are presented as follows;

Hypothesis 1: Physical factors will not significantly be responsible for occupational health and safety hazards among site workers in cement industries in the South-South region of Nigeria

Table 1: Chi-square Analysis of Physical factors and Occupational Health and Safety Hazards

Variable	Cal X^2	t- value	Df	P-value	Decision
Physical Factors	23.02	3.841	1	.05	Rejected

Table 1 above indicated a calculated X^2 value of 23.02 at df l, with a table value of 3.841. This is higher than the table value, therefore the hypothesis that says physical factors will not significantly be responsible for occupational health and safety hazards among site workers in cement industries in the South-South region of Nigeria is hereby rejected.

This finding is in line with the assertion of Achalu (2019) that physical hazards commonly occur as occupational health and safety hazards in work places. He went further to describe

physical hazards as those hazards that can be seen or felt, which examples include noise; light, ionizing, radiation, high and low pressures, high and low temperature, vibrations, x-rays, laser beams and heat stress or extreme heat. Physical hazards include injuries resulting from falls during the process of cement production in the factory and occur in workplaces through the process of bagging and filling section as well as stepping into the conveyor belt during production of cement. Also, Clausen et al. (2012) submitted that inadequate machinery guarding, exposed electrical wiring, inadequate lightening, defective hand tools, unsafe working condition and workplace design are also factors responsible for occupational health and safety hazards.

Also, in support of this finding, Canfeng (2012) revealed that physical hazards can be as a result of fire explosion due to extreme temperature and also exposure to vibration in the factory. The main hazardous factors in quarrying of raw materials can be defined as dust and noise. Noise emits during blasting, crushing and operation of conveyors in quarrying. Noise sources in cement manufacturing plant include; sound or noise from milling machines, crushers, electric motors, etc. Dust emission is one of the most significant impacts of cement manufacturing and it is associated with handling and storage of raw materials (including crushing and grinding of raw materials), solid fuels, transportation of materials (e.g. by trucks or conveyor belts), kiln systems, clinker coolers, and mills, including clinker and limestone burning and packaging/bagging activities (Gautam & Prasain, 2011). Packaging is the most polluting process (in terms of dust) in cement production (Cumbane, 2011). Nitrogen oxide (NOX) emissions are emitted from the high temperature combustion process of the cement kiln. Carbon dioxide defined as greenhouse gas is mainly associated with fuel combustion and with the decarbonation of limestone (Gautam & Prasain, 2011).

In corroboration of this finding Etuk (2012), confirmed that vibrations from machines in the cement plant causes general or whole body vibration to the workers which lead to occasional pain, periodic spells and feeling of numbness experienced by workers at the bagging and refilling section. During production of cement, workers are exposed to high level of noise from the engines which lead to hearing impairment. Noisy workplace can make workers irritable, nervous and sick, where the level of noise exceeds 85 decibel it is ideal to provide and put into use the protective gadgets and equally subject workers to annual audiometric assessment (Azogwa, 2014). In addition, noise induces stress, raises artificial blood pressure and contributes to heart related problems. Most of the cement factory workers develop signs and symptoms after inhaling silica or dust into their lungs and inhalation of free silica which are found in flint and quartz (Achalu, 2019). Cement dust can cause lung function impairment, chronic obstructive lung diseases (Saucier & Janes, 2004). Noise is also a major hazard encounter during the production of cement; milling plants used in grinding the cement product causes high tension of noise; this can simply damage someone hearing levels, maintenance and cleaning personnel are mostly at risk. He however, suggested that the use of improved noise personal protective equipment may help to reduce the effects of exposure.

Hypothesis 2: Chemical factors will not significantly be responsible for occupational health and safety hazards among site workers in cement industries in the South-South region of Nigeria

Table 2: Chi-square Analysis of Chemical factors and Occupational Health and Safety Hazards

Variable	Cal X^2	t- value	Df	P-value	Decision
Chemical Factors	306.36	3.841	1	.05	Rejected

The above table 2 indicates a calculated X^a value of 308.36 at df 1, with a Crit. t-Value of 3.841. This result indicates that the calculated X^2 value is higher that than of the table value. Consequently, the hypothesis that says chemical factors will not significantly be responsible for occupational health and safety hazards among site workers in cement industries in the South-South region of Nigeria is hereby rejected.

This finding corroborates that of Herztein (2013), which submitted that chemicals factors are recognized as constituting health hazards in occupations where production processes are undertaken. Chemical hazards arise from excessive air born concentrations; chemical hazard could occur through either inhalation, dermal or ingestion and through contaminated hands. Chemicals factors are acidic or alkaline substances which may come naturally, or artificially, as solids, liquids, gasses, fumes, dusts or vapors to constitute health hazard. Achalu (2019) and Nwachukwu (2015), furthermore, explained that chemical hazards can be grouped into solid, liquid and gasses; the solid chemicals comprises of lead, mercury, phosphorus etc., the liquid chemicals consist of petrol, kerosene, methyl, alcohol, sulphuric acid; while gases are hydrogen, carbon monoxide, hydrogen propane, chlorine etc., and all the above are major contributory factors to health and safety hazards in work environments.

In line with this finding Jain and Sunil (2013) also confirmed that chemicals from cement factories have the capacity of causing diseases, fire outbreak, explosion, environmental pollution and death in cement work places. During cement production chemical hazards can cause respiratory diseases, skin diseases, cardio vascular disease, cancer and neurological disorder which often shorten life expectancy. Chemical hazards contribute adversely to the air pollution by emission of toxic substances into the atmosphere such as carbon monoxide, sulphuric oxide during production process in the cement plant.

Hypothesis Three: Biological factors will not significantly be responsible for occupational health and safety hazards among site workers in cement industries in the South-South region of Nigeria

Table 2: Chi-square Analysis of Biological factors and Occupational Health and Safety Hazards

Variable	Cal X^2	t- value	Df	P-value	Decision
Biological Factors	111.39	3.841	1	.05	Rejected

The above table indicates a calculated X^2 value of 111.39 at df 1, and a crit. t-value of 3.841. Therefore, since the calculated X^9 is higher than the table value the hypothesis that says that biological factors will not significantly be responsible for occupational health and safety hazards among site workers in cement industries in the South-South region of Nigeria is hereby rejected.

In line with this finding Achalu (2019), confirmed that in the cement plant, microorganisms develop spontaneously from most of the chemical reagents when expired and apparently, biological hazards which are living things such as plants and animals, microbial agents that cause disease such as insects, viruses, yeast, spores, parasites and fungi, bacterial and viral diseases which effects include infectious diseases, rashes and allergic response are most likely to occur.

Gupta (2012), in line with the finding further explained that biological hazards emanate from living things, such as; plants, animals and micro agents within the workplace. Significant biological exposures in cement manufacturing process include skin infections from prolonged and over used work coveralls and aprons, droplet infection particles and parenteral exposure. This according to Cherry, Meyer and Holt (2011), contributes to the causes of acute and chronic infections among workers.

Many chemicals (Garg & Anupama, 2012) when allowed to stand for several days become sour, acidic produce methane and ill smelling gas which are poisonous and harmful to health. The workers in the cement industries are prone to disease infections if preventive measures such as personal hygiene and good housekeeping that will help improve workers health and reduce infections within the workplace are not taken. He however, therefore recommended that workers should always wash their coveralls and aprons and keep a good personal hygiene to avoid the risk of health problems within the workplace.

SUMMARY

The study attempted to investigate if physical, chemical and biological factors constitute occupational health and safety hazards among site workers in cement industries in the south-south region of Nigeria. The population for the study consisted of all the site workers in all the cement industries in the South-South geopolitical zone of Nigeria. The sampled states were Edo State and Cross River States respectively. The sampled workers included those in the department of quarry, production, maintenance, research & development, technical and administrative/non-technical, which were classified into two broad sections called “operational and administrative” sections respectively. The sampled size is 1,000, which consisted of 850 male workers representing 85% and 150 female workers representing 15% of the total sample size. A total of 1,000 questionnaire forms were administered, retrieved and utilized for the

study. The study adopted a Taro Yamane formula and the multi-stage sampling procedure (proportionate, stratified random and accidental) to draw the samples for the study. The reliability of the instrument was determined through the Crombach Alpha, which gave a value of r = 0.89. The data collected was analyzed with the use of the descriptive statistics of simple percentages and the inferential statics of Chi-square. The data analysis and discussion of findings, summary, conclusion and recommendations were later presented.

CONCLUSION

Based upon the findings of this study, the following conclusions were drawn:-

1. Physical factors are significantly responsible for occupational health and safety hazards among site workers in cement industries in the South-South region of Nigeria.

2. Chemical factors are significantly responsible for occupational health and safety hazards among site workers in cement industries in the South-South region of Nigeria.

3. Biological factors are significantly responsible for occupational health and safety hazards among site workers in cement industries in the South-South region of Nigeria

Recommendations

Consequent upon the findings of this study the following recommendations are drawn:-

1. The personal protective equipment against physical, chemical and biological foreign bodies should be provided and the use should be enforced at all times in cement industries.

2. Health promotion programs should be integrated by management to help improve workers awareness, knowledge, attitude and practices regarding to safety measures in the cement factories.

3. Periodic medical examination policy should be adopted by management of cement industries to help reduce cases of health problems among workers.

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