

SCHOOL OF PUBLIC HEALTH

COLLEGE OF HEALTH SCIENCES

UNIVERSITY OF GHANA

**SELF REPORTED HEALTH STATUS OF GHANA
CEMENT COMPANY (GHACEM) WORKERS IN TEMA
AND TAKORADI**

BY

NYAMEKE FOVOLE ADJOBA ASUAH-KWASI

(10180281)



**THIS DISSERTATION IS SUBMITTED TO THE UNIVERSITY OF
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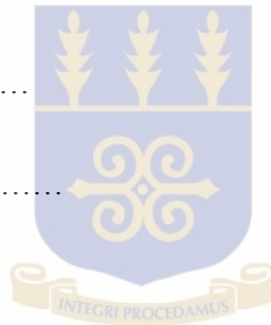
DECLARATION

This work is the result of an independent investigation under the supervision of Dr. Julius Fobil. Where my work is indebted to the works of others, I have made due acknowledgement. I declare, therefore that this dissertation has not been presented elsewhere, either in part or in whole for another degree.

Candidate's Name: Nyameke Fovole Adjoba Asuah-Kwasi

Signature.....

Date.....



Supervisor's Name: Prof. Julius Fobil.

Signature.....

Date.....

DEDICATION

This work is dedicated to my late father, Dr. Matthew Asuah-Kwasi who had inspired me to go for the best always. This is also dedicated to my mom, Jennifer Asuah-Kwasi, my siblings and all loved ones who supported me throughout the course of my study.



ACKNOWLEDGEMENTS

Although only my name appears on the cover of this dissertation, a great many people have contributed to its production. I owe my gratitude to all those people who have made this dissertation possible.

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I am also indebted to the management of Ghacem Limited (Tema and Takoradi) especially Mr. Collins Annai and Mr. Victor Thompson.

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To all friends and loved ones who their support and care helped me overcome setbacks and stay focused on my graduate study. I greatly value their friendship and I deeply appreciate their belief in me.

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ABSTRACT

Introduction: Construction activities in Ghana continues to increase in light of economic growth, population increase and urbanization with cement remaining the most preferred material for construction of buildings and this has increased the demand for cement in Ghana. Much of the cement used for construction is being produced in the country, presenting a lot of concerns for the health of cement workers in the country. Ghacem is the leading producer of cement in the country operating two grinding plants in Tema and Takoradi. Epidemiological studies have indicated that exposure to cement dust have health problems such as chronic cough and phlegm production, skin irritations and itching, runny eyes and irritation of the eyes. Cement factory workers are exposed to various health hazards during manufacturing and production processes with studies showing that these exposures have several health complications. The study purpose was to provide baseline information on the common health problems faced by cement workers in the country.

Methods: A total of 156 cement workers completed a survey giving information about their health history, behavioural habits and occupational exposure and safety. Univariate analysis was expressed as frequencies and percentages. Association between health status and behavioural factors, use of personal protective equipments and the duration of work and between the health conditions and the different working groups was determined at 95% CL.

Results: For this study 156 cement workers participated and from the data, the most common health problems include burning, runny and itchy eyes (41.0%), fatigue (32.7%), sneezing (32.1%) and stuffy nose (30.0%) with the least complaint being stomach ache (16.0%). There was no significant association between smoking history ($\chi^2(1,n=156)=2.537$, $p=0.281$) and alcoholic beverage consumption ($\chi^2(1,n=156)=1.414$, $p=0.493$) and health status of study participants. Out of the 156 study participants who were aware of workplace hazards, 29.1% said dust was the most common work place hazard, and the least common

hazards on their health. Majority of the study participants, 59%, 28.8%, 34.6%, 34.6%, 43.6%, 49.4% and 30.8% reported use of protective overall, face protection, goggles, safety gloves, safety boots, helmets and ear protection respectively. The data showed that there was significant association between the use of protective overall and the health status (χ^2 (1,n=156)=13.821, p=0.001) among participants whereas there was no significant association with the other personal protective equipments used and their health status. Complaints of skin irritations and itching were significantly associated with workers in the technical group (χ^2 (1,n=156)=6.132, p=0.047). The data from this study shows that there was no significant association between duration of work and health status (χ^2 (1,n=156)=0.048, p=0.976). The use of protective overall participants whiles working was seen to be significantly associated with their health status (p=0.03): participants who use protective overall are about 4 times more likely to be healthier than those who do not. (CI 1.179-15.956)

Conclusion: From the study the common health problems encountered by cement workers included burning, runny and itchy eyes, fatigue, stuffy nose, sneezing and muscle aches with protective overall being an effective means of improving health status. This study documenting baseline information on the health status of cement workers would provide the avenue for additional work to be carried out using special tools and equipments to provide detailed and adequate information about their health status.

Keywords: Ghana, cement workers, health status, personal protective equipments

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LIST OF ABBREVIATIONS

FEV- Forced Expiratory Volume

FVC- Forced Vital Capacity

PEFR- Peak Expiratory Flow Rate

BMI – Body Mass Index

IPPD - *N-Isopropyl-N'-phenyl-p-phenylenediamine*

DEFINITION OF TERMS

Forced Expiratory Volume- The volume of air exhaled under forced conditions

Forced Vital Capacity- Determination of vital capacity from a maximally forced expiratory effort

Peak Expiratory Flow Rate- A person's maximum speed of expiration as measured with a peak flow meter.

Vital Capacity- The greatest volume of air that can be expelled from the lungs after taking the deepest possible breathe

CHAPTER ONE

INTRODUCTION:

1.1 Background:

Cement use has increased steadily in Ghana over the years due to increase in construction activities and expansion of infrastructure for development. The increased demand for construction materials has consequently led to an increase in production of cement (“The Global Cement Report,” 2011). It is however necessary for cement producing companies to increase the number of employees and to upgrade their production technology to accommodate this increase in the demand for cement. Cement factories are considered to be highly exposed to pollutants in terms of particulate emission and exposure to such environments could have acute or chronic health implications. Cement workers have been shown to be susceptible to a lot of life threatening debilities or health problems, which can be attributed to their working environment as these factories are characterized by dusty environment and the use of heavy machinery (Pournourmohammadi et al., 2008).

In Ghana, construction activities continue to increase in light of economic growth, population increase and urbanization. Cement also remains the most preferred material for the construction of buildings and as such cement demand in Ghana is on the increase. Due to the lack of raw materials, cement production in Ghana is limited to the importation of clinker by cement factories and addition of additives to the clinker and finally ground into the finished product as Portland cement (“The Global Cement Report,” 2011). Much of the cement used for construction is produced within the country and this presents serious concerns for the health of cement workers in the country. Ghacem is the country’s leading producer of cement operating two grinding plants at Tema and Takoradi with increase in

production from 2.2 million tonnes to 3.4 million tonnes at the end of 2012 (“Ghacem increases production capacity |,” 2012).

Dermal exposure to cement has been implicated in allergic dermatitis and inhalation of the dust has been shown to play a part in some cases of laryngeal, stomach and lung cancer and impairment of lung function (Smailyte, Kurtinaitis, & Andersen, 2004). Also epidemiological studies have indicated that exposures to cement dust has health problems such as chest tightness, phlegm production, skin irritations, conjunctivitis, catarrh, stomach ache, boils, chronic cough, chronic bronchitis, burning, itching, runny eyes, headache, fatigue and biochemical alterations in cement workers (Pournourmohammadi et al., 2008). Although several census-based studies have shown an increased risk of cancer in cement factory workers, studies conducted by Pukkala, (1995); Olsen & Sabroe (1984) concluded that this risk could also be attributed to other social habits and life styles such as smoking.

The use of heavy machinery in such industries drives the need for skilled personnel but yearly these experienced personnel are faced with various industrial accidents, which lead to different types of occupational injuries. These occupational injuries have substantial effect on the economy of the nation in that they cause major loss in productivity and productive hours, skilled manpower, finances as well as a source of suffering to the victim and their families (Iqbal, Iqbal, Taufiq, & Ahmed, 2010). Noise is a physical environmental factor that greatly affects human health, the use of heavy machinery and equipments in the cement manufacturing process which contribute large amount of noise to the industry is a cause for concern for safety and health of its workers (Mndeme & Mkoma, 2012).

Self reported health status is a subjective way of assessing one’s health and even though there are uncertainties concerning the validity of using self-report for assessing population health, it has been found that people’s perception of their own health is a good predictor of future health care use and of mortality rates (Subramanian et al, 2009) and may ultimately

1.2 Statement of the problem

Cement workers are exposed to dust at the various stages of manufacturing and production such as the quarrying, handling of raw materials, during the grinding of the clinker, blending, packing and the shipping of the finished products (Meo, 2004). Studies have shown that exposure of workers to cement dust during the manufacturing processes causes several health complications including irritations to the skin, mucous membranes of the eye and the respiratory system (Zelege, Moen, & Bråtveit, 2010).

There is a limited amount of information on the health of cement factory workers in Ghana, especially how these worker perceive their own health and ultimately what actions they take under such perceived health circumstances. Moreover, although the major cement manufacturing factories have safety protocols, it is not understood if these protocols are adhered to and if there is a need to verify if these workers adhere to these safety protocols.

The Global cement report (2011), indicates that cement consumption in Ghana has increased steadily over recent years on the back of good construction and it is set to continue and ultimately lead to increase in cement production. This increase in production is also reflected in an increase in workload, thus if the appropriate safety measures are not reviewed and adopted, this could lead to adverse health consequences on workers (Ahmed & Newson-Smith, 2010).

1.3 Justification

In order to contain any anticipated adverse health outcomes associated with the increase in construction activity, it is important to also ensure that these activities do not adversely affect the health of cement workers and all those involved in these construction activities. It is therefore imperative to investigate common health problems, build a baseline database on

common health problems among cement workers in Ghana and the analysis of which should guide occupational health policy reforms in cement production industry in the country.

Therefore, the rationale of the study was to provide data on the common health problems faced by cement workers in Ghana and to know whether the cement workers are aware of the potential dangers they face during routine work and how their actions affect their health as well as health seeking behaviours. The research would provide information for the effective planning and organization of safety measures and implementation of policies that would improve the health status of workers by ensuring that cement manufacturers maintain high safety records.

1.4 Objectives

1.4.1 General Objective

- To investigate the common health problems among cement workers (Ghacem) in Ghana

1.4.2 Specific Objectives

- To ascertain the behavioural factors which predict the health status.
- To ascertain the health problems associated with the two main working groups in the cement factory
- To determine the knowledge of cement workers on some hazards of cement factories
- To determine the preventive measures being used and how effective they are to the workers

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

2.1.1 A brief history of cement production

Civilization brought about the need for buildings and as such a material that could hold bind stones together was necessary. Clay was used as binding material first by the Assyrians and the Babylonians and with the Egyptians' discovery of lime and gypsum as a better binding material used in their pyramids construction. The Romans from 300 BC produced the first "pozzolanic" cement by mixing fine volcanic ash from the Mount Vesuvius with slaked lime. Before the discovery of Portland cement, large amounts of natural cement were used and it was produced from the burning of clay and lime (Buckley, n.d.; Lambett, n.d.)

Joseph Aspdin patented Portland cement in October 1824 when he used hard limestone mixed with clay. He grounded it to fine slurry with water and then broke the mixture into lumps and calcined in a furnace till the carbonic acid was expelled. The mixture was ground beaten or rolled to a fine powder and the name Portland cement was given to it due to the resemblance of its colour after setting to Portland stone (Meo, 2004).

2.1.2 Content and manufacturing process of cement

Portland cement is a mixture of oxides of calcium, silicon, aluminium, iron, magnesium and limestone, sand, shale, clay and iron ore or mill scale. The major constituents of Portland cement are tricalcium silicate (C_3S), dicalcium silicate (C_2S), tricalcium aluminate (C_3A) and tetracalcium alumino-ferrate (C_4AF) with C_3S and C_3A responsible for the strength of cement. There are two types of production of Portland cement, the dry and the wet method.

In the dry method the quarried clay and limestone are separately crushed and fed together into the mill, which is ground finely into the raw mix and stored in the silo. The raw mix is preheated so as to dry it before it goes into the kiln and it is burnt producing the clinker, which is then cooled with air fans before storage in the clinker silo. In the wet method the clay is mixed into a paste in a wash mill and the crushed limestone is added and grounded to form slurry. The slurry is then fed into the kiln where there is the formation of the dry clinker balls due to the heat and the rotation of the kiln. The clinker in both methods is then mixed with the gypsum and grounded into cement in the cement mill and stored in the cement silo until packaging is done and dispatch or dispatched in bulk as shown in fig 1 (Cowen, 1988).

2.1.3 Cement manufacturing in Ghana

Cement manufacturing in Ghana is done from the clinker stage where the clinker for production is being imported as well as the gypsum. The clinker is grounded into powder where gypsum is added to form the cement and stored in the cement silo until packaged. Workflow for the manufacturing process is in stages and the first stage is the discharge of the clinker balls from the harbour jetty, which are transported to the clinker silo. In the next stage balls are fed into the milling machine where the clinker is grounded into powder and then, the addition of gypsum, which is the third stage. The final product is stored in the cement silo until packaging or bulk transfer is done. The final stage is when the loading of the bagged cement which are sent to the package house till they are sold to the general public.

Quality assurance and Control processes are done hourly so as to ensure high standards and quality of the product that are sent out with maintenance works done on machinery regularly.

Cement Production Process

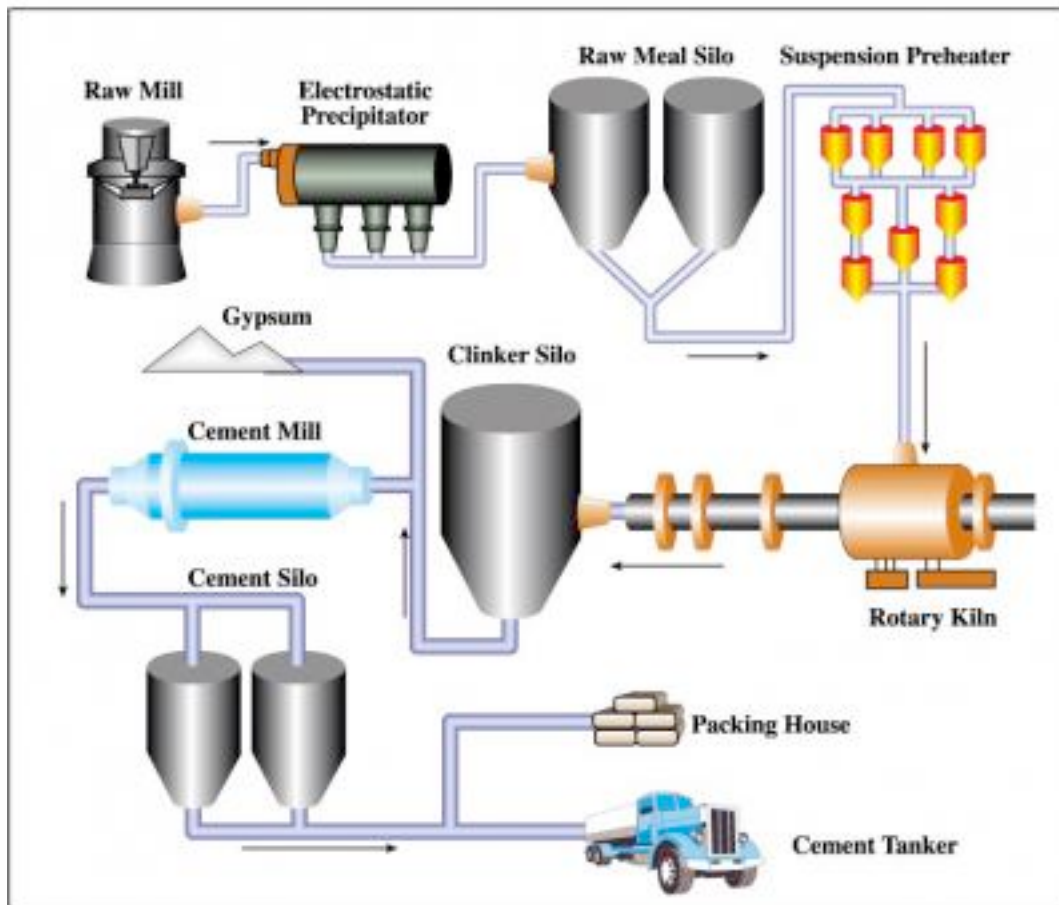


Figure 1: Cement Manufacturing Process

2.2 Health hazards associated with cement factory works

In the cement manufacturing industry there is the use of potentially hazardous materials and processes, which occur on a large scale as well as being labour intensive. Some of the health hazards that can be attributed to cement manufacturing industry include exposure to dust, high temperatures and noise, contact with allergic substances and injuries relating to slips and falls and machinery hazards. (Marlowe & Mansfield, 2002).

2.2.1 Exposure to dust

Workers of cement factories are exposed to cement dust at various stages of the manufacturing which include quarrying and handling of raw materials, during the manufacturing and grinding of the raw materials into clinker, blending and addition of additives and finally packaging and shipping of the finished products. Main entries of cement dust particles into the body are by inhalation or swallowing as such its target of deposition is the respiratory tract and the gastrointestinal tract respectively with skin and eye contact being minor. Their physical and chemical property of importance includes particle size and density, shape and penetrability, surface area and the respiratory response to its alkalinity making its pathogenesis probably due to its irritating, sensitizing and pneumoconiotic properties (Meo, 2004).

2.2.1.1 Health effects of cement dust

According to Meo et al. (2008) occupational exposure to cement dust can cause various health problems. General clinical manifestations of cement workers due to exposure to cement dust includes chronic cough, phlegm production, impairment of lung function, chest tightness, bronchial asthma, restrictive lung disease, skin irritation, conjunctivitis, stomach ache, watery and itching eyes, headache, boils, fatigue as well as cancers of the lung, stomach and colon (Oleru 1984; Johansson et al. 1992,; Rafnsson et al. 1997).

A study carried out by Maier et al. (1999) suggests that there is increased risk for head and neck cancers among workers in the construction industry and can be attributed to occupational carcinogenic agents such as cement dust, asbestos, tar products, paints, metal and wood dust. This study also shows that among number of subject exposed to wood dust, organic chemicals, and coal product or to cement showed an increases relative risk for head and neck cancer after exposition to wood dust and cement with cancer risk due to cement exhibition showing a positive correlation to the duration of exposition and remained

1999). Continuous exposure of workers to cement dust have been shown to statistically significantly associated with the development of pterigium and conjunctivitis (Alakija, 1988)

Mirzaee & Kebriaei showed that exposure to cement dust is associated with acute respiratory symptoms and chronic ventilatory function impairment such as wheezing, shortness of breath, cough, phlegm and dyspnae and was high among the exposed workers than the unexposed workers (Mirzaee & Kebriaei, 2008). Al-Neaimi, Gomes & Lloyd, (2001) demonstrated that inhalation of cement dust irritates the respiratory epithelium leading to coughing, wheezing, dyspnoea, sinusitis, shortness of breath, bronchitis and bronchial asthma being significantly greater among the exposed workers compared to the unexposed workers. There was a high prevalence of respiratory symptoms among workers of a cement factory in the United Arab Emirates and health problems such as cough and phlegm were found to be related to exposure of dust, cumulative dust and smoking habit with chronic bronchitis being related to smoking habit (Ahmed & Abdullah, 2012)

Merenu et al. (2007) and Smailyte, Kurtinaitis & Andersen (2004) suggests that chronic exposure to cement dust impairs lung function with studies showing that lung function, vital capacity and Forced Expiratory Volume (FEV) percentage were significantly lower in workers exposed to cement dust compared to those unexposed and excess mortality risk from malignant neoplasms and a borderline increased risk of death from lung cancer. Although occupational exposure to cement dust leads to higher prevalence of respiratory symptoms, diseases and impaired ventilatory functions smoking also increases the effect of these adverse effects (El-Dine, Sadek, Zayet, & Mahfouz, 2004). The duration of exposure to cement dust shows that long term exposure to the dust has significant impairment on lung functions (Meo, Al-Drees, Al Masri, Al Rouq, & Azeem, 2013).

According to Badri & Saeed (2008) and Kakooei et al. (2011) reduction in Forced Vital Capacity, Forced Expiratory Volume (FEV) and Peak Expiratory Flow Rate (PEFR) were

exposure to Portland cement dust may result in restrictive pulmonary diseases. Greater prevalence of chronic respiratory symptoms and the reduction of ventilatory capacity among cement workers has been reported to be due to chronic exposure to Portland cement dust (Yang et al., 1996) and a study conducted by Al-Neaimi et al. (2001) has concluded that adverse respiratory health effects that were observed among cement workers could not be explained by age, BMI and smoking and therefore was probably caused by their exposure to cement dust. A study to determine the effect of long term exposure to cement dust on lung function in non- smoking cement mill workers shows significantly impaired lung functions in the mill workers indicating that long term exposure to cement dust can affect lung functions (Meo et al., 2013).

A study conducted by Smailyte, Kurtinaitis & Andersen (2004) showed evidence of slightly increased risk from rectal cancer and for colon cancer, members in the group with the highest risk were those with the longest period of work since first exposure. Findings of a study conducted among construction workers showed that male workers who regularly consume alcohol and tobacco represent an extreme risk group for head and neck cancer as well as the need for the concurrence of smoking and exposure to cement dust to produce severe respiratory impairment (Maier et al. 1999, McDowall 1984).

Cohort studies carried out among workers of a cement plants for at least five years between the years 1950 and 1980 concluded that there was no association between exposure to cement dust and death from stomach cancer and this was attributed to the low statistical power given by the cohort (Amandus, 1986) however findings from Koh et al. (2013) suggests a potential association between exposure in the cement industry and an increased risk of stomach cancers and rectal cancers.

2.2.2 Contact with allergic substance

“Contact of cement powder with moist skin or contact of skin with wet cement, can be very irritating, however other ingredients, such as silica and other metal and alkali oxides will also contribute to the cement” (Winder & Carmody, 2002). According to Winder & Carmody (2002), cement dermatitis can be due to the high alkalinity nature of cement, which can damage the skin directly and also the presence of chromates in cement produces sensitization.

Studies conducted among cement workers and construction workers in Taiwan showed that there were a high percentage of the workers with occupational cement hand dermatitis with a greater portion of them being sensitive to chromate and there was the advocacy for the regulation of the addition of ferrous sulphate and the promotion of the use of personal protective equipments, improvement of work practices and health education (Guo et al. 1999; Wang et al. 2011).

Although dichromate is seen to be the prominent allergen of construction workers, there is the need to address other important occupational allergens such as thiurams, N Isopropyl-N'-phenyl-p-phenylenediamine (IPPD) and cobalt and its prevention methods (Uter et al., 2004).

2.2.3 Exposure to noise

The main sources of noise pollution in a cement factory or plant are the grinding mills and the exhaust fans and the control of noise pollution is by the use of silencers for the fans, room enclosures for mill operators, noise barriers as well as the use of personal hearing protections if the noise cannot be reduced (International Finance Corporation, 2007).

A study conducted in a cement factory in Tanga, Tanzania showed that noise pollution is a problem in cement factories, and has adverse health effects on the workers, which in turn interferes with workers performance (Mndeme & Mkoma, 2012).

According to Hernández-Gaytán et al. (2000) and Soleo et al. (1989), noise is a serious risk factor in certain areas such as the crude or baked mills department of cement factories and increase number of hearing loss cases can be due to the occupational noise exposure found in this industry.

2.2.4 Physical Injuries

Occupational injury is deemed to be a serious problem in any industry as injuries directly affect the productivity of the industry through loss of productive hours as well as loss of money as compensation. Studies conducted in selected cement industries in Bangladesh showed that workers over 50 years of age were more prone to injuries, as well as most skilled and unskilled personnel's also being injured with most of these injuries were caused by welding, bucket elevator and belt conveyor. Insufficient supply of personal protective equipments, poorly maintained equipments, discomfort during the use of personal protective equipment and over confidence also contributed to the causes of injuries (Iqbal et al., 2010).

Unhealthy workplace and work processes can put workers' health at risk and this can be seen in a study conducted in Brazil to evaluate work process and its effects on the health of workers in a cement factory where levels of particulate matter and noise measured were of high values than maximum limits set by the Brazilian legislation and opinions expressed by the workers (Ribeiro et al., 2002).

CHAPTER THREE

METHODS

3.1 Study design

A cross sectional study was conducted among cement workers (GHACEM) in Tema and Takoradi. Each study participants gave information about their health history, occupational exposure and safety and behavioural factors when structured questionnaires were administered to them.

3.2 Study location

The study was carried out in the two cement plants of Ghacem in Tema and Takoradi. The Ghana Cement Limited (Ghacem) was founded by the then Government of Ghana in collaboration with the Norcem AS of Norway on 30th August 1967. In 1999 Heidelberg Cement took over Scancem (formerly Norcem AS) and Ghacem was made a subsidiary. The study was conducted at the two cement mill factories of Ghacem Limited in Tema and Takoradi. The plants initially were producing 2.2 million tonnes of cement per annum but it increased to 3.4 million tonnes per annum at the end of 2012 and this due to an expansion works at the Tema plant moving production from 1.2 million tonnes to 2.2 million tonnes. Ghacem is located at the ports of entry into the country; this facilitates easy access to the imported clinker for manufacturing of cement.

Ghacem Limited workers are divided into 2 broad groups, technical and the non- technical. The technical group is made up of the production and maintenance workers and the non-technical is made up of the finance and administration, sales and marketing and general services.

3.3 Variables

Outcome Variables: Health Status of the Cement Workers

Healthy Status of cement workers was recoded from the health problems identified where a yes indicates at least one health condition and a no indicates none of the health condition. The health problems that were assessed included burning, runny and itching of eyes, skin irritations and itching (Dermatitis), chronic cough, stomachache or dyspepsia, persistent headache, fatigue, muscle aches, stuffy or runny nose, sneezing, ear problems and injuries due to accidents.

Explanatory Variables:

- Socio-demographic Factors of the workers:

Age, Sex, Marital Status, Educational Level, Ethnicity, Nationality

- Behavioural Factors:

The consumption of alcoholic beverage and the regularity, Smoking history

- Occupational exposure and safety:

Number of years worked at the factory, normal line of work undertaken on daily base, knowledge of workplace hazards and the kind of hazard, knowledge of effect of hazard on one's health, knowledge of personal protective equipments, use of personal protective equipments, training for and the frequency of use of personal protective equipments and training on occupational safety and health.

3.4 Study population

The study population was cement factory workers in the two plants at the time of study. Informed consent was sought from each worker that was interviewed.

3.4.1. Inclusion Criteria

Any person working in the factory was eligible for the study

3.4.2. Exclusion Criteria

Failure to obtain consent or any worker who declined to participate was excluded from the study.

3.5 Sampling

A sample size of two hundred and thirty- two (232) individuals were used. These were individuals' management of the Ghacem factory granted access to participate. The participants who were then available at the two factories at the time of data collection were conveniently selected. Workers who fit the inclusion criteria after purpose of study had been explained and consent received answered the questionnaire. Study participants filled a total of 156 questionnaires.

3.6 Data Collection Tools and Techniques

Structured questionnaires were used for the data collection. The purpose of the study was explained to participants and they were assured of confidentiality. The structured questionnaires were then administered to consenting participants by two trained staff of Ghacem to document their socio-demographic factors, behavioural factors, occupational exposure and safety and health problems were documented

3.7 Data Processing and Analysis

The data was cleaned and coded and entered in Microsoft Excel and exported to Statistical Package for Social Sciences (SPSS) Windows version 18 for analysis.

Descriptive statistics such as frequencies, percentages and bar charts were used to summarize baseline characteristics, to determine the common health problems among the workers and knowledge of occupational exposure and safety. Bivariate analysis using Chi Square was used to establish associations between the health condition and area of work, the health status and preventive measures being used, behavioural factors and health status and the

health conditions and the duration of work in the factory. Logistic regression was done to show the effect of preventive measures on the health status of the workers when there was 0.05 statistical significance after testing for association. Results were presented in tables and graphs. During data entry and validation, database files were accessible by study investigators only.

3.8 Ethical Consideration/Issues

Approval was sought from the School of Public Health (College of Health Sciences, University of Ghana, Legon), Ghana Health Service Ethical Committee of the Ministry of Health and the management of Ghacem Limited at both factories. Participants were fully informed about the purpose, procedures, risks, and benefits of participating in this study and informed consent was sought before recruitment. Each participant was assured that their responses would be kept confidential and data collected will be used for the purpose of the study only. Study participants were made aware of the voluntary withdrawal from the study and were also not paid for participating in the study.

3.9 Pre-test/ Pilot Study

The structured questionnaires were pretested at a construction site, University of Ghana, Legon. The construction site shared similar characteristics with Ghacem, as there was the use of cement as well as construction machinery therefore allowing for corrections, modifications and fine-tuning before the start of the actual study.

3.10 Limitations

The study had limitations principal investigator (PI) had no primary contact with the study participants as management of Ghacem Limited restricted access to study participants. There were time constraints on the part of both the principal investigator (PI) and the study participants as there was inadequate time for maximum filling of the questionnaires. In spite

of the limitations faced by the study I believe that the study will be to the knowledge of the health of cement workers.

CHAPTER FOUR

RESULTS

4.1. Demographic Characteristics of Study Participants

From this study, a total of 156 participants took part in the study, comprised of 65.4% males and 34.6% females. Majority of the study participants was less than 25 years, 64 (41.0 %), with 28.8%, 12.8%, 12%, 15% being between 26-30 years, 31-35 years, 36-40 years and 40 years and above respectively (Table 1).

Majority of the staff was listed as junior staff 64 (41.0%) and the remaining 69% were senior staff (28.8%) and contract workers (30.1). Proportion of the study participants single or not married was 83 (53.2 %), married or leaving together was 62 (39.7%), divorced or separated was 6 (3.2%) and widowed was 5 (3.2%). (Table 1)

Table 1: Demographic Characteristics of Study Participants (N=156)

Demographic characteristics	Frequency (%)
Sex	
Male	102 (65.4)
Female	54 (34.6)
Age (years)	
Less than 25	64 (41.0)
26-30	45 (28.8)
31-35	20 (12.8)
36-40	12 (7.7)
40 and above	15 (9.6)
Position	
Junior Staff	64 (41.0)
Senior Staff	45 (28.8)
Contract	47 (30.1)
Marital Status	
Married/Living together	62 (39.7)
Divorced/Separated	6 (3.8)
Widowed	5 (3.2)
Single/Never married	83 (53.2)

The educational level of the study participants was assessed and 102 (65.4%) had tertiary education, 37 (23.7%) had vocational or technical training, 10 (6.4%) had secondary education and 7 (4.5%) had primary education. A total 134 (85.9%) participants reported

none of the above. Half of them were of Akan ethnicity 78 (50%) and 29(18.6%) were Ga-Adangbes, 26 (16.7%) were Ewes, 11 (7.1%) were Mole Dagbani and the remaining 12(7.7%) were of other ethnicity (Table 2).

Table 2: Education and Socio-cultural Characteristics of Study Participants (N=156)

Demographic Characteristics	Frequency (%)
Educational Level	
Primary	7 (4.5)
Secondary	10 (6.4)
Vocational/Technical	37 (23.7)
Tertiary	102 (65.4)
Religion	
Christianity	134 (85.9)
Islam	14 (9.0)
Traditional	5 (3.2)
None	3 (1.9)
Ethnicity	
Akan	78 (50.0)
Ga Adangbe	29 (18.6)
Ewe	26 (16.7)
Mole Dagbani	11 (7.1)
Other	12 (7.7)

The common health problems faced by participants are reported in figure 2. Most of the participants reported experiencing burning, running and itchy eyes 64 (41%), fatigue 51

(32.7%), sneezing 50 (32.0%), stuffy nose 47 (30.1%) and muscle aches 41 (26.3%). Some reported experiencing ear problems 35 (22.4%), persistent headache 34 (21.8%), injuries due to accidents 32 (20.5%) while a few reported experiencing chronic cough and skin irritations 28 (17.9%) and stomach ache 25 (16%).

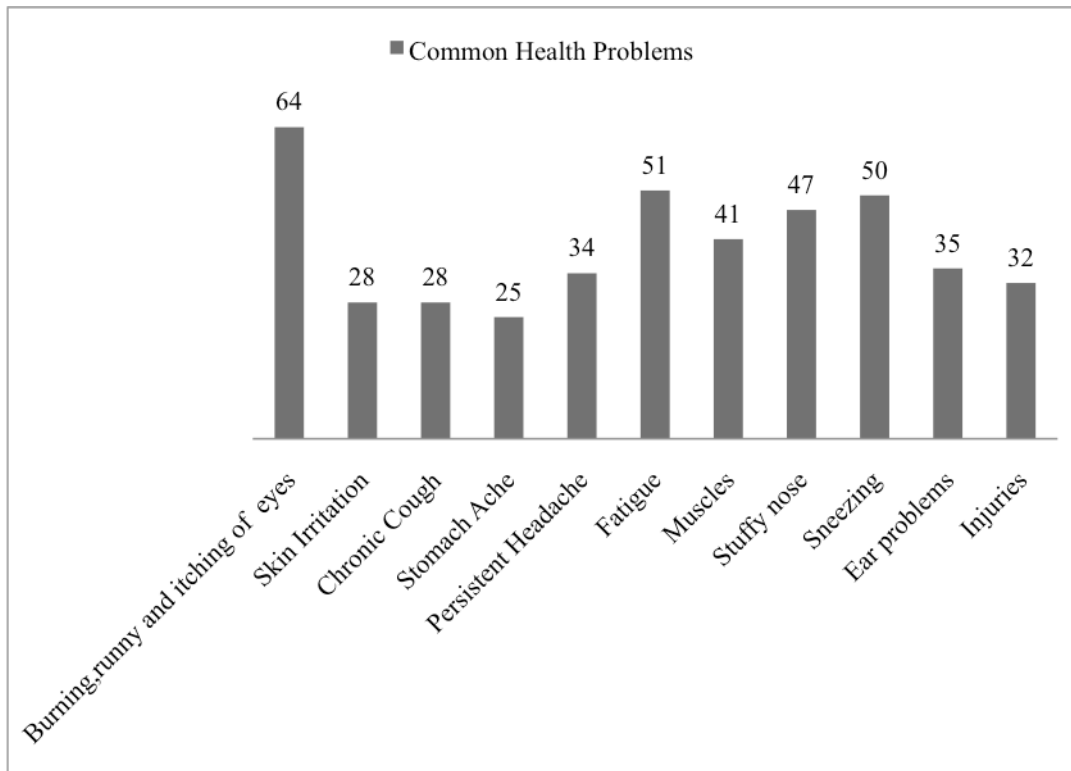


Figure 2: Distribution of Common Health Problems faced by cement workers

4.2. Off- factory behavioural traits that have health implications for cement workers

Certain habits and behavioral traits have an effect on the health status of individuals. There was a need to assess some behavioral traits outside the factory environment that could also play a role in the health condition of cement workers. The major activities associated with adverse health conditions were smoking and alcoholic consumption. It was observed that 14 out of 156 respondent were active smokers whereas another 14 respondents had quit smoking some time before the interviews. A majority however did not smoke at all. When

alcohol whereas only 3 respondents admitted to have quit drinking. Again a majority of respondents claimed not to consume any kind of alcohol. Table 3 indicates that there was no significance between smoking history ($\chi^2(1, n=156)=2.537, p=0.281$) and alcoholic beverage consumption ($\chi^2(1, n=156)=1.414, p=0.493$) and health status of study participants.

Table 3: Association between Behavioural Factors and Health Status of Study Participants

Behavioural Factors	Total sample respondents (N=156)	Not		χ^2 statistic
		Healthy (N=59)	Healthy (N=97)	
Smoking	14	2.6	6.4	2.537**
Non Smoker	128	33.3	48.7	
Quit	14	1.9	7.1	
Alcoholic Beverage Consumption				
Yes	37	7.1	16.7	1.414**
No	116	30.1	44.2	
Quit	3	0.6	1.3	

** p value not significant

4.3 Occupational Exposure and Safety

The study inquired from respondents, their awareness of certain hazards peculiar to the cement factory. Out of the study participants who were aware of workplace hazards, 29.1% believed dust was the most common work place hazard, 17.9% believed falling materials, 14.0% believed fire, 13.8% believed smoke, 13.3% believed milling machines and 12% believed heat were also common workplace hazards (Table 4).

Furthermore, 83.3% of participants acknowledged the effects of these hazards on themselves.

Table 4: Distribution of Health Hazards

Hazards	Frequency	Percent (%)
Dust	114	29.1
Heat	47	12.0
Falling Materials	70	17.9
Smoke	54	13.8
Fire	55	14.0
Milling Machine	52	13.3
Total	392	100.0

The data showed that majority of the participants had knowledge in occupational exposure and safety through training programs, awareness of protective equipments, personal protective equipments and workplace hazards (Fig 3).

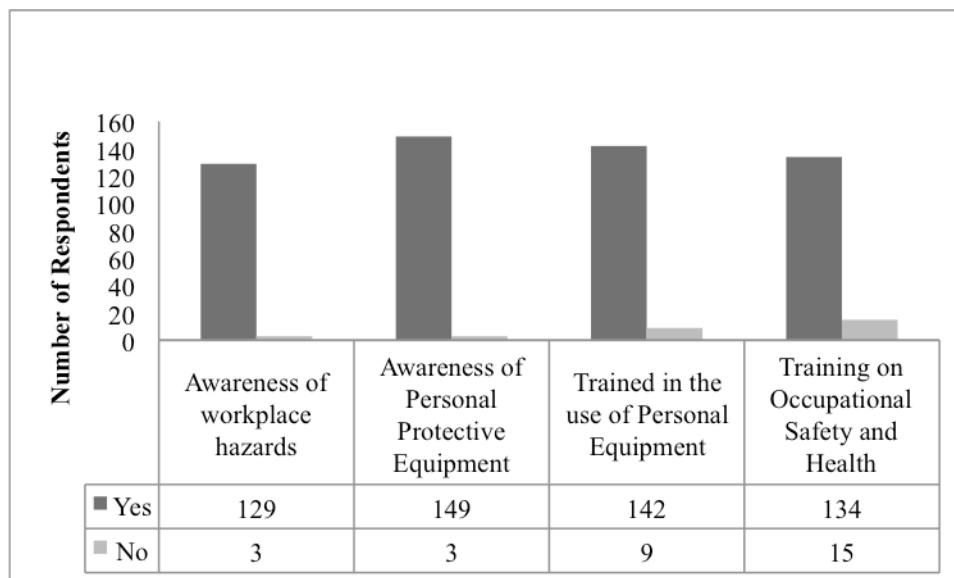


Figure 3: Distribution of participants' knowledge of occupational exposure and safety

Overall the use of personal protective equipments among study participants was high. Majority of the study participants, 59%, 28.8%, 34.6%, 34.6%, 43.6%, 49.4% and 30.8% reported use of protective overall, face protection, goggles, safety gloves, safety boots, helmets and ear protection respectively (Fig 4).

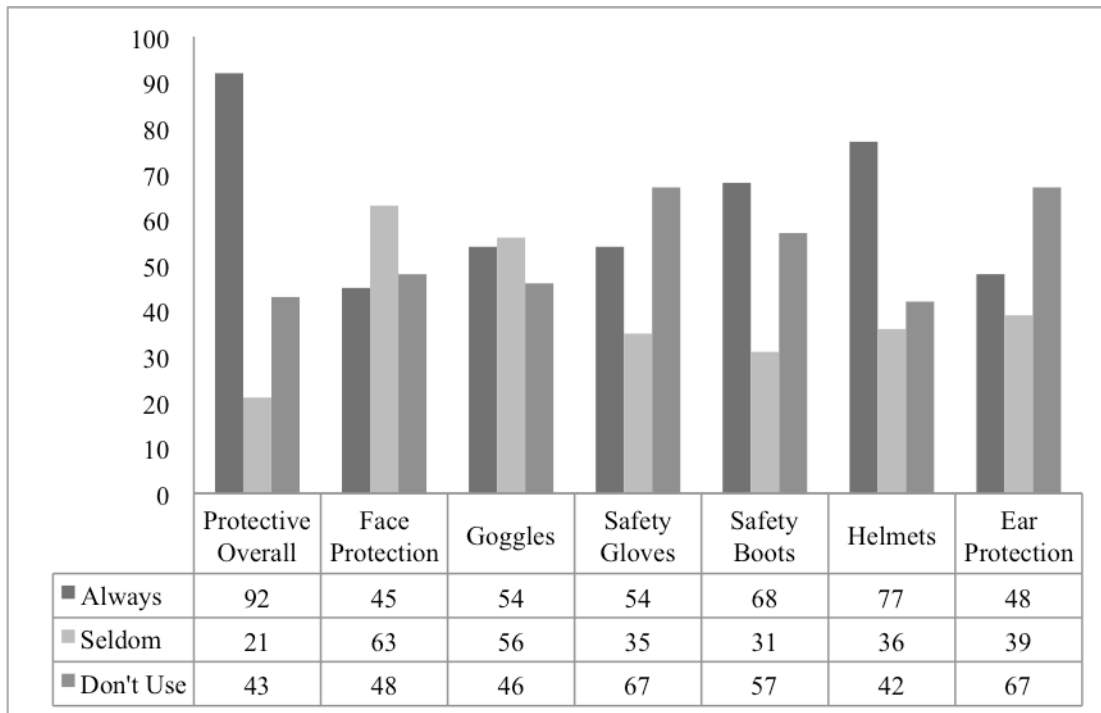


Figure 4: Distribution showing participants' use of personal protective equipments

From this study the use of personal protective equipments indicates that there was a significant association between the use of protective overall and the health status of study participants ($\chi^2 (1, n=156)=13.821, p=0.001$) whereas the use of face protection, goggles, and safety gloves did not indicate any significant association ($\chi^2 (1, n=156)=0.193, p=0.908, \chi^2 (1, n=156)=0.624, p=0.732, \chi^2 (1, n=156)=3.965, p=0.138$ respectively)(Table 5).

Table 5: Association of Personal Protective Equipments and Health Status (N = 156)

Preventive Measures	Total sample respondents (N=156)	of Healthy (n= 59)	Not Healthy (n=97)	χ^2 statistic
Protective				
Overall				
Always	92	15.4	43.6	13.821*
Seldom	21	8.3	5.1	
Don't Use	43	14.1	13.5	
Face Protection				
Always	45	10.3	18.6	0.193**
Seldom	63	16.0	24.4	
Don't Use	48	11.5	19.2	
Goggles				
Always	54	13.5	21.2	0.732**
Seldom	56	12.2	23.7	
Don't Use	46	12.2	17.3	
Safety Gloves				
Always	54	12.8	21.8	0.138**
Seldom	35	11.5	10.9	
Don't Use	67	13.5	29.5	

* $p < 0.05$ **p value not significant

The data from the study shows that there was no significant association between the regular use or do not use of safety boots, helmets and ear protection by the study participants and their health status (χ^2 (1,n=156)=4.947, $p=0.084$), χ^2 (1,n=156)=5.402, $p=0.145$)(χ^2

Table 6: Association of Personal Protective Equipments and Health Status (N = 156)

Preventive Measures	Total sample respondents (N=156)	of Healthy (n= 59)	Not Healthy (n=97)	χ^2 statistic
Safety boots				
Always	68	15.4	28.2	0.084**
Seldom	31	10.9	9.0	
Don't Use	57	11.5	25.0	
Helmet				
Always	77	14.7	34.6	5.402**
Seldom	36	11.5	11.5	
Don't Use	42	11.5	15.4	
Ear protection				
Always	48	12.8	17.9	7.075**
Seldom	39	12.8	12.2	
Don't Use	67	12.2	30.8	

**p value is not significant

Among the different working groups there was a significant association between skin irritations and itching (health condition) and the technical group (χ^2 (1,n=156)=6.132, $p=0.047$) while with the other health conditions (burning, runny and itchy eyes, chronic cough, stomach ache and persistent headache) there was no significant association among any of the groups (Table 7).

Table 7: Association of Health Conditions and the Different Working Groups (N=156)

Health Conditions	Total sample of respondents (N=156)	Technical (n=61)	Non Technical (n=71)	χ^2 statistic
Burning, runny and itching of eyes				
No	92	23.1	10.3	0.791
Yes	64	16.0	5.1	
Skin irritations and itching				
No	128	31.4	40.4	6.132*
Yes	28	7.7	5.1	
Chronic cough				
No	128	32.7	10.9	2.442
Yes	28	6.4	4.5	
Stomach Ache				
No	131	34.6	10.9	4.033
Yes	25	4.5	4.5	
Persistent Headache				
No	122	33.3	34	3.066
Yes	34	5.8	11.5	

*P < 0.05

From this study fatigue, muscle aches, stuffy nose, sneezing, ear problems and injuries had no significant association with whether the study participants were from the technical or non-technical group (Table 8)

Table 8: Association of Health Conditions and the Different Working Groups (N= 156)

	Total sample of respondents (N=156)	Technical (n=61)	Non Technical (n=71)	χ^2 statistic
Fatigue				
No	105	29.5	27.6	3.292
Yes	51	9.6	17.9	
Muscle Aches				
No	115	30.8	32.7	1.524
Yes	41	8.3	12.8	
Stuffy/ Runny nose				
No	109	28.8	30.8	0.731
Yes	47	10.3	14.7	
Sneezing				
No	106	29.5	30.1	3.752
Yes	50	9.6	15.4	
Ear problems				
No	121	29.5	37.8	3.050
Yes	35	9.6	7.7	
Injuries				
No	124	37.2	31.4	1.340
Yes	32	8.3	7.7	

The data from this study shows that out of the 156 study participants who took part in the study, there was no significant association between duration of work and health status (χ^2 (1,n=156)=0.048, $p=0.976$) (Table 9).

Table 9: Association of Duration of Work and Health Status (N=156)

Duration of Work	Total sample of respondents (N=156)	Healthy (n= 59)	Not Healthy (n=97)	χ^2 statistic
<1	41.7	14.4	27.3	0.150*
1-5	44.7	16.7	28.0	
5+	13.6	5.3	8.3	

**p-value is not significant*

4.4 Occupational Safety Analysis

Protective overall gear use was significantly associated with participants' health status ($p=0.03$) and participants who used about the gear were 4 times more likely to be healthier than those who did not. ($p = 0.03$; OR = 4.34; 95%CI: 1.179-15.956) (Table 10)

Table 10: Association between Observance of Preventive Measures and Healthy Status
(N=156)

Preventive Measures	B	SE of B	P-value	Odds Ratio	95 % CI	
					Lower Bound	Upper Bound
Protective						
Overall	1.467	0.665	0.03*	4.337	1.179	15.956
Face						
Protection	-0.158	0.603	0.79	0.854	0.262	2.782
Goggles	0.257	0.637	0.69	1.293	0.371	4.505
Safety Gloves	-0.616	0.512	0.23	0.540	0.198	1.475
Safety boots	-0.282	0.584	0.63	0.755	0.240	2.369
Helmet	0.346	0.761	0.65	1.413	0.318	6.278
Ear protection	-0.983	0.580	0.09	0.374	0.120	1.166
	-0.120	0.567	0.83			

P < 0.05 Note: Outcome variable is the health status of the cement workers

CHAPTER FIVE

DISCUSSION

5.0 Discussion

The cement industry has been characterized by its energy and resource intensive processes with its environmental, health and safety impacts. Ensuring safe and healthy working environments for its employees is an essential key to corporate social responsibility, and is one of the most vital issues for the cement industry (Initiative, 2004). According to Rom (2008) cement workers are exposed to potential or actual hazards such as cement dust, high temperature, noise and vibrations which has either acute or adverse effects on their health (as cited in Shafik & El-Mohsen, 2012).

Health problems of importance affecting the cement industry includes diseases of the respiratory system, gastrointestinal system, skin diseases, hearing and visual disorders and physical injuries due to accidents with most of these diseases needing specific equipments to detect them. The aim of this study was to investigate the common health problems among cement workers through self-report.

The advocacy and regular use of protective overall has been shown to have significant effect on the reduction of occupational dermal diseases such as contact dermatitis among cement workers (Mathias, 1990). Individual preventive measures such as the use of protective clothing gloves and correct skin cleaning and collective preventive measures is believed to prevent contact dermatitis (Loffler & Effendy, 2002).

In this study, there was a significant association between the use of protective overall and their health status of the study participants, which is evident that the regular use of protective overall is effective. 98% of study participants indicating awareness of personal protective

personal protective equipments. Although there was no significance between the other personal protective equipments and the health status of the study participants, other studies carried out shows that the consistent use of personal protective equipments is essential in protecting cement workers from cement related health problems (Zeyede K Zeleke et al., 2010, Mirzaee & Kebriaei, 2008, Meo, 2003).

Complaints of skin irritation and itching were found to be significantly associated with the technical work group. The technical work group was made up of production workers and maintenance workers who were in direct contact with cement dust daily. This could be due to continuous exposure of the workers to the cement dust as regular exposure of the skin to cement dust leads to cement dermatitis. Cha et al (2012) demonstrated this effect on workers in a study comparing the effects of cement dust among exposed and unexposed workers (Cha et al., 2012). Lachapelle, 1986 indicates that cement dust has been recognized as a skin problem factor that may cause itching, skin allergen irritant as well as skin boils and burn (as cited in Meo, 2004). High prevalence of skin allergies was recorded for workers in three cement factories when a study was conducted to assess their health risks (Sana, Bhat, & Balkhi, 2013).

In this study, despite the fact that there was no significance between the other health conditions and the two main working group, studies have indicated that workers found among the technical group are more prone to cement related diseases than non- technical workers through the different studies carried out between exposed workers and non exposed workers (Kakooei et al., 2011, Zeyede K Zeleke, Moen, & Bråtveit, 2011, Mwaeselage, Moen, & Bråtveit, 2006, Al-Neaimi et al., 2001)

This study found that majority of study participants' had high knowledge of occupational exposure and safety, 97.7% were aware of work place hazards, 98% know about personal protective equipments with 94% of the study participants being trained in the use of personal

protective equipments and 89.9% indicating that having been trained in occupational safety and health.

This high knowledge of occupational exposure and safety can be attributed to greater percentage of the study participants having tertiary education in that a study conducted has indicated that years of education, receiving information about job associated hazards and attending a training course about occupational safety were the most important predictors of workers' knowledge about occupational hazards (Ahmed & Newson-Smith, 2010)

In this study, dust (29.1%) was indicated as the most common work place hazard among the study participants as dust concentrations in cement factory are visible thus its negative health effects are easily seen by workers of such factories. Many studies carried out has concentrated on the effects of long term exposure of cement dust on the respiratory system and other parts of the body (Zeyede Kebede Zeleke, 2011, Wang et al., 2011 Kakooei et al., 2011, Badri & Saeed, 2008, Merenu et al., 2007, Alakija, 1988). Notwithstanding the fact that dust was indicated as the most common work place hazard, the participants had some knowledge about the other work place hazards.

There was no significant association between the health status of the study participants and their behavioural factors and this can be attributed to the sample size used in the study. Other studies suggests behavioural factors such as smoking among cement workers has an association with some respiratory problems that they encounter (Ballal et al., Abou-Taleb, Musaiger, & Abdelmoneim, 1995 and El-Dine et al., 2004)

From this study, 41% of the study participants had burning, runny and itchy eyes as the most commonest health problem and this is in line with a studies conducted which identified cement dust as an eye allergen as well as its potential occupational hazard which causes eye problems among cement workers (Oleru, 1984, Alakija, 1988, Shafik & El-Mohsen, 2012).

Fatigue, sneezing, stuffy nose and muscle aches were also seen to be prevalent among the study participants and this is seen in other studies (Sana et al., 2013, Abou-Taleb et al., 1995)

5.1 Limitations

Signs and symptoms of health problems were self-reported; and subjective and may be inaccurate.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

Occupational health and safety in cement industries is key in maintaining the health status of its workers. This study indicates that burning, runny and itchy eyes, fatigue, sneezing, stuffy nose and muscle aches were the most common health problem among cement workers in Ghacem (Tema and Takoradi). The regular use of protective overall is effective and helps in maintaining the health status of the workers and significant association was found between skin irritations and itchy among the technical work group.

As this study provides baseline information of the health status among cement workers in Ghana, further studies can be done using specific equipments and tools such as audiometer, peak flow meter and Spiro meters can be used. These equipments measure the sensitivity of hearing, maximum speed of expiration and the air capacity of a person respectively so as to provide detailed information on the health status of cement workers.

6.2 Recommendation

Management of Ghacem Limited

The use of engineering measures would further help in the prevention of health related diseases among workers

- i. Mechanization of machinery such as the use of automatic loaders
- ii. Ventilation fans for dust control
- iii. Provision of personal protective equipments
- iv. Regular environmental monitoring

Regular Periodic and Pre- Periodic Medical Examinations of employees should be done.

Regular training of their employees should be done so as to enhance their knowledge on occupational health and safety.

Employees of Ghacem Limited

Consistent use of personal protective equipments will help further in the prevention of occupational health related diseases.

School of Public Health, University of Ghana, Legon

Also further studies with larger sample sizes are needed to confirm and evaluate occupational health hazards related to Ghanaian cement workers.

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APPENDICES

Appendix 1: Informed Consent Form

Subject number:

Project Title:

Self reported health status Ghana Cement Company (GHACEM) workers Tema and Takoradi. Department of Biological, Environmental and Occupational Health Science: School of Public Health, College of Health Sciences, University of Ghana, Legon.

Background

Dear Participant, my name is Nyameke Fovole Adjoba Asuah-Kwasi. I am a student from the School of Public Health, University of Ghana. I am conducting a study on the Self reported health status Ghana Cement Company (GHACEM) workers Tema and Takoradi.

The aim of this study to investigate the common health problems among Ghacem cement workers, Ghana

Procedures

The study will involve answering questions from a questionnaire on individual common health problems faced as well as knowledge on exposure and safety. This is purely an academic research that forms part of my work for the award of a Masters Degree.

Risks and Benefits

The results of the study would help advice policy makers on the formulation of policies to improve the health status of cement workers. Also the study would help the management of

Ghacem to carry out necessary health education as well focussing on changing unsound behaviours, which negatively affect the health and performance of workers.

CONSENT

I,.....decl
are that the purpose, procedures as well as risks and benefits of the study have been
thoroughly explained to me in English language and I have understood.

I hereby agree to answer the questionnaire

Signature of participant Date..... /
..... /

Interviewer's statement:

I, the undersigned, have explained this consent form to the subject in the English language
(Twi or Ga language) that he understands the purpose of the study, procedures to be followed
as well as the risks and benefits involved. The subject has freely agreed to participate in the
study.

Signature of interviewer:

Date: / /

Address

Right to refuse

Participation in this study is voluntary and you can choose not to answer any individual
question or all the questions. You are at liberty to withdraw from the study at any time.
However, I will encourage you to fully participate since your opinions are important to help
identify common health problems among cement workers.

Anonymity and Confidentiality

I would like to assure you that whatever information you will provide will be handled with strict confidentiality and will be used purely for research purposes. Your responses will not be shared with anybody who is not part of the study team. Data analysis will be done at the aggregate level to ensure anonymity.

Dissemination of Results

The results of this study will be mailed to you, if you provide your address below.

.....
.....
.....

Costs and/or Payments to Subject for Participation in Research

There will be no costs for participating in the research. Also, you will not be paid to participate in this research project.

Any questions concerning the research project should be directed to Dr. Julius Fobil, School of Public Health (0243462514), Nyameke Fovole Adjoba Asuah-Kwasi (Tel: 0207640443) and Hannah Frimpong, Administrator Ghana Health Service Ethical Review Committee (0244516482).

Appendix 2: Questionnaire**Self reported health status of Ghana Cement Company (Ghacem) workers in Tema and Takoradi**

I am a student from the School of Public Health, doing a study on the above topic. I would like you to answer questions on the questionnaire. I have no connection with any external bodies what so ever, I assured you that information I am collecting will be limited to research purposes only.

Subject Number..... Name of factory..... Date.....

A. Background Characterisitcs

How old are you?

Less than 25 [] 26-30 [] 31-35 [] 36 - 40 [] 40 and above []

2 Gender Male [] Female []

3.What is your position?

Junior staff [] Senior staff []

What is your current marital status?

Married or living together [] Divorced / separated [] Widowed [] Single /Never married []

What is the highest level of education you have attained?

Primary [] Secondary [] Vocational/ technical [] Tertiary []

5. What religious group do you belong to?

Christianity [] Islam [] Traditional [] None []

Akan Ga Adangbe Ewe Mole Dgbani Other

B. Behaviourial Factors

Habits:

1. Do you smoke? Yes Quit No

If No, please skip to question five (5)

2. What did (do) you usually smoke?

Cigarettes Cigars Pipe

3. How many did (do) you smoke a day?

Less than 1 1-4 5-10 15 or more

4. How long have you been smoking?

Less than a year 1-5 years 5-10 years 10 years and above

If you have quit, when?

Less than a year 1-5 years 5-10 years 10 years and above

5. Do you presently consume alcohol? Yes No Quit

If yes, how often?

Regular 2-4 times a week Rarely

C. Occupational Exposure and Safety

2 What is your normal line of work in the production line, please state

.....

3 Are you aware of any workplace hazards: Yes No

If yes, please tick where appropriate

Dust Heat Falling materials Smoke Fire

Milling machines

4 Does any of these hazards have any effect on your health Yes No

5 Are you aware of any Personal Protective Equipment used in the factory: Yes

No

6 Have you been trained in the use of Personal Protective Equipment: Yes

No

7 Do you use any of the following Personal Protective Equipment whiles working, please

tick where appropriate?

	Always	Seldom	Don't use
Protective Overall	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Face Protection (Mask)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Goggles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Safety Gloves	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Safety boots	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Helmets	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

8 Have you ever receive any training on occupational safety and health?

Yes [] No []

D. History of health problems

1 Do you have any of these health problems?

	Yes	No
Burning,runny and itching of eyes	[]	[]
Skin irritations and itching (Dermatitis)	[]	[]
Chronic cough	[]	[]
Stomachache or Dyspepsia	[]	[]
Persistent headache	[]	[]
Fatigue	[]	[]
Muscle aches	[]	[]
Stuffy or runny nose	[]	[]
Sneezing	[]	[]
Ear problems	[]	[]
Injuries due to accidents	[]	[]
Others(specify).....		