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Risk and hazard mitigation of cement-related activities in the city of San Fernando, Pampanga: An investigation of construction workers' awareness and propose safety measure

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ABSTRACT

The construction industry in the Philippines is a major contributor to the economy of a nation, playing a significant role in the development of its infrastructure. One of the most significant and commonly used construction materials is cement, and workers are exposed to it. The use of cement on construction sites in the Philippines can pose several risks. These risks can include air quality issues, skin irritation, and inflammation of the airways due to the release of hazardous chemicals and dust.

One of the major problems on construction sites in the Philippines is workers safety. Construction sites often have dangerous conditions and other hazards. This study assessed the awareness of construction workers on the risks and hazards associated with cement-related activities. A sample size calculator was used in the selection of 193 respondents from different new construction companies in City of San Fernando, Pampanga. A survey questionnaire containing close-ended questions was validated by a psychometrician, safety engineer, and statistician and used to determine the awareness of construction workers. Furthermore, based on the results of the

survey, the majority of the construction workers were aware of cement-related risks and hazards. And 53.89% of the respondents experienced headaches, while 49.74% experienced eye irritation, 32.64% also experienced chest tightness, 65.28% of the respondents experienced skin itching and irritation, and 27.98% had a cough and phlegm. Lastly, 32.12% experienced difficulty in breathing. From here, the results suggest that construction workers must be made more aware of the health effects of cement exposure and utilization of personal protective equipment must be strictly imposed in the construction sites.
Keyword: *City of San Fernando, Pampanga, Risk and Hazard Mitigation, Cement Related, Awareness, Safety measure.*

Chapter I
THE PROBLEM AND REVIEW OF RELATED LITERATURE AND STUDIES

1.1 Introduction

The construction industry in the Philippines is a major contributor to the economy of a nation, playing a significant role in the development of infrastructure of a country. The industry is divided into two sectors, namely the public sector and the private sector. The public sector is mainly responsible for the construction of roads, bridges, airports, and other public works projects, while the private sector is engaged in the construction of residential, commercial, and industrial buildings. In recent years, the industry has seen an increase in the number of foreign investors, which is contributing to the growth of the industry. The government has also implemented several reform initiatives to make the sector more efficient and transparent.

Construction workers play a big role in making a structure. They are responsible for mixing, handling, and applying the cement mixture to brick laying, pouring, and plastering. Because of the nature of their job, they are highly exposed to various occupational risks and hazards caused by the long exposure to cement-related works. The safety of the construction workers is one of the priorities in every construction project no matter what the project is. One of the most significant and commonly used construction materials is cement. It is used to make concrete, mortar, and grout. Cement is a basic material used to create concrete in constructing structures such as bridges, roads and highways, buildings, and residential houses. It is also used to plaster walls and ceilings. It is a bonding agent for aggregates (fine and coarse aggregates) making it into a hard and solid concrete.

The use of cement in construction sites in the Philippines can pose several risks and hazards. These risks can include air quality issues due to the release of hazardous chemicals and dust. Prolonged and repeated exposure to cement dust can cause the debilitating and fatal lung disease called silicosis. By identifying these hazards and risks, stakeholders can implement effective safety measures and environmental strategies to mitigate their potential negative consequences. This lung condition arises when a person breathes in silica particles, which are microscopic crystals found in materials like sand, rock, mineral ores, and cement. Inhaling these particles can cause scarring of the pulmonary tissues, making it difficult to breathe according to Villegas (2020).

According to Hallowell M. R., et al. (2019), The Occupational Safety and Health Act of 1970 led to improved construction safety and health management. Contractors implemented safety programs to reduce hazards, but the process of selecting program components lacked formality. A recent study aimed to determine the effectiveness of safety program elements by quantifying their ability to mitigate risks. Researchers developed a risk classification system, identified effective elements, and used the Delphi method to measure their impact. The study found that upper management support, strategic subcontractor selection, and management were the most effective elements. Conversely, recordkeeping, accident analyses, and emergency response planning were the least effective. The study's data can assist in strategically selecting safety program elements, addressing specific risks, and allocating resources in limited funding situations.

In addition, improper handling of cement can cause skin irritation. Long-term exposure to cement dust can cause irritation to the eyes, nose, throat, and skin. It can also cause difficulty breathing and inflammation of the airways. Inhaling cement dust can also lead to an increased risk of developing asthma, bronchitis, and other respiratory illnesses. Therefore, it is essential for construction sites in the Philippines to take necessary safety precautions when handling and using cement. Shah et al (2015) discovered that within a formal sector industrial workforce of 0.4 million and a total workforce of 11.2 million, approximately 20,000 workers suffer injuries and 200 fatalities annually due to occupational accidents. The primary reasons for these accidents can be attributed to unsafe working conditions, inadequate supervision and training, utilization of outdated machinery and equipment, insufficient maintenance, poor housekeeping practices, non-compliance with safety regulations, and overcrowded production units with limited space.

One of the major problems in construction sites in the Philippines is worker safety. Construction sites often have dangerous conditions. Another form of hazard in the construction industry of the Philippines that may

cause great danger is the incorrect or unsafe handling of cement. These accidents may be caused by shoddy maintenance and poor safety precautions. Additionally, employees who don't wear the proper protective gear run the danger of developing major health problems like skin conditions and other ailments brought on by dust and other airborne particles. The lack of safety education among workers is also a problem, as many are unaware of the dangers of their work and the proper safety procedures to follow.

This study aims to examine the awareness of construction workers regarding the possible risks and hazards to cement-related activities. The study will involve a review of the related literature on cement exposure and a survey questionnaire, which will be conducted to the construction workers in City of San Fernando, Pampanga, the safety measures they are taking, and the health effects they are experiencing. The results of the study will be used to provide possible interventions and develop strategies for improving the safety of the workers.

1.1 Review of Related Literature

1.2.1. Assessment of the Awareness and Safety Practices in Mitigating Hazards of Silica Dust Exposure among Construction Workers

Metals, stones, sand, wood, and cement are the materials present at the location of construction sites. These are the major contributors and producers of various risks and hazards. Workers in the construction industry are put at risk for inhaling particles existing on construction materials especially cement as stated by Saong et. al., (2021).

1.2.2. Preventing Skin Problems from Working with Portland Cement

In our modern world we use cement to build our house, buildings, hospital etc. Cement has harmful chemicals like hexavalent chromium, as well as sodium and potassium oxides. But cement is dangerous to construction workers' faces and skin. A worker who is exposed to cement dust can cause serious short-term and long-term injuries like skin problems. According to the Occupational Safety & Health Administration (OSHA), direct contact with cement can cause chemical burns on the skin. Skin problems can range in severity. Workers may experience blisters, dead or calloused skin and skin discoloration. Cement can smear through clothing, gloves, or boots, it may cause burns and irritations that a worker might not notice right away. That burns and irritations from cement are painful to the skin of the worker. Even when workers wash his body, face, or skin, the harmful chemical compound on cement will still continue burning on skin. Extreme burns may harm the connective tissue beneath the skin's surface as well as the skin itself. Cement dust is also dangerous to workers' respiratory systems. According to a case report by Lung India, published in the US National Library of Medicine, National Institute of Health, being always exposed in cement dust can cause respiratory conditions like chronic obstructive pulmonary disease.

1.2.3. Health Hazards of Cement Dust

In the 21st century, millions of people are still laboring in an environment filled with dust and are consequently exposed to health risks such as fumes, gasses and more dust. The cement industry, which plays an important role in the development of our modern world, produces a lot of dust, which can impair lung function, cause chronic obstructive and restrictive lung disease, and increase the risk of developing pneumoconiosis and cancers of the lungs, stomach and colon, as stated by Meo (2004).

1.2.4. Exposure Effect to Cement Dust Pollution: A Mini Review

Cement factories and plants escalated to accommodate the demand and supply of cement and other raw materials in construction. Thus, various possible dangers and problems occur within and all over a region and community are put at risk. Various pollutants make a difference on the health of people and workers exposed to it, corresponding health problems developed like chronic pulmonary diseases, cancer, silicosis, etc. according to Adeyanju et. al., (2019).

1.2.5 Portland Cement Concrete Pavements for Country Roads

As mentioned by Moorefield C. et. al (2016) The way cement should be managed can vary based on the specifications' demands concerning testing. Certain specifications necessitate that the cement must be retained

until the outcome of the 28-day test is disclosed, while others allow its utilization once it has successfully passed any tests conducted within seven days.

1.2.6 PORTLAND CEMENT: Composition, Production and Properties

According to Telford T. (2015), during the calculation, it is assumed that all the iron oxide exists in an aluminoferrite solid solution called C4AF. Additionally, any excess alumina, beyond what is needed to satisfy the iron in this ferrite, is considered to be present as C3A. The remaining lime, after deducting the lime required for these compounds, is allocated between C3S and C2S. The combined lime refers to the total amount determined by chemical analysis, excluding the free lime, which can be identified by extracting it with ethanediol.

1.2.7 Effects of Manual Construction Activities on Site Workers in Takoradi, Ghana

As stated by Osei-Poku G. et al. (2016), the construction site workforce comprises various roles such as carpenters, electricians, laborers, masons, painters, plumbers, and steel benders. Among these workers, laborers face higher risks and hazards due to their involvement in cement-related activities. These activities include carrying blocks to designated areas for laying, using shovels to mix mortar and concrete, transporting head pans filled with fresh concrete or mortar, cement bags, and water buckets on their heads. They also employ pickaxes to excavate trenches for foundations and septic tanks, push wheelbarrows loaded with mortar, fresh concrete, or 50kg cement bags across the site, and pour concrete. Mason workers are also exposed to cement through tasks such as laying blocks/bricks, plastering works, and performing concrete-related activities like floating.

1.2.8 Construction Safety Risk Mitigation

According to Hallowell M. R., et al. (2019), job hazard analysis in the construction industry involves reviewing the activities associated with a construction process to identify potential hazardous exposures that could result in harm. Hazards can be identified through various means such as reviewing OSHA logs, violation reports, accident investigation reports, conducting interviews with laborers, or relying on intuition. It is crucial to effectively communicate these hazards to workers. Worksite inspections can be carried out by a contractor's safety manager, a safety committee, a representative from the contractor's insurance provider, or an OSHA consultant. The primary objective of safety and health inspections is to identify uncontrolled hazardous exposures, violations of safety standards or OSHA regulations, and unsafe worker behaviors. Regular inspections are necessary to ensure ongoing safety compliance.

1.3 Study Area

The City of San Fernando, Pampanga is one of the most heavily industrialized cities in the Philippines. It is home to a vast number of factories and industrial plants and is a major hub for construction work. The construction industry has grown substantially in the past few years, and the demand for construction workers is high. However, it is important to ensure that these workers are properly trained and aware of the safety protocols and procedures associated with handling cement and other materials used in construction. This research aims to assess the awareness of construction workers in San Fernando, Pampanga regarding cement related works.

1.4 Objectives of the Study

General Objective

To investigate the awareness of construction workers regarding the potential risks and hazards associated with cement-related activities, and to propose safety measures and interventions to mitigate these risks.

Specific Objectives

The study specifically aims to achieve the following:

1. To conduct a thorough literature review to find all potential risks and dangers in cement-related operations.
2. To investigate whether the respondents are aware of any dangers or hazards that may be brought on by cement-related activities.

3 To identify all potential interventions through a thorough literature review and to possibly adapt these interventions to mitigate and reduce these risks.

1.5 Statement of the Problem

The study aims to answers the following questions:

1. What are the potential risks and hazards associated with activities relating to cement?
2. Which percentage of construction workers are aware of the risks connected to activities involving cement?
3. What safety measures and interventions can be proposed and successfully implemented to reduce the dangers associated with cement-related activities and enhance the safety and security of construction workers in this industry?

1.6 Significance of the Study

The results of the study will be of great benefit to the following:

To Construction Workers - Specifically to laborers and masons. These workers are exposed to using cement and concrete on a daily basis, and without the proper knowledge, it can cause harm to themselves. Being able to identify workplace risks and hazards helps them better prepare, eliminate, control, and prevent events.

To Construction Firms - The health of employees and ensuring safe conditions are of primary importance to the construction site. This study will help each company identify any gaps in their current training and safety procedures. It can also be a basis for providing guidance to their workers and identifying areas for improvement.

To Researchers - the outcome of the study is beneficial to the neither present researcher or the future researchers. This study may be one of the bases that a new theory in the same topic will arise.

1.7 Scope and Limitations

Scope

• Workers' Awareness

This research focuses on investigating the awareness of construction laborers and masons when handling cement-related activities. In addition, the researchers will propose safety measures to mitigate the risks and hazards caused by cement.

• Comprehensive Literature Review

Recent studies and research were used as a reference in finding out the effects of cement-related activities.

• New Construction Company in City of San Fernando, Pampanga

The study will focus on the municipality of San Fernando. To conduct the survey, the researchers chose all new registered companies in the city. Each company should have an existing project in the province, but not necessarily in the City of San Fernando, Pampanga.

•Respondents

A total of 193 construction laborers and masons served as the respondents to this study. A total population sample was used to determine the distribution.

Limitations

• Availability of Data

The limitations of this research project include the availability of data. A total of twenty-plus new companies were subject to this study, but due to the information they provided, the study focused on seven new companies to conduct the survey.

1.8 Conceptual Framework

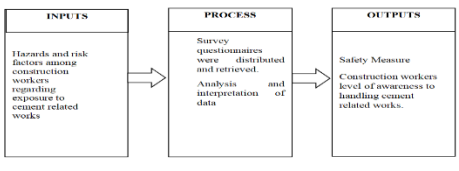

Figure 1. Conceptual Framework

The Input variable includes the hazards and risks factors among construction workers regarding exposure to cement related works.

The Process variables are survey questionnaires that were distributed and retrieved. After the data were gathered, the researchers analyzed and interpreted the said data to come up with a conclusion.

Under the Output variable, after analyzing the gathered data and determining the occupational hazards and risks, the researchers proposed recommendations to prevent or lessen the chance of occurrence of the harmful effects.

1.9 Definition of Terms

Aggregate. something formed by adding together several amounts or things.
Cement Mixture. It is a mixture of cement, water, sand, and/or gravel.
Cement-Related Works. This includes any work that involves cement such as mixing, pouring, plastering, and even lifting.
Concrete. It is a construction material made up of cement, fine aggregates (sand), and coarse aggregates combined with water which hardens with time.
Construction Worker. In this research, it refers to a person who is concerned with cement works.
Commercial building. are buildings where commercial activities take place. Commercial buildings include office buildings, retail space, warehouses and more.
Hazards. This pertains to anything that may cause injuries to construction workers
Industrial building. Industrial buildings include buildings used directly in the production of power, the manufacture of products, the mining of raw materials, and the storage of textiles, petroleum products, wood and paper products, chemicals, plastics, and metals.
Microscopic crystals. A crystal is a solid where the atoms form a periodic arrangement.
Mitigations. the action of reducing the severity, seriousness, or painfulness of something.
Pulmonary tissues. A type of disease that affects the lungs and other parts of the respiratory system.
Risk. It refers to the likelihood of a hazard to occur.
Residential building. all buildings intended for private occupancy whether on a permanent basis or not.
Silica particles. are amorphous substances that have a spherical form.

Chapter II
METHODOLOGY

2.1 Phase 1 – Methodological Framework

This chapter clearly defines the research methods used to conduct the study. The researcher explains how the necessary data and information to address the research objectives and questions was collected, presented, and analyzed. Reasons and justification for the methodological framework, research design, research locale and respondent sampling, research instrument, data collection, and data analysis and evaluation are given.

Research Design

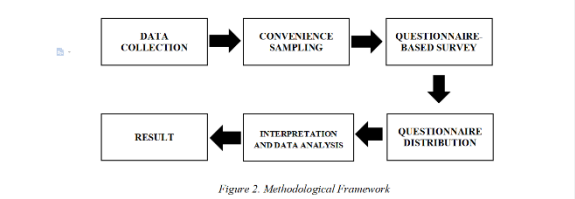

Figure 2. Methodological Framework

The researchers utilized a quantitative method approach in collecting data to satisfy the research objectives. A survey was conducted, which falls under a quantitative research method.

2.1.2 Research Locale & Respondent Sampling

This study was based on the total population, the alternative use of probability was not considered due to limited resources and the availability of the workers. The respondents to the research were the 193 construction workers of selected new companies in the City of San Fernando, Pampanga.

2.1.3 Research Instrument

To ensure that all possible areas of inquiry are covered, the researchers employed a closed-ended questionnaire survey form that consisted of 14 questions pertaining to awareness of cement related hazards and risks, awareness in proper handling of cement related works, and construction toolbox talks or meetings. The questions were adapted from a study conducted by Sierra-Calderon et. al., (2017) which assessed the appearance of dermatitis and skin lesions to the workers exposed to cement-related hazards. The researchers modified the questionnaires to determine the effect of other hazards: allergic reactions that interfere with breathing, chronic bronchitis, asthma, emphysema, lung cancer, pneumonia, tuberculosis, shortness of breath, cough, wheezing, seizures, chest pain, irregular heartbeat, swelling in your legs and feet (not caused by walking), high blood pressure, eye irritation, skin allergies, anxiety, fatigue, heart burn/indigestion.

2.2 Phase 2 – Data Collection

To collect the data, the researchers used a survey questionnaire given to the construction workers in the City of San Fernando, Pampanga. Through surveys, quantitative data can be used to collect data and to investigate the awareness of construction workers in handling cement-related works in the said city, such as the number of workers who have acquired knowledge about cement-related works, the number of workers who have received safety training, their experience with cement works, and how they think safety should be improved in the workplace.

2.3 Phase 3 – Data Analysis and Evaluation

To employ a quantitative research design using a survey questionnaire to gather data on the awareness of construction workers on potential risks and hazards associated with cement-related activities, and to use statistical analysis such as frequency distribution, mean, and standard deviation to analyze the data.

Chapter III
Result and Discussion

3.1 Quantitative Data Analysis

This part presents the data that have been collected through quantitative survey. This also deals with the presentation, analysis, and interpretation of the results of the study about "Risk and Hazard Mitigation of Cement- Related Activities in City of San Fernando, Pampanga: An Investigation of Construction Workers' Awareness and Propose Safety Measure"

3.1.1 Number of Respondents each Company

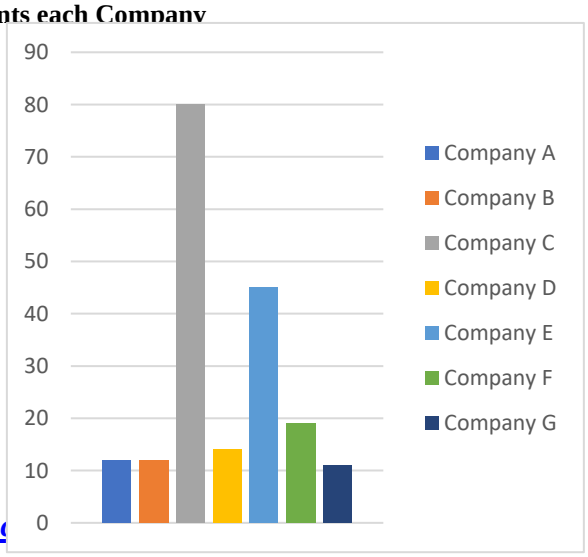

Figure 3. Frequency Distribution of Respondents

Company C had the highest number of respondents or participants, which is 80. It is followed by Company E, which had 45 respondents. The next company that followed was Company F. which had 19 respondents. It is also followed by Company D, which had 14 respondents. Then the Company A and Company B had 12 respondents. Lastly, the company with 11 respondents is Company G.

3.1.2 Awareness of Cement-Related Hazards

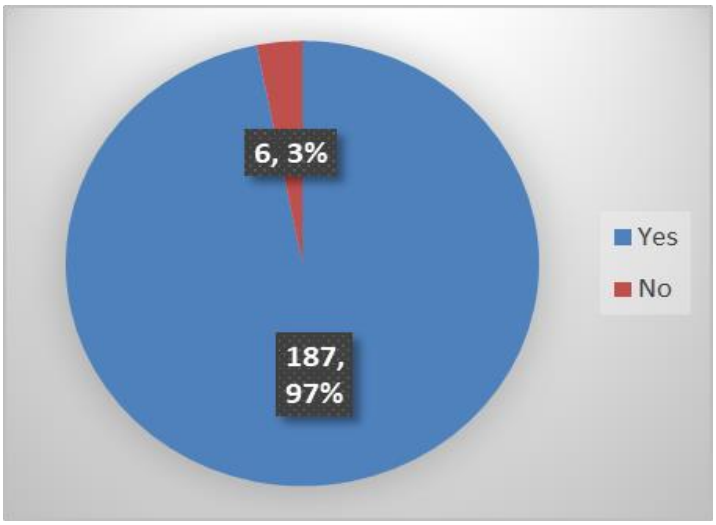

Figure 4. Frequency Distribution Regarding Awareness of Construction Workers in Cement-Related Construction Hazards

Based on figure 2, the majority of the respondents are aware of the cement-related hazards with a frequency of 187 and a percentage of 97%. Only six of them or 3% are not aware. In summary, most are aware, which means they have enough knowledge about their work to help minimize the severity of hazards and risks in their field.

3.1.3 Cement-Related Risks

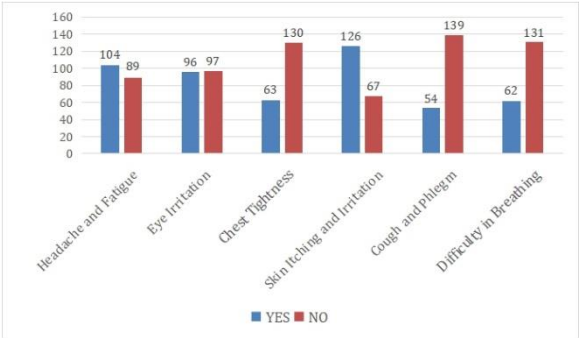

Figure 5. Frequency Distribution Regarding Cement-related Risks for Construction Workers

Based on Figure 3, all of the construction workers, a total of 126 respondents or 65.28% experienced skin itching and irritation. 104 respondents or 53.89% experienced headache and fatigue. 96 respondents or 49.74% experienced eye irritation. Sixty-three (63) of them or 32.64% experienced chest tightness. While 62 construction workers or 32.12% experienced difficulty in breathing, and 54 respondents or 27. 98% experienced cough and phlegm.

Mehraj et. Al. (2013) stated that 21 types of ailments were recorded among residents exposed to cement which include allergic reactions that interfere with breathing, chronic bronchitis, asthma, emphysema, lung cancer, pneumonia, tuberculosis, shortness of breath, cough, wheezing, seizures, chest pain, irregular heartbeat, swelling in your legs and feet (not caused by walking), high B.P, eye irritation, skin allergies, anxiety, fatigue, heart burn/indigestion.

3.1.4 Awareness of Cement Handling

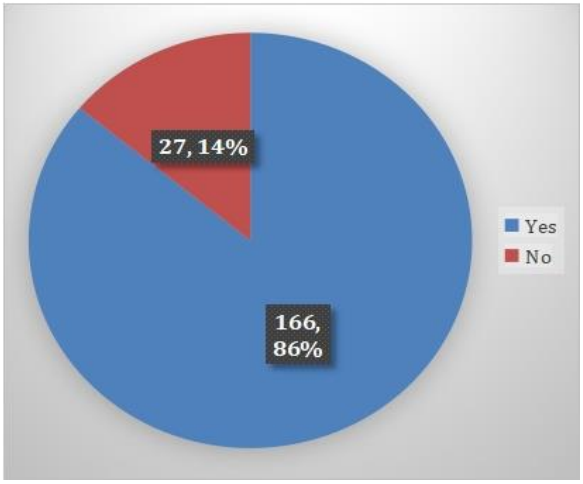

Figure 6. Awareness of Construction Workers on Proper Handling of Cement-Related Works

Based on figure 3, the majority of construction workers, as indicated by 86% with a frequency of 166 of the respondents, possess awareness about the proper handling of cement-related works, while 14% of them are indicated as lacking awareness. This high level of awareness reflects their strong understanding of safety protocols and guidelines, ultimately contributing to a safer work environment with a reduced risk of accidents or injuries.

The majority of participants demonstrated awareness of workplace hazards and acknowledged the hazardous nature of their occupations. This positive trend is expected to contribute to the reduction of workplace injuries as stated by Musa et. al., (2012).

3.1.5 Safety Gear Usage

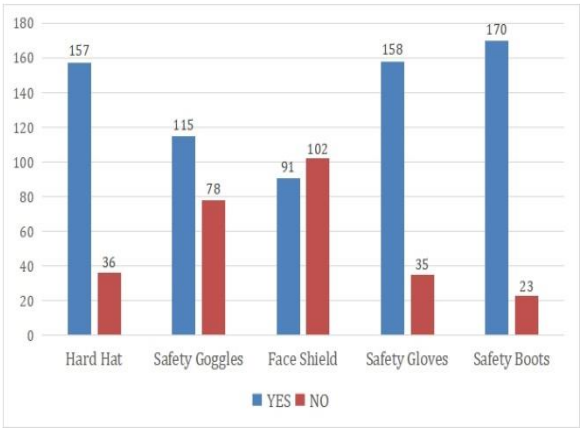

Figure 7. Usage of Safety Gears in Handling Cement-Related Works

Based on figure 5, all of the construction workers, a total of 157 respondents, or 81.35%, used hard hats. While 115 respondents, or 59.59%, used safety goggles. Then 91 respondents, or 47.15%, used face Shield. And 158 respondents, or 81.87%, used safety gloves, and lastly, 170 respondents, or 88.8%, used safety boots. This indicates that most of the construction workers used personal protective equipment during their work, except for using a face shield. This also means that they were aware of possible hazards that may arise from cement works, which can help mitigate the risks and hazards on construction sites.

According to Jannadi et. Al. (2013) a risk model (RAM) was developed to determine the risk associated with a particular activity and the justification factor for a proposed remedy. RAM is a computer model written using a visual basic and built in such a way that the user does not have to remember steps or formulas. This computer model conducts a pre-analysis inquiry on proper usage of personal protective equipment, based on the result of the analysis, RAM will calculate the probability (P) or likelihood that harm will occur if a hazardous event takes place.

3.1.5 Construction Toolbox Talk

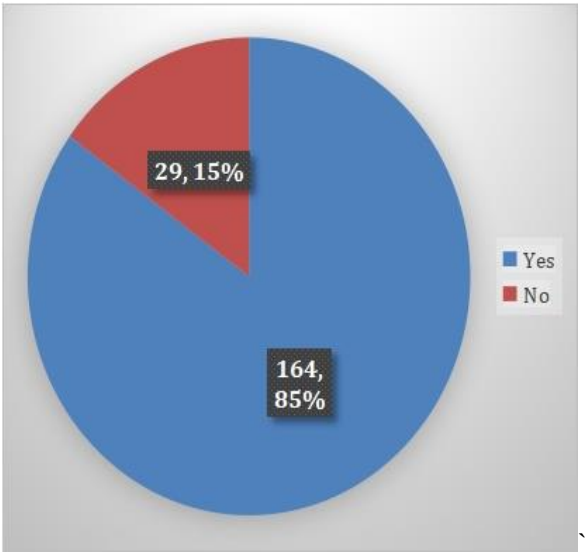

Figure 8. Construction Toolbox Talk Prior to Start of Work

In this figure, based on the results of the survey, 85%, or a total of 164 respondents, answered "yes," indicating that their company provides construction toolbox talks prior to the start of work. While 15% or 29 respondents gave an answer of "no".

According to Jeschke et al. (2017), in traditional construction sites, the daily dialogue between leaders and workers primarily revolves around production, quality, and time-related matters, often neglecting discussions on occupational safety and health (OSH) issues. To address this gap, a leadership training program called 'Toolbox-training' was created. This program aims to enhance construction foremen's knowledge and communication skills in effectively planning work tasks and identifying the associated OSH risks on construction sites. By integrating OSH considerations into daily planning discussions, the program aims to improve overall safety and reduce workplace accidents in the construction industry.

As mentioned by Freschet (2018) After 5 weeks of tool box talks and 5 weeks of observing safety practices in the field, it was evident, through simple observation, that the tool box talks made a significant improvement in safe practices on construction sites. After tool box talks were given, the workers began wearing appropriate P.P.E. such as dust masks, face shields, gloves, welding hoods, and long sleeve shirts. Workers became much more aware of the threat of dust and how it can affect their bodies, causing most of the workers to start wearing respirators.

Chapter IV

CONCLUSIONS, AND RECOMMENDATIONS

After analyzing the data gathered for this research, it is clear that construction workers face potential health risks and hazards associated with cement-related activities. However, our findings also suggest that workers are aware of the risks and hazards and are taking steps to mitigate these risks. In this conclusion, the researchers will provide a summary of the key findings related to the identified risks and hazards associated with cement-related activities, draw conclusions based on the analysis, and provide recommendations for future research and practical applications.

4.1 Synthesis on problem 1: Identification of potential risks and hazards associated with cement-related activities.

Prolonged inhalation of the construction workers in cement-related hazards can provoke or cause clinical symptoms such as internal and external problems and abnormalities according to Meo (2013). Workers are exposed to cement dust at various construction and production procedures such as handling raw material or cement. As stated by Rahmani et al. (2018), cement dust contains various types of metal oxides including calcium oxide, silicon oxide, aluminum trioxide, ferric oxide, magnesium oxide, sand and other impurities. Respiratory problems with high prevalence and varying degrees of airway obstruction about cement exposure have been reported by earlier studies. Rahmani et al. (2018) also mentioned that, in a related study, it has been reported that the cement industry workers, who are directly exposed to the dust for longer durations, suffer from more shortness of breath, as compared to the workers who take precautionary measures. As indicated by Bedoya-Marrugo et al. (2017), dermatitis or skin problems in workers are generated by exposure to cement in the execution of tasks and work activities within which requires the use of chemicals that can cause skin diseases in workers, demonstrating that dermatitis Occupational contact (OCD) is a common occupational disease affecting a variety of groups of workers.

4.1.2 Synthesis on problem 2: Assessment of construction workers' awareness of the hazards associated with cement-related activities.

Based on the results presented in figure 2, the majority of the respondents (97%) are aware of the cement-related hazards, indicating that they have enough knowledge about their work to help minimize the severity of hazards and risks in their field. Nonetheless, the majority still experience health risks such as headache and fatigue, eye irritation, chest tightness, skin itching and irritation, cough and phlegm, and difficulty in breathing, despite their awareness of cement related hazards.

4.1.3 Synthesis on problem 3: Identification of interventions to prevent and minimize risks and hazards in cement-related activities.

Utilization of Local Exhaust Ventilation (LEV) Systems: LEV systems are useful for capturing and removing dust produced during cement-related activities. Before it can be inhaled by workers, these systems are made to remove the dust at its source. The amount of dust in the air has been found to be greatly reduced as a result, which may lower the risk of respiratory issues among workers.

Use of Personal Protective Equipment (PPE): Workers can be protected from potential risks connected with cement-related operations by using PPE such as gloves, a face shield, a hardhat, safety boots, and safety goggles. To guarantee that workers are sufficiently protected, construction companies should enforce the use of PPE and instruct personnel on its safe use.

It should be emphasized, nonetheless, that the information acquired for the use of PPE in this study is based on self-evaluation and might not be completely accurate. It is likely that some employees record incorrect PPE usage or overestimate its use for a variety of reasons, including forgetfulness or concern over disciplinary action.

Implementation of Training Programs: Training programs can be used to inform employees about potential risks related to activities involving cement and how to avoid them. These programs may include toolbox meetings to be held at the start of work for various information and for orientation of workers on the effects of cement on health and how to prevent it.

Regular Audits and Inspections: Regular audits and inspections should be carried out to make sure that the suggested interventions are being implemented and that workers are being sufficiently protected. This gives the chance to take remedial action and can assist in identifying any gaps or weaknesses in the safety program.

4.2 Summary

In conclusion, exposure to cement-related hazards can lead to various health problems for construction workers, including respiratory and skin problems. Cement dust contains metal oxides and impurities that pose a

risk to workers. Despite being aware of the hazards, workers still experience health risks. Therefore, training programs such as construction toolbox meetings and personal protective equipment can help mitigate these risks. It is recommended that construction firms enforce the use of personal protective equipment, conduct audits to assess the effectiveness of prevention programs, and provide workers with knowledge and recommendations to minimize the severity of hazards and risks in their field. By implementing these measures, construction firms can protect the health and well-being of their workers and prevent workplace injuries and illnesses related to cement exposure.

4.3 Recommendations

It is crucial to keep improving the efficacy and accuracy of research in this field since it is crucial to guarantee the safety and wellbeing of personnel engaged in cement construction operations. To this end, the researchers advise future studies to take into account the following recommendations in order to improve the validity, reliability, and usable implications of their findings.

Use a more representative sample that includes demographic profile: Using a more representative sample of construction workers with demographic profile can help increase the study's generalizability and improve its external validity. This can be achieved by increasing the sample size or by selecting a more diverse and representative sample of workers from different regions or types of construction projects.

Use more objective measures: Using more objective measures to assess workers' awareness of hazards and their use of protective measures can increase the reliability and validity of the study's results. This can be done through direct observations, objective tests, or more precise measures of PPE use and compliance.

Conduct longitudinal studies: Longitudinal studies can provide more comprehensive and accurate information about the long-term health effects of cement-related activities. By following workers over time, researchers can track changes in their health and the effectiveness of various interventions, which can inform more targeted and effective prevention strategies.

Explore social and contextual factors: Future studies can benefit from exploring the social and contextual factors that influence workers' awareness and use of protective measures. This can include examining the role of workplace culture, leadership, training, and communication in promoting a safe and healthy work environment.

Evaluate the cost-effectiveness of interventions: It would be useful to evaluate the cost-effectiveness of various interventions for reducing health risks associated with cement-related activities. This can help companies and policymakers make informed decisions about investing in interventions that can yield the greatest benefits for workers' health and safety.

Translate findings into practice: Finally, it is important to translate the findings of research into practice. Researchers can work with industry stakeholders to promote the adoption of best practices and interventions based on the study's results. This can help ensure that workers are adequately protected from health risks associated with cement-related activities and that workplaces are safer and healthier overall.

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