HEALTH HAZARDS AND SAFETY CONTROL MEASURES AMONG WORKERS OF CEMENT INDUSTRIES IN NIGER DELTA

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ABSTRACT

The study identified the health hazards and control measures among workers of cement industries in Niger Delta. Two research questions and two null hypotheses guided the study. The study adopted a descriptive cross-sectional research design with analytical correspondence. The populations for the study consist of workers of two cement industries in Niger Delta. Taro Yamani formula was used to arrive at a sample size of 438 which represent the total population for the study. The study employed stratified random sampling technique to select workers for the study from each stratum (department). One self-designed instruments titled "Assessment of Occupational Hazards and safety practices was used for data collections. Face and content validities of the instruments were ensured. Cronbach's alpha reliability coefficient of AOHHSP was established at 0.72. The research questions 1and 2 were answered using mean and standard deviation while null hypothesis 1and 2 were tested using T-Test and ANOVA table at 0.05 alpha level of significance. Data were analyzed using statistical package for social sciences (SPSS) version 21. The study found among others that the workers of these selected cement industries were fully aware of the occupational hazards and safety such as exposure to cement dust which causes difficulty in breathing. Most workers in the industries are faced with physical hazards such as; The respondents in these selected cement industries revealed that hazards such as excessive heat, poor ventilation as a result of poor indoor air, lighting within the factory and installation of scaffolds during any work at height and radiation as a result of emission of energy. Also, electrocution as a result of working on exposed live electrical conductors without insulated gloves and tools, noise from engines and machines, high temperature, dust from cement and vibration from machines are common known physical hazards in their work place. Based on the findings, recommendations were made; there is need for management of cement industries to develop a frame-work that will initiate the integration and implementation of safety regulations in cement factories so as to reduce associated occupational hazards, health promotion program should be integrated by management to help improve works knowledge, attitude and practices regarding to safety measures within the cement factory and periodic medical examination policy should be adopted by management of cement industries to help reduce cases of health problems among workers of cement industries in Nigeria.

INTRODUCTION

Industrialization is known as one of the most important influence of any economy leading to development of infrastructure of any nation. Hence, occupational health and safety is a public health priority in industrialized countries and a primary concern, especially in high risk industries (Rachid et. al., 2015). Industry such as cement is a major component for building infrastructure and construction works. It is an important construction material used for the development of infrastructure, and key to economic growth of any developed and developing society (Koh et. al., 2011; Nkhama, 2017). Cement industries are among the largest leading manufacturing sector with a production process which involves grinding, drying and mixing of limestone as well as additives like bauxite ore and iron into a powder form called raw meal (Rampuri, 2017). Due to the engaging production process, workers are exposed to health hazards which are tremendously harmful to their health (El – Sobky, 2010).

Many health and safety legislative and regulatory has been formulated to protect workers from hazards and health problems, strategies in the aim to improve the sustainability of cement production (Haupt et al., 2011). Standards and regulations tend to support the traditional command-and-control, deemed to comply or prescriptive approach of addressing unsafe situations as well as existing and potential hazards, while ignoring the responsibility of the employer in addressing unsafe worker behaviour (Taylor, 2013). Periodic check-ups and early detection of hazards can be used to control cement factory work-related accidents and diseases, which has continue to be a major problem in the world today (Abongomera, 2010; Gupta 2011; Rogers, 2011). In many cement industries workers are exposed to occupational hazards resulting to diseases and injuries but a considerable interactive effort with exchange of ideas in many organizations within and outside the cement industry tries to address these problems (Rampuri, 2017). There are potential adverse health risks from the exposure to cement dust and other cement by-products such as gaseous waste (Sultan et al., 2013; Zeleke, et al., 2010). Also there are toxic and poisonous mixtures of dissolved solids are dangerous substances consisting of inorganic and organic components which are discharged into the environment (Aga & Anyadike 2020). Large volumes of dust from cement factories and mining operations in the Nigerian quarries are discharged daily into the air. A lot of airborne particulate matter is generated by the numerous stone-crushing industries (Ugbogu, et al., 2010)

Environmental Health and Safety Management (2010) explains that some of the diseases do not emanate on the workers' health quickly as expected but when the diseases finally manifest it is often difficult to trace the root causes to the workers' past exposure. The International Labour Organization (ILO) observed in 2008 that more than two million workers die each year from work-related accidents and diseases, and added that this is probably an underestimation. The ILO estimates that workers suffer 270 million accidents and at least 335.

Sultan (2013) explained that workers in the industry are prone to have lung function impairment resulting from occupational respiratory problem like cement dust. Cement can cause ill health in workers through skin and eye contact or inhalation. The risk injury attached to the cement factory workers depends on the duration and level of exposure and individual sensitivity (Saucier & Jane, 2014; McCann & Babin, 2017).

In addition to the various health hazards, cement workers are especially exposed to dust which causes lung function impairment, chronic obstructive lung disease, restrictive lung disease, pneumoconiosis and carcinoma of the lungs. Cement production process involves quarrying, crushing, raw material grinding, blending, kiln burning, cement grinding and packaging (Meo, 2012). Therefore, ensuring healthy and safe working conditions for employees and contractors is a fundamental key to corporate social responsibility, and is one of the most important issues for the cement industry (World Business Council for Sustainable Development, 2011). Occupational health is the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations. The main focus in occupational health is to maintain worker's health and working capacity, to improve the working environment to become conducive to safety and health, and to develop the working organizations and cultures in a direction which supports health and safety of people (Ahmed et al., 2010).

So many workers in cement industries are exposed to significant occupational health hazards and consequently at high risk of work related diseases which vary from minor irritations or injuries to cancers (De-Coninck, 2011; Steven, 2012). Generally causes of accidents in the cement industries can be mentioned due to 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 (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). Especially in case of cement factories, the population mostly exposed to cement dust pollution include workers and managers of cement plants and factories; families of workers and managers living in staff houses of factories; and other neighborhood habitations.

Most of the processes in quarrying and the associated activities of rock drilling, blasting, stone cutting, rock crushing, and aggregate manufacture generate dust which can cause dangerous levels of airborne contamination in the workplace as a result of frequent exposure to cement dust within the working environment. Noah, (2018). Local rock has a high silica content which makes silicosis the major health hazard of exposed persons who inhale the dust. According to (Rice, 2012) hazardous materials are responsible for annual death of several thousands of workers worldwide. Oginyi (2010) in a study conducted on environmental impact assessment of cement manufacturing in Edo State of Nigeria, it was reported that in 96.7% of all the industries sampled, no worker used protective devices.

Statement to the Problem

Hazards are emitted during cement production process, most workers are not fully aware of these hazards. It is assumed that most cement industry workers are deficient in knowledge on the occupational hazards arising from working in cement industries. Most of the cement industry workers are from the lower socio-economic class and are often employed without the pre-requisite and needed trainings to work in the industry (Gabriel, Charity and Solomon 2020).

Currently, there is a higher rate of occupational hazards in the cement industries. Workers of these industries are exposed to different hazards such as noise generating from engine and machines which causes hearing loss, stress and blood pressure. James (2018) opined that occupational hazards affect workers' performance in Nigeria's cement industry. Survey research method was employed in conducting the research: a structured questionnaire was designed and administered to one hundred and eighty-three (183) workers of Lafarge Cement Plant in Sagamu, Ogun State, Nigeria. The study revealed that the frequency level of occupational hazards had a significant influence on workers performance; a significant difference exist between performance levels of healthy workers to unhealthy workers; and that safe workers had high tendencies of performing on the job than workers who were unsafe at work in the cement industry.

Research Questions

1. What are the occupational health and safety hazards in s cement industries in Niger Delta?
2. What are the hazard control measures by management in of cement industries in Niger Delta?

Hypothesis

1. There is no significant difference in occupational health and safety hazards among workers of selected cement industries in Nigeria based on age
2. There is no significant difference in hazard control measures by management of selected cement industries in Nigeria based on work experience.

Concept of Occupational Health and Safety

Occupational health is a multidisciplinary activity aimed at the protection and promotion of the health of workers by preventing and controlling occupational diseases and accidents and by eliminating occupational factors and conditions hazardous to health and safety at work, the development and promotion of healthy and safe work, work environments, and work organizations; the enhancement of the physical, mental and social well-being of workers and support for the development and maintenance of their working capacity, as well as professional and social development at work; enabling workers to conduct socially and economically productive lives and to contribute positively to sustainable development (Achalu,2019).

Occupational health is the study of promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations. The main focus in occupational health is to maintain worker's health and working capacity, to improve the working environment to become conducive to safety and health, and to develop the working organizations and cultures in a direction which supports health and safety of people (Ahmed et al., 2010). Presently, industrialization in developing countries has been leading one of the threats for the people health and if industries are not well designed and appropriate safety measures are not adopted, serious adverse health consequences to the workforce can be ensued.

Classification of Occupational Health Hazards in Cement Industries

Hazards in the cement industries can be grouped into physical hazards, chemical hazards, biological hazards, ergonomic hazards and psychosocial hazards.

Physical Hazards in Cement Industries

Physical hazards are those hazards that can be seen or felt. 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. (Achalu, 2019). Physical hazards within the workplace include injuries resulting from falls during the process of cement production in the factory through the process of bagging and filling section as well as stepping into the conveyor belt during production of cement. Physical hazards include: inadequate machinery guarding, exposed electrical wiring, inadequate lightening, defective hand tools, unsafe working condition and workplace design (Clausen, Christensen, Lund and Kristiansen, 2012). In addition, electric shock from the electrical circuits at the control room in the filling section. The United States Department of Health & Human Services (USDHHS,2013), reported that workers having years of experience -more than 10 years were more exposed to hearing loss, eye problem, high blood pressure, respiratory damage resulting from dust, thermal stress from high temperature and occupational traumatic injuries.

Chemical Hazards in Cement Industries

Chemicals are acidic or alkaline substances which may occur naturally, or artificially, as solids, liquids, gasses, fumes, dusts or vapors (Nwachukwu, 2015). Some chemical substances constitute health hazard. Examples include dust, acid, bases, heavy metals, fire explosion, vapor, drugs, dyes, explosives, solvents, fumes which affect the central nervous system, lungs, digestive system, circulatory system (Achalu,2019). In whatever form they exist chemicals are recognized health hazards in occupations where they are involved in production processes. Chemical hazards arise from excessive air born concentrations; chemicals could occur through either inhalation, dermal or ingestion and through contaminated hands (Herztein, 2013). These toxic chemicals may have acute or chronic

effects on the workers such as dizziness, headache, nausea, vomiting, sleepiness, fatigue, loss of concentration, respiratory tract irritation, lung cancer and pulmonary edema (Plog et al, 2011).

Biological Hazards in Cement Industries

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 (Gupta, 2012). In the cement plant, microorganisms develop spontaneously from most of the chemical reagent when expired. Achalu, (2019), defined biological hazards 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.

Ergonomic Hazards in Cement Industries

Ergonomic hazards which are also referred as mechanical hazards which involve possibilities of physical injuries to human body due to moving objects, flying objects from broken machines and plants, slips and fall of workers as a result of their job process (Jain and Sunil, 2015). They went further to state that some mechanical hazards are most common in industries and the result is injury, disability and possible death of workers. During production in the cement factory, workers have to stand for a long time it could result to ergonomic hazards such as back pain, waist pain and other muscular skeletal problems (Asogwa, 2013). He went further to states that, the most prevalent complaint among cement workers are body pain and headache. This is expected because of the physical nature of activities in the cement factories.

Psycho-social Hazards in Cement Industries

According to Cooper (2013), psychosocial hazards are hazards that arises from the working condition of the employee which may include; lack of job satisfaction, frustration, stress, anxiety, inconsistency in payment of salaries and poor human relationship in the workplace. Frone (2012), examined the relationship between work family conflict and several types of psychiatric disorders, it was revealed in the study that work to family and family to work conflict were positively related to having a mood of anxiety and substance dependence disorder. Also, Chen, Yu & Wong (2014) explored the impact of occupational stress and other psychosocial factors on musculoskeletal pain among Chinese cement factory workers, it revealed in the study that 7.5% of workers suffered from low back pain and 32% from elbow pain as a result of prolong standing in the factory. Psychosocial hazards are hazards that arise from the workers failure to adapt to alien psychosocial environment of his or job (Asogwa, 2013).

Health Hazards and Control Measures in Cement Industries

The basic principle of hazard control and prevention is to completely eliminate the hazard but the fact is that complete elimination of hazards inherent in any job is tantamount to eliminating the job itself. Thus, the next alternative is the control of various physical, chemical, biological, mechanical, chemical, ergonomic and psychosocial hazards at work. (Achalu,2019). Risk control measures are measures put in place in the workplace that will help reduce and detect hazards that will lead to injury, accidents or death within the workplace. Hierarchy of hazard control is the system used in industry to minimize or eliminate exposure to hazards. It is widely accepted system promoted by numerous safety organizations.

The hierarchy hazard control system within the workplace includes: elimination, substitution, engineering control, administrative control, administrative control and personal protective equipment's. So, every industry needs to set up safety and control measures in its organization in the prevention of injuries, accidents or death within the workplace. According to Achalu (2019) in line with Asogwa (2013) the following are highlighted as safety preventive measures and control measures to reduce diseases and eliminate hazards within the work place.

Complete Elimination of Hazards/Substitution in Cement Industries

This is the process of removing the hazard from the workplace. It is referred to measures put in place to endeavor that hazards are eliminated and control measures are being put in place and should be used whenever possible. This can be achieved through the following.

Substitution of the Process

- Replace hazardous material or machines with less hazardous materials.
- Replace faulty machines with new machines.
- Replace of manual handling of transportation of raw materials within the cement plant with lifting machines.
- Using of wet process than dry process during production of cement within the cement plant.
- Replace of chemicals substances that are hazardous with less hazardous chemicals within the workplace.
- Placement of safety signs and signals within the cement plant for workers to adhere to.
- Install and maintain dust fitters to control dust within the workplace.
- Heat recovery to maintain fuel energy requirements.
- Insulate pipe work and kilns to retain heat.
- Install wet scrubber systems to reduce particulate emissions.

Engineering Control

They are methods that are built into the design of a plant, equipment or process to minimize the hazard. Engineering controls are a very reliable way to control workers exposures as long as the controls are designed, used and maintained properly. The basic engineering control is that, to the extent feasible, the work environment and the job itself should be designed to eliminate hazards or reduce exposure to hazards. While this approach is called engineering controls, it does not necessarily mean that an engineer is required to design control. Engineering controls are first line of defense against injury/illness, because they have the potential to completely eliminate a hazard, and do not rely on human behavior to be effective. For instance, rather than require employees to wear respiratory protection which must be monitored, inspected, trained, managed, it must be effective to install a ventilation system that does not require any of those management activities or better yet, find an alternative substitute that is less hazardous.

Examples: mechanical guards, wet enclosures and isolation with good ventilation within the cement factories. The basic types of engineering controls are:

- **Process control:** This involves changing the way a job activity or process is done to reduce the risk within the cement plant. Monitoring should be done before and as well as after the change is implemented to make sure the changes are implemented to make sure the changes did result in lower exposures. Examples of process control include: use of wet methods rather than dry when drilling or grinding lime stone to produce cement during production process in the factory, use of steam cleaning instead of solvent degreasing and use of mechanical transportation rather than manual handling of transportation of finished products.

Total Enclosure and Isolation: An enclosure keeps a selected hazard physically away from the worker. Enclosed equipment, for example, is tightly sealed that is typically only opened for cleaning or maintenance. Others include gloves boxes used in the cement factories. Where chemicals is in a ventilated and enclosed space and the employee works with the material by using gloves that are built in, care must be taken when the enclosure is opened for maintenance as exposure could occur if adequate precautions are not taken (Rosenstock, 2012).

Research Methodology

Research Design

An analytical cross-sectional research design was adopted for this study. It is a quantitative based cross sectional design, which uses data to make statistical inferences about the population of interests or to compare subgroups within a population. It describes features of the population such as prevalence of health problems but cannot prove cause and effect. It is a non-experimental description research method.

Study Area

The study was carried out in cement industry A and B in the South-South geopolitical zone of Nigeria. South-South consists of six (6) states which include Akwa Ibom, Bayelsa, Cross River, Delta, Edo and Rivers State. This study was carried out among two selected cement industries in Nigeria. The study was carried out in two cement industries in Edo State and Cross River State respectively which are located in the South-South geo-political zone of Nigeria. Company A is located in Edo State which is also situated in South-South geopolitical zone of Nigeria with its capital in Benin City. The 2014 estimate population of Edo State is 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 many centuries ago which has remained as flash point for tourist attractions for the state. Edo State consists of 18 local which are also controlled and represented by elected local government chairmen. Their occupation is farming which is a means of survivor for the good people of Edo State. Company A is situated in Okpella in Etsako East Local Government Area of Edo State. It 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.

Company B is located in Cross River State which is situated in South- South geopolitical zone of Nigeria bordering 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 in Calabar. The population of Cross River state consists largely of the Efik and Ekoi people. Food crops including yams, cassava, rice and corn are cultivated. Deep sea fishing and shrimping along the coast are one of their major means of survival. Cross River State consist of 18 Local Government Areas which are controlled by elected local government chairmen who represent the L.G.A respectively. Company A is situated in Mfamosing L.G.A of Cross River State. The Mfamosing plant is a modern production facility with an annual cement production capacity of 5 million metric tonnes per annum.

Population for the Study

The study was carried out among workers in the two selected cement industries in South-South geo-political zone of Nigeria were the researcher was able to get assess into the cement factories namely Cement Company A, located in Edo State and Cement Company B located in Cross-Rivers State, Nigeria with a staff population of about 4,103 from both companies respectively which records were available through the Human Resources Department of the two selected cement industries. The population for the study consists of workers among two selected cement industries in Nigeria which are Company A located in Okpella, Edo State and Company B located in Mfamosing, Cross River State were the study was carried out respectively. Majority of the workers are blue collar workers while few of the workers are white collar workers which were used for the study. The population consists of more Male workers which represent 70% of the total population and few female workers which represent 30% of the total

population for the study. A total of 548 questionnaires were distributed with 523 returned giving a return rate of 95.4%. The returned questionnaires were examined and 25 were rejected because they were incomplete or responses were unclear, while 21 were not retrieved. The final 502 questionnaires (95.9%) of the returned questionnaires are considered to be representative of the sample and were used for analysis. The departments in the cement factories are broadly classified into administrative and operational sections. The administrative unit comprises mainly personnel, marketing, clerical, security, clinical and other logistic staff. The operational section broadly classified into production, manufacturing and maintenance units comprises of workers directly exposed to dust and includes workers in the bagging, crushing and packing section; loaders, mechanical engineers, technicians, and other support staffs.

Inclusion and Exclusion Criteria

The inclusion criteria for this study were supervisors, technicians and skilled, semi-skilled and unskilled workers. These are workers with a work experience of 1 year or more and are available at the time of administration. While, the exclusion criteria were workers with less than one (1) year work experience and workers who are not on duty (i.e absenteeism, leave or hospitalized) at the time of administration.

Sample and Sampling Technique

Sample Size

Sample size for this study was calculated using Taro-Yamane (1967) formula for determining sample. The formula is given as:

$$n = \frac{N}{1 + N(e)^2} \qquad (3.1)$$

where n = sample size, e is tolerance error (or the desired level of precision) = 0.05 and N is the population of the study.

$$n = \frac{4103}{1 + 4103(0.05)^2} = \frac{4103}{11.2575} = 364.46 \approx 365 \text{Participants}$$

Sampling Technique

Stratified random sampling technique was used in this study. The technique is a method of sampling that involves the division of a population into smaller sub-groups called strata, because of large heterogeneous population. The strata are formed based on members shared attributes or characteristics. Stratified random sampling is also called proportional random sampling. Random samples are then selected from each stratum through simple random sampling technique. The proportional allocation for each stratum was constituted using simple random sampling in a sampling fraction (SF). Thus, the sample for each stratum (department) was computed as follows:

$$SF = \frac{n}{N} = \frac{438}{4103} = 0.1067 \qquad (3.2)$$

Therefore, sample for each stratum is given as:

Strata Sample = Total Population x Sampling Fraction

(3.3)

Table 3.1: Strata Samples

Departments	Population	Sample
Quarry	1293	138
Production	984	105
Maintenance	459	49
R & D	403	43
Technical	543	58
Non-Technical	421	45
TOTAL	4103	438

However, to make up the non-response, 10% of 248 were added, making it an extra 25 respondents. Thus, the minimum appraised sample size of 273 respondents was sampled in each cement industry of study with a total sample size of 438.

Method of Data Collection/Instrumentation

3.6.1 Questionnaire

This study used instrument titled "Assessment of Occupational Health Hazards and Safety Practices among Workers of Selected Cement Industries in Nigeria Questionnaire (AOHSP)" was used to elicit information from the respondents. A structured questionnaire was designed by the researcher. Section A of the questionnaire consists of demographic variable such as age, gender, marital status, level of education, job experience and department. While, section B was designed using modified 4-point likert scale (strongly agree (SA)/always (AL), agree (A)/occasionally (O), disagree (D)/rarely (R) and strongly disagree (SD)/never (N)) with their corresponding weights of 4, 3, 2 and 1 point respectively. Section B of the questionnaire assessed awareness. Section C identify occupational hazards in cement industries, Section D identified health problems in cement industries, Section E assessed safety practices in cement industries and Section F of the questionnaire assessed control measures of occupational health and safety hazards among workers of selected cement industries in Nigeria respectively. The questionnaire was distributed to the workers during lunch hour by the help of three trained research assistant.

Validity/Reliability of the Instruments

The research instrument was given to researcher's supervisor and other experts in the field of occupational health and safety for validation. Validity is measuring what the researcher intends to measure in a research (Oyegun, 2003). Also, Nzeneri, (2002) stated that validity of an instrument determines the extent which the instrument is able to collect; it connotes the trustworthiness of an instrument. Reliability refers to the accuracy of the measuring instrument or the consistency between measurements in a series. The reliability of the instrument was ascertained through a test-retest method. A sample of 20 respondents was administered copies of the instrument within internal of two (2) weeks. The data collected was analyzed using Cronbach Alpha and a reliability index of 0.83 was obtained, thus the instrument was reliable for the study.

Method of Data Analysis

The study applied descriptive statistic such as charts, frequency, percentages, mean, standard deviation and inferential statistic such as analysis of variance (ANOVA), correlation and chi-square analysis. Descriptive statistic was applied to obtain answers for research questions while inferential statistic was used to test for hypotheses. ANOVA is necessary to determine variability between variables, while correlation is adopted to determine the relationship or association between independent and dependent variables of the study. Chi-Square is used to determine association between social demographic and variables of interest. These analyses were aided using statistical package for social sciences (SPSS) version 21.

Ethical Approval

Ethical approval was obtained from the Research Ethical Committee of the University of Port Harcourt. Also, introductory letter was obtained from the Centre for Occupational Health, Safety and Environment, University of Port Harcourt. Written informed consent was obtained prior to the administration of the instrument and permission was obtained from both workers and the company. Each participant has a right to decline or withdraw the study at any time, without any harassment or harm and workers provided signed informed consent prior to the commencement of the instrument.

RESULTS AND DISCUSSION

Analysis of Questionnaire

A total of 548 questionnaires were distributed with 523 returned giving a return rate of 95.4%. The returned questionnaires were examined and 25 were rejected because they were incomplete or responses were unclear, while 21 were not retrieved. The final 502 questionnaires (95.9%) of the returned questionnaires are considered to be representative of the sample and were used for analysis.

4.2 Data Presentations

4.2.1 Socio-Demographic Data

Table 4.2: Socio-Demographic distribution of respondents

Socio-Demographic Variables (n=502)	Frequency	Percentage (%)
Gender		
Male	301	60.0
Female	201	40.0
Age (Years)		
≤ 25	57	11.4
26- 30	129	25.7
31 – 35	128	25.5
36 – 40	130	25.9
41+	58	11.6
Marital Status		
Single	178	35.5
Married	219	43.6
Divorced/Separated	61	12.2
Widow/Widower	44	8.8
Educational Level		
Primary	105	20.9
Secondary	205	40.8
Tertiary	192	38.2
Years of Job Experiences		
1-5	100	19.9
6-10	121	24.1

11-15	158	31.5
16+	123	24.5
Department/Categories		
Quarry	190	37.8
Production	117	23.3
Maintenance	51	10.2
R & D	34	6.8
Technical	58	11.6
Non-Technical	52	10.4

The socio-demographic distribution of respondents were gender, age as well marital status, work experience, level of education and department. The study showed that a total of 301 (60%) males and 201 (40%) females, while there were 178 (35.5%) singles, 219 (43.6%) married, while 61 (12.2%) divorced/separated and 44 (8.8%) widows/widowers. Fifty-seven (11.4%) out of 502 respondents were aged less or equal to 25 years, while 129 (25.7%) were aged between 26 and 30 years, 128 (25.5%), 130 (25.9%) and 58 (11.6%) respondents were aged between 31 and 35 years, 36 and 40 years, 41 years and above respectively. Also, a total of 190 (37.8%) respondents were in quarry department, 117 (23.3%) production, 51 (10.2%) maintenance, 34 (6.8%) research and development, 58 (11.6%) technical and 52 (10.4%) respondents indicated non-technical department.

Also, 100 (19.9%) out of 502 respondents indicated that they have work experience between 1and 5 years, 121 (24.1%) respondents had worked between 6 and 10 years; while 158 (31.5%) indicated that they have work experience between 11-15 year and 123 (24.5%) had job experience 16 years and above.

Research Question 1: What are the occupational health and safety hazards in selected cement industries in Nigeria?

Table 4.4a: Mean physical hazards in selected cement industries in Nigeria.

S/N	Statement	SA (%)	A (%)	D (%)	SD (%)	Total (%)	Mean	Std.	Decision
1	Noise from engines and machines lead to hearing impairment, induces stress, raises artificial	111(22.1)	236(47)	130(25.9)	25(5)	502(100)	2.86	0.81	Agree

	blood pressure and contributes to heart related problems.								
2	Radiation as a result of emission of energy damages living tissue in the human body.	126(25.1)	211(42)	142(28.3)	23(4.6)	502(100)	2.88	0.84	Agree
3	Vibration from machines during bagging process in the cement plant causes general or whole body vibration and lead to occasional pain, periodic spells, feeling of numbness by workers at the bagging and refilling section of the cement industry	75(14.9)	202(40.2)	143(28.5)	82(16.3)	502(100)	2.54	0.94	Agree
4	Electrocution: Working on exposed live electrical conductors without insulated gloves and tools causes electric shocks which lead to muscle sprain, tissue damage, fibrillation of the heart, loss of consciousness, and even death.	117(23.3)	224(44.6)	144(28.7)	17(3.4)	502(100)	2.88	0.80	Agree
5	Poor installation of scaffolds during any work at height causes falls at height which could lead to accident or death	128(25.5)	218(43.4)	135(26.9)	21(4.2)	502(100)	2.90	0.83	Agree

6	Poor lighting within the factory can lead to eye strain because of insufficient lightening due to lighting levels are low, too high, or inconsistent.	126(25.1)	227(45.2)	122(24.3)	27(5.4)	502(100)	2.90	0.84	Agree
7	Poor ventilation as a result of poor indoor air quality can lead to employees suffering from headaches, fatigue, and allergies, dizziness, shortness of breath, coughing and nausea.	128(25.5)	214(42.6)	140(27.9)	20(4)	502(100)	2.90	0.83	Agree
8	Extreme temperature causes fatigue, discomfort and distraction and can increase accidents.	123(24.5)	203(40.4)	156(31.1)	20(4)	502(100)	2.85	0.83	Agree
9	Excessive heat could lead to various illnesses such **as** heat edema, heat rashes and heat cramps.	125(24.9)	222(44.2)	142(28.3)	13(2.6)	502(100)	2.91	0.79	Agree
	Grand Total	1059(23.4)	1957(43.3)	1254(27.8)	248(5.5)	4518(100)	2.85	0.84	Agree

Table 4.4a revealed that respondents agreed that physical hazards such as excessive heat, poor ventilation as a result of poor indoor air, lighting within the factory and installation of scaffolds during any work at height and radiation as a result of emission of energy. Also, electrocution as a result of working on exposed live electrical conductors without insulated gloves and tools, noise from engines and machines, high temperature and vibration from machines. These means are greater than criterion mean of 2.5.

Table 4.4b: Mean chemical hazards in selected cement industries in Nigeria.

S/N	Statement	SA (%)	A (%)	D (%)	SD (%)	Total (%)	Mean	Std.	Decision
1	Dust causes chronic obstructive lung disease, restrictive lung disease etc.	103(20.5)	232(46.2)	141(28.1)	26(5.2)	502(100)	2.82	0.81	Agree
2	Flammable gases causes fire outbreak during operation within the factory.	73(14.5)	131(26.1)	148(29.5)	150(29.9)	502(100)	2.25	1.04	Disagree
3	Breathing some fuel oils may cause nausea, eye irritation, increased blood pressure, headache, light-headedness, loss of appetite, poor coordination, and difficulty concentrating.	112(22.3)	224(44.6)	147(29.3)	19(3.8)	502(100)	2.85	0.80	Agree
4	Effects of respirable crystalline silica can cause silicosis which is, in fact, the most significant lung disease caused by breathing mineral dusts.	129(25.7)	221(44)	130(25.9)	22(4.4)	502(100)	2.91	0.83	Agree
5	Fires and explosions in the factory are frequently caused by risk factors such as faulty gas lines, poor pipefitting, improperly stored	129(25.7)	204(40.6)	142(28.3)	27(5.4)	502(100)	2.87	0.86	Agree

	combustible materials or open flames.								
6	Acid and chemical burns can cause serious physical consequences for the burn victim such as damages in the deep tissue and can cause long-term pain and disability that may require therapy and rehabilitation.	119(23.7)	228(45.4)	132(26.3)	23(4.6)	502(100)	2.88	0.82	Agree
	Grand Total	665(22.1)	1240(41.2)	840(27.9)	267(8.9)	3012(100)	2.76	0.89	Agree

From Table 4.4b respondents agreed that chemical hazards such as effects of crystalline silica, acid and chemical burns, fires and explosions in the factory are frequent, breathing of fuel oils, and dust but disagree to flammable gases.

Table 4.4c: Mean biological hazards in selected cement industries in Nigeria.

S/N	Statement	SA (%)	A (%)	D (%)	SD (%)	Total (%)	Mean	Std. Deviation	Decision
1	Poor environmental condition due to lack of proper sanitation.	109(21.7)	225(44.8)	134(26.7)	34(6.8)	502(100)	2.81	0.85	Agree
2	Poor personal hygiene.	129(25.7)	222(44.2)	128(25.5)	23(4.6)	502(100)	2.91	0.83	Agree

3	Bacterial infection due to unclean environment can cause skin infection and skin reactions.	133(26.5)	214(42.6)	131(26.1)	24(4.8)	502(100)	2.91	0.84	Agree
4	Microorganisms from stagnant water.	131(26.1)	200(39.8)	149(29.7)	22(4.4)	502(100)	2.88	0.85	Agree
5	Improper disposal of waste materials.	135(26.9)	205(40.8)	146(29.1)	16(3.2)	502(100)	2.91	0.83	Agree
	Grand Mean	637(25.4)	1066(42.5)	688(27.4)	119(4.7)	2510(100)	2.88	0.84	Agree

Table 4.4c revealed that workers agreed biological hazards such as poor personal hygiene, improper disposal of waste materials, bacterial infection due to unclean environment, microorganisms from stagnant water and poor environmental condition due to lack of proper sanitation; because these means are greater than criterion mean of 2.5.

Table 4.4d: Mean ergonomic hazards in selected cement industries in Nigeria.

S/N	Statement	SA (%)	A (%)	D (%)	SD (%)	Total (%)	Mean	Std. Dev.	Decision
1	Work overload causes stress, dissatisfaction and burnout.	119(23.7)	220(43.8)	140(27.9)	23(4.6)	502(100)	2.87	0.83	Agree
2	Manual transportation of equipment and material causes injury, accident	142(28.3)	228(45.4)	109(21.7)	23(4.6)	502(100)	2.97	0.83	Agree

	and muscle sprain to the workers.								
3	Awkward/improper posture: Standing or sitting in the same position for an extended period of time is a common cause of back, neck, and leg pain. Awkward posture often stresses the spine and causes muscle fatigue and pain.	112(22.3)	188(37.5)	124(24.7)	78(15.5)	502(100)	2.67	0.99	Agree
4	Standing for long period of time causes fatigue.	117(23.3)	244(48.6)	115(22.9)	26(5.2)	502(100)	2.90	0.81	Agree
5	Improper lifting of materials and equipment results to musculoskeletal disorders.	92(18.3)	194(38.6)	127(25.3)	89(17.7)	502(100)	2.58	0.98	Agree
6	Repetitive motions as a result of performing repetitive tasks with the same movements over a long period of time often face problems concerning neck and muscle pain.	153(30.5)	218(43.4)	107(21.3)	24(4.8)	502(100)	3.00	0.84	Agree
	Grand Mean	735(24.4)	1292(42.9)	722(24)	263(8.7)	3012(100)	2.83	0.90	Agree

Table 4.4d revealed that workers agreed that ergonomic hazards like repetitive motions, manual transportation of equipment and material, accident and muscle sprain to the workers, standing for long period of time, work overload, awkward/improper posture and improper lifting of materials and equipment. These means are greater than the criterion mean of 2.5.

Table 4.4e: Mean psychosocial hazards in selected cement industries in Nigeria.

S/N	Statement	SA (%)	A (%)	D (%)	SD (%)	Total (%)	Mean	Std.	Decision
1	Working in isolation in the unit causes stress and boredom.	144(28.7)	227(45.2)	113(22.5)	18(3.6)	502(100)	2.99	0.81	Agree
2	Workplace violence creates a ripple impact causing physical, psychological, and financial problems	119(23.7)	219(43.6)	142(28.3)	22(4.4)	502(100)	2.87	0.82	Agree
3	Poor work design such as inadequate space utilization, ineffective workplace technology, poor lighting, inefficient workplace processes, lack of workplace flexibility and balance, uncomfortable working conditions etc causes psychosocial hazards to the cement factory workers	158(31.5)	204(40.6)	119(23.7)	21(4.2)	502(100)	2.99	0.85	Agree
4	Delays in payment of salaries can lead to poor work performance and absenteeism of the	131(26.1)	207(41.2)	138(27.5)	26(5.2)	502(100)	2.88	0.85	Agree

employee in the factory.								
Grand Mean	552(27.5)	857(42.7)	512(25.5)	87(4.3)	2008(100)	2.93	0.84	Agree

Table 4.4e showed that psychosocial hazards like working in isolation, poor work design such as inadequate space utilization, ineffective workplace technology, delays in payment of salaries and workplace violence; because these means are greater than criterion mean of 2.5. Thus, this implies that physical, chemical, biological, ergonomic and psychosocial hazards are occupational health and safety hazards in selected cement industries in Nigeria.

Hypothesis

Hypothesis 1: There is no significant difference in occupational health and safety hazards among workers of selected cement industries in Nigeria based on age.

Table 4.9: ANOVA of occupational health and safety based in selected cement industries in Nigeria based and age

	Sum of squares	**Df**	**Mean Square**	**F**	**P-Val**
Between Groups	47.546	2	21.366	.327	.142
Within Groups	11336.117	597	48.764		
Total	12383.663	599			

P > 0.05

Table 4.9 shows that the sums of squares are 47.456 and 11336.117 while the mean squares are 21.366 and 48.764, with degrees of freedom of 2 and 597. The calculated F value of .327 is not significant at .142 when subjected to probability level of .05. Therefore, the null hypothesis is accepted. By implication, age does not significantly influence occupational health hazards and safety among workers in cement industries in Niger Delta.

Hypothesis 2: There is no significant difference in hazard controls measures by management in cement industries in Niger Delta based on working experience.

Table 12: ANOVA on hazard controls measures by management in selected cement industries in Nigeria and working experience

	Sum of Squares	df	Mean square	F	P-Val
Between Groups	28.654	2	19.651	.043	.000
Within Groups	12365.286	597	46.973		
Total	12393.940	599			

Table 12 shows that the sums of squares are 28.654 and 12365.286 while the mean squares are 19.651 and 46.973, with degrees of freedom of 2 and 597. The calculated F value of .043 is significant at .000 when subjected to probability level of .05. Therefore, the null hypothesis is rejected. By implication, there is significant difference between hazards controls measures by management in selected cement industries in Nigeria based on working experience.

Discussion

Research question one which seek to identify occupational health and safety hazards showed that these hazards are classified into physical, chemical, biological, ergonomic and psychosocial hazards. The hypothesis showed that occupational health hazards and safety is not significantly different based on age. The respondents in these selected cement industries revealed that hazards such as excessive heat, poor ventilation as a result of poor indoor air, lighting within the factory and installation of scaffolds during any work at height and radiation as a result of emission of energy. Also, electrocution as a result of working on exposed live electrical conductors without insulated gloves and tools, noise from engines and machines, high temperature, dust from cement and vibration from machines are common known physical hazards in their work place.

Acid and chemical burns, fires and explosions in the factory are frequent, breathing of fuel oils, and dust but disagree to flammable gases are common known chemical hazards. Also poor personal hygiene, improper disposal of waste materials, bacterial infection due to unclean environment, microorganisms from stagnant water and poor environmental condition due to lack of proper sanitation are common known biological hazards. Repetitive motions, manual transportation of equipment and material, accident and muscle sprain to the workers, standing for long period of time, work overload, awkward/improper posture and improper lifting of materials and equipment are common known ergonomics hazards. Working in isolation, poor work design such as inadequate space utilization, ineffective workplace technology, delays in payment of salaries and workplace violence are common known psychosocial hazards in their cement factory

Research question 2 sought to identify hazard control measures by management. Majority of the respondents agreed that authorization is required before working at height, management demonstrates commitment to effective implementation of occupational health and safety rules, ensures health/safety policies are updated, ensures that risk

assessments are carried out before any routine job task, ensured that all accidents are investigated. Also, they opined that workers participate in safety meetings, check cards (safety observation cards), management makes provision for training personnel and personal protective equipment, proper waste disposal system and fall protective system and management ensures that occupational health and safety rules program is integrated in the organization's management system. Also some respondents disagreed that management ensures workers go for pre-periodic medical examination, ensures workers participate in hazard identification as contained in OHSR. More so, they disagreed to the fact that adherence to good housekeeping, sufficient lighting and identification and fixing of fall hazards such as slippery surfaces, damaged ladders and walkways are measure put in place by management. They disagreed that management ensures that workers are trained and aware of their duties in the implementation of occupational health and safety rule (OHSR), ensures that there is a system in place to monitor and evaluate the effectiveness of the implementation of OHSR, demonstration of leadership in appreciating personnel who comply with OHSR. Majority of the respondents accepted that there is significant difference between hazards controls measures by management in selected cement industries in Nigeria based on working experience.

Conclusion

The implementation of occupational health and safety management systems in cement industries are not advanced when compared to other manufacturing industries. The best way to save from occupational accident and health problems is to avoid it by supporting health and safety practices at work. If it occurs, the best way to minimize damages and expenses of accidents and health problems is by introducing reactive practices. The study found out that physical, chemical, biological, ergonomic and psychosocial hazard were prevalent among the workers of these selected cement industries.

Recommendation

Based on the strength of the above findings and conclusions, the study offers the following recommendations for minimizing the attendant occupational health hazards among cement industry workers:

1. There is need for management of cement industries to develop a frame-work that will initiate the integration and implementation of safety regulations in cement factories so as to reduce associated occupational hazards.
2. Health promotion program should be integrated by management to help improve works knowledge, attitude and practices regarding to safety measures within the cement factory.
3. Periodic medical examination policy should be adopted by management of cement industries to help reduce cases of health problems among workers of cement industries in Nigeria.
4. Workers in the cement industries should be trained on hazards identification and hazards prevention processes.

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