

FACTORS CONTRIBUTING TO ACCIDENT CAUSATION IN THE GRATE COOLER SECTION AT SINO-ZIMBABWE CEMENT COMPANY FROM JANUARY 2005 TO DECEMBER 2013.

By

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A DISSERTATION SUBMITTED TO THE DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL SCIENCE OF THE MIDLANDS STATE UNIVERSITY IN PARTIAL FULFILMENT OF THE REQUIREMENTS OF THE MASTER OF SCIENCE IN SAFETY HEALTH AND ENVIRONMENT MANAGEMENT DEGREE.

Midlands State University



May 2014.

DEDICATION

I dedicate this dissertation to my daughter Tawananyasha Chaitezvi and my family especially my sisters for their unwavering support throughout my research.

ACKNOWLEDGEMENTS

I express my sincere gratitude to my supervisor Doctor D. Moyo for his unceasing reviews, guidance and encouragement and I would also want to express my gratitude to the Chairperson of Environment and Geography department and his team at Midlands State University. I extend my thanks to all my colleagues and friends. I would also like to acknowledge all the authorities who assisted me with all the relevant information that was used in this research. These include Mr M.D Moyo, (General Manager Administration) , Mr E. Mutuswa, Mr J. Sango and Mr R Ruziwa (Sino-Zimbabwe Cement Company Heads of departments) for their support and many other who contributed to the study. My thanks also go to my wife Christine Nabwenje.

ABSTRACT

The major aim of this research was to examine factors contributing to accident causation at Grate Cooler section from 2005 to 2013. The cross sectional design was used. A stratified random sample method was used. The study population consisted of 165 employees at Grate Cooler Section with a sample of 92 workers which included seven heads of departments. Research instruments which were used to gather data included questionnaires, observations and interviews. The major findings was that heat is the major hazard at Grate Cooler section and human factors are contributing factors of accidents causation at Grate Cooler section as such accidents are mainly caused by co-workers. Also the findings revealed that the company does not have proper risk assessment system hence accidents are high. The company is also lacking visible Felt leadership. The research recommends that the company should be certified to any standard of safety, Health and Environment systems such as ISO 14001, OHAS 18001 in order to reduce accidents and should have a comprehensive risk management system. The study recommends that further studies be undertaken by National Social Security Authority to establish the factors causing accidents at Grater Cooler Sections such that further lost time injuries and fatalities are reduced in Zimbabwe.

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List of acronyms.

HIRA Hazard identification risk assessment

LTI Lost Time Injuries.

OHSAS Occupational Health and Environment assessment series.

SHE Safety, Health and Environment

CHAPTER ONE: INTRODUCTION

The chapter gives the background to the study, statement of the problem, objectives, and justification of the study, limitations, description of the study area and definition of terms.

1.1 Background to the study

An accident does not arise from a single cause; more frequently there is a combination of factors which must all be simultaneously present, (Gonese, 2002). A potentially unsafe situation does not give rise to an accident. Accidents are caused by factors such as the result of an unsafe act or practices, human element which results from poor attitude, physical condition, lack of knowledge or skills to enable one to work safely or the result of unsafe conditions of equipment or materials and lack of management commitment (Grenshany et al 1997). Accidents cause disorganization, injury, financial cost to the company, disablement or sometimes death. To the worker; accidents bring pain and suffering not only to him but his or her family as well. Overall, occupational accidents affect the economy of the country (Veronen,U 2001). More than three thousand million tons of cement is processed in China each year, and cement-related burn injuries have been rapidly increasing in the Chinese cement industry in recent years (Xiao 1995). Burns caused by prolonged contact of wet cement with skin have been widely reported. Occupational injuries present a major public health problem resulting in serious social and economic consequences that could be prevented if appropriate measures are taken. The World Health Organization (WHO) in 2009 reported that accidents are responsible for 3.5 million deaths throughout the world each year.

The International Organization for Labour (ILO) estimates that globally 2.3 million women and men succumb to work-related accidents or diseases every year. This corresponds to over 2.02 million due to unsafe acts using H.W. Heinrich's principle. Investigations into major accidents like Chernobyl and Three Mile Island by reliability engineers and human factor specialists have pointed out human factor as the root (Kirwan,B ,A 1994). According to new estimates by the ILO, 2013, the number of job-related accidents and illnesses, which annually claim more than two million lives, appears to be rising because of rapid industrialization in some developing countries (Satar, B 2001). A new assessment of workplace accidents and illness indicates that the risk of occupational accidents has become by far the most prevalent danger faced by people at

their jobs – accounting for 1.7 million annual work-related deaths (Greenshank et al 1997). In its latest estimates, the ILO found that in addition to job-related deaths, each year there are some 268 million non-fatal workplace accidents in which the victims miss at least three days of work as a result, as well as 160 million new cases of work-related illness (NIOSH 2013). The ILO has previously estimated that workplace accidents and illness are responsible for the loss of some four per cent of the world's GDP in compensation and absence from work.

Every year throughout the world, Grate Cooler accidents occur and the world is paying heavily for accidents or injuries in terms of both human suffering and economic losses (Sharm P.D, 2009). Despite some progress, the question of safety at Grate Cooler is still a serious problem. Bangladesh is a developing country (Vestbo, J 1990). Over population, illiteracy and poverty are three major features of this country. In the industrial sector of this country, these three major features play a vital role (Sultan A, 2012). In maximum cases workers who start to work in industries are unskilled as they are not provided with sufficient training (Bruno F, 2003). These raw hands start to work as unskilled labor and through working in the practical field they become skilled as time goes on (Hart,2009). But every year, these workers are experiencing thousands of industrial accidents which lead to different occupational injuries. These injuries have a major effect on the national economy as they cause losses of productive hours, skilled manpower, and money as compensation and in addition sufferings to the victims and their family etc. (Hisham.2011). Perhaps enough attention has not paid on this regard because labor is found cheap here but this should not be the case. The workers should be provided with proper safety which will lead to reduced number of injury. (ILO 2004)

In 2008 a survey by WHO showed that worldwide 900,000 cases of occupational accidents was reported in 2004 from among 4.5 million injured workers in 1 year at Grate Cooler. In Chile in the same year the occupational safety insurance schemes reported 74,800 disabling injuries from a population of 350,000 workers who works at Grate Cooler Section. In 2010 the corresponding number was 112,700 cases of injuries, (Singh A, 1997). In Bolivia in 2011 the population of 24 thousand workers in large cement manufacturing industries had 5430 Lost time injuries in one year (Siracusa, 2010). These figures give annual rate of accidents, causing disabling injuries ranging from 21 to 34 per workers at risk at Grate Cooler section (NIOSH, 2013).

According to Carlos R, 2007, a publication on "Request for assistance in Preventing Occupational Fatalities in Grate Cooler", described 16 deaths that occurred at Grate Cooler. From October 2011 through April 2012, NIOSH, as a part of the Fatal Accident Circumstances and Epidemiology (FACE) Program, has investigated five fatal falls involving workers who work at Grate Cooler. NIOSH recommends on this regard that employees who work in such places should have proper training, proper visible Felt Leadership and warning individuals against sitting or stepping on these units, manufacturers should modify the design of Grate cooler section to strengthen falling hazards sufficiently to support the weight of a worker who steps, sits, or falls on Grate cooler structures.

In March 2007, Samey MH, Haque MJ, showed that in Bangladesh each year about 500 workers are killed, injured and impaired due accidents at the Grate Cooler .

Broken down by region, the figures indicate that workplace accidents have leveled off in many industrialized and newly-industrialized countries, while some countries now undergoing rapid development in Asia and Latin America are experiencing increases in accidents (Blumbera,B 2011). For example, the ILO analysis showed that while the number of fatal and non-fatal workplace accidents held steady or declined in most regions, in China the estimated number of f Lost time accidents rose from 73,500 in 1998 to 90,500 in 2012, while accidents causing three or more days absence from work increased from 56 million to 69 million (Hisham,2011). “This is happening because in the newly developing countries workers are often coming out of the rural areas, with few skills and very little training in safe work practices,” says Jukka Takala, Director of the ILO’s Safe work Programme. “Most have never worked with heavy machinery, and some have little or no experience with industrial hazards such as electricity, so they don’t know how dangerous these things can be. Yet these are elements of the kinds of jobs that are available for low-skilled workers in rapidly industrializing countries.”

The number of work place accidents in Zimbabwe has remained exceptionally high for an economy that has an average capacity utilization of 39.7 percent (EMCOZ 2012). Statistics show that occupational accidents fell to 3 241 in the first 7 months of 2013 from 3 621 during the same period last year. According to EMCOZ 2012, the union was being disappointed to note that the

rate of accidents in 2010 compared to 2009 especially at Grate Cooler section in Cement manufacturing industries has greatly increased .In 2010 the records show that reported occupational injuries were 4410 (including Lost time injuries, Medical Treatment Cases and First Aid Cases) with 20 fatalities while in 2009, 2112 injuries and 26 fatalities were recorded. This has an increase of 41% (NSSA On Guard 2012).In 2007, 2008, 2009, 2010, 2011 and 2012 the Zimbabwe cement industries Injury Frequency Rate was 1.9 the most contributing section was Grate Cooler. The standard is less than one.

Locally, according to 2012 Cement manufacturing Union report published extensively in respect of the frequency of reported accidents and ill health in cement manufacturing industries. They reported that the total number of reported workplace accidents and cases of ill health resulting in more than three days absence in 2004,2005,2006,2007 and 2008 was \$545,550. (NSSA, 2008). However, in Zimbabwe accurate assessment of the costs of these accidents and ill health has been difficult, due to lack of proper systems of quantifying present accidents data on such costs. A recent report by PPC Bulawayo annual report 2013 extrapolated the cost of Grate Cooler workplace accidents and ill health to be between \$15 000 to \$20 000per annum including medical bills and overtime costs for the abovementioned company.

The Zimbabwe national number of workplace deaths also declined from 63 to 49, but NSSA Director for Occupational Health and Safety Rodgers Dhliwayo says the level is still very high, hence the organization is pushing for a pro-active approach to dealing with accidents. (NSSA, On Guard 2012)

Zimbabwe has experienced occupational accidents in the past when 427 mine workers perished at Kamandama, Hwange Colliery and fifteen construction workers perished after a goods hoist crashed at the CABS Millennium Towers. Recently the use of improvised boilers has been a major cause of accidents in Zimbabwe. Investigations have indicated human error as factors.

According NSSA's occupational safety and health report released by New Zimbabwe dated 15 September 2013, the number of people dying in work related accidents eased increased to 43 compared to 38 fatalities during same period last year. Most of the causalities occurred in

Harare, which recorded 20 deaths from 1,073 injuries. NSSA's Director of Occupational Safety and Health, Rodgers Dhliwayo, blamed the fatalities and increased numbers of injuries the failure by companies to invest in occupational safety, "In short, they do not care much about the safety and health of their workers. The immediate causes of accidents ranged from ignorance, recalcitrance, stubbornness, short-cutting procedures, lack of management Visible Felt Leadership and incompetence," he said .According to NSSA 2012 On guard report there were 5,141 serious occupational injuries which resulted in 103 deaths, the highest number of occupational injuries and deaths since the country came out of hyperinflation. In 2011, there were 4,158 serious work-related injuries recorded, 75 of which were fatal. In 2010 there were 4,410 serious injuries, resulting in 90 deaths

According to NSSA 2013 Quarterly regional reports, at Sino Zimbabwe the injury frequency rate as per section was above NSSA threshold limit, for the Grate cooler section the rate of accidents is increasing. In Zimbabwe, there is not much information on the cause of accidents in the cement manufacturing industry. Consequently this study sought to evaluate the accident causation in the grate cooler.

1.2 Statement of the problem.

Numerous studies that seek to critically evaluate causation of accidents in Grate Cooler have been conducted (Carlos R,2007) However, some works have tended to focus 'why' employees are injured in the Grate cooler mainly, approach the subject from a "worker blame perspective" but this research focused also on the management "visible Felt leadership ". In particular, studies conducted in Zimbabwe that evaluate causation of accidents are rather few. In 2007/08 a total of 34 million working hours were lost because of workplace-related accident or illness. Of these, 6 million were due to injuries within the workplace while 28 million were 'work-related' ill health days (NIOSH, 2013).

According to SZCC annual S.H.E report 2009 a total of 2 people were killed in the Grate Cooler which was loss of lives. (Long term, death rates have fallen, but the fatality figures have changed very little over the past six years)

According to the company Clinic 2010 report ,the most usual organs involved are the spine, upper limb, the head, eyes, skeleton, and skin problems reported at the Clinic . According to data from the Company 2013 strategic report, average of two workers are injured at the Grate Cooler per week and an additional 10 workers are involved in near misses.

General hazards in the Grate Cooler include high voltage (33kv), explosive materials, dangerous fires, flammable gases, high temperatures (1300degrees Celsius , heights (50metres above ground), , hot furnaces and , powerful or sharp moving machinery, , poisonous gases, radiation, toxic materials.(S.H.E 2010 baseline Risk assessment report)

About 70 percent of the reported serious accidents at Sino –Zimbabwe Cement Company most of the accidents occur in the Grate Cooler where people are often working at dangerous heights or at risk of being struck by falling objects. (S.H.E July Month-end report 2011)

There will always be dangers involved in working in Grate Cooler or in an environment where there is a danger of being hit by a falling object or burns.

SZCC is a mining and manufacturing company with its main operations station at Indiva farm Gweru. The company manufacture mainly cement from limestone rock. Its manufacturing activities include: rock blasting, rock drilling, crushing, grinding, conveyer belt operations and cement milling. Due to the nature of the cement manufacturing process work, workers at SZCC are exposed to high risk of occupational injuries at Grate cooler which produce more than 1300 degrees Celsius in temperatures and most of the areas are confined space. Between 2000 -2004 when the company started, the trend of occupational injuries at grate cooler has been stable, but there was a sharp rise between 2005 and 2013.From January 2005 to December 2013, 173 cases of occupational injuries were reported at the company Clinic. Of these, 72% were treated as outpatients with mild –moderate injuries, 28% were admitted with severe injuries some of which warranted surgery, and 4% were disabling injuries as a result of occupational injuries. The lost time injury frequency rate on average per year was more than 3% against NSSA of less than 1 per year.

Like any manufacturing company, SZCC is a working environment where there is continuous potential risk of occupational injuries to its workforce. The injuries in the Grate are affecting the morale of workers and the image of the company. (The Herald, 13th May 2013)

Financial implications: It was reported that LTI of more than three days off duty in 2013 cost the company \$3500 due to the hospital bills and other costs of which between \$5000 and \$6300 was accounted by accidental damage to property and equipment (SZCC S.H.E 2013 annual report). Between 2009 and 2011 the company was forced to close for two weeks on average due to fatalities which occurred at Grate Cooler and the company lost about two million United States Dollars (Sino-Zimbabwe Cement Company 2011 Annual Finance Department Report)

Using Heinrich's triangle for occupational injuries, for the 28% lost time injuries registered at SZCC for 2005/2013, there could have been 452 minor injuries and 6400 near misses that occurred. Reported injuries at the company gives an injury rate of approximately 100 injuries per 1000 workers which is far higher than the 47.8 injuries per 1000 workers given by ILO in 1995. This raises questions as to whether all occupational injuries are reported or only a fraction is reported to the clinic, also causes contributing to occupational injuries at Grater Cooler are not clear to SZCC management; therefore factors contributing to accident causation in the Grate Cooler section at Sino-Zimbabwe Cement is going to be conducted by the researcher.

1.2 Objectives.

Broad objective

To evaluate accident causation in the Grate Cooler section at Sino-Zimbabwe Cement Company from 2005 to 2013

Specific objectives

1. To identify occupational hazards associated with Grate Cooler section.
2. To investigate the causes of accidents at Grate Cooler Section.
3. To evaluate the effectiveness of risk assessment management system at Grate Cooler Section from January 2005 to December 2013
4. To assess the role of Visible Felt Leadership at the Grate cooler section.

1.3 Justification of the study.

A worldwide need has emerged to provide policy-makers with quantified information on accidents causation in the Grate Cooler. This study has important implications and relevance to the National Social Security, policy makers, Sino-Zimbabwe Cement Company Senior Management, Line Managers and workers also not forgetting the research community. Most accidents do not just happen. There is a cause. Human behavior can often be part of the cause (Bruno F, 2003). In terms of the NSSA Act, Public Health Act, Works and Factories Act, S.I 68 of Accident Prevention and Compensation Act and Pneumoconiosis Act local authorities are responsible for administering these Acts within their areas of jurisdiction. It is the thrust of the research to equip them with relevant information and knowledge on the causes of accidents in the Grate Cooler for all cement manufacturing companies around Zimbabwe. Consequently the research findings will present a unique causation analyses on the accidents in Grate Cooler.

- A number of accidents have been recorded in Grate Cooler in cement manufacturing companies. Maximised Safety, Health and Environmental Management Systems may be achieved through application of the research findings and recommendations. Evidently the research will provide a solid foundation for workable future direction for managing and preventing accidents to the Sino-Zimbabwe Cement Company management.
- To regulatory agencies the relevance of the study cannot be understated. The NSSA is legally responsible for enforcing and finding causes of accidents in various workplaces. The study will identify the strength and weakness within the existing legislative framework with regard to causation of accidents in the Grate Cooler. Such information becomes crucial in terms of priority settings, policies formulation and targets for accidents prevention measures.
- To the research community the research study findings will provide useful guidelines on causation of accidents in Grate Cooler for cement manufacturing plants and a fundamental reference in terms of literature review.
- The research will also offer the researcher an important opportunity to enrich, sharpen and deepen his skills in the research field, hence intellectual growth in the field of research.

- Harm to human life, Mossink and De Greef (2012) reported that the cost of accidents is not just a burden to businesses but also to the injured workers, their families and society in general. They reported that consequences for employees included loss of quality of life and human Suffering.

1.4 Study Area.

Sino-Zimbabwe Cement Company is located at Indiva Siding, some 38km from Gweru off the Mvuma Road. The company commenced operations in 2000 and it is one of the major cement producers in Zimbabwe. The operation produces high quality Portland and Masonry Cement for both the local and international market. Sino-Zimbabwe Cement Company mine limestone through an opencast system at the Quarry which is located some 7km from the cement manufacturing plant. The company employees approximately 437 permanent workers, 312 contractors and 173 casual employees (2013 Human Resources labour compliment report)

Figure 1.1 map of the study area

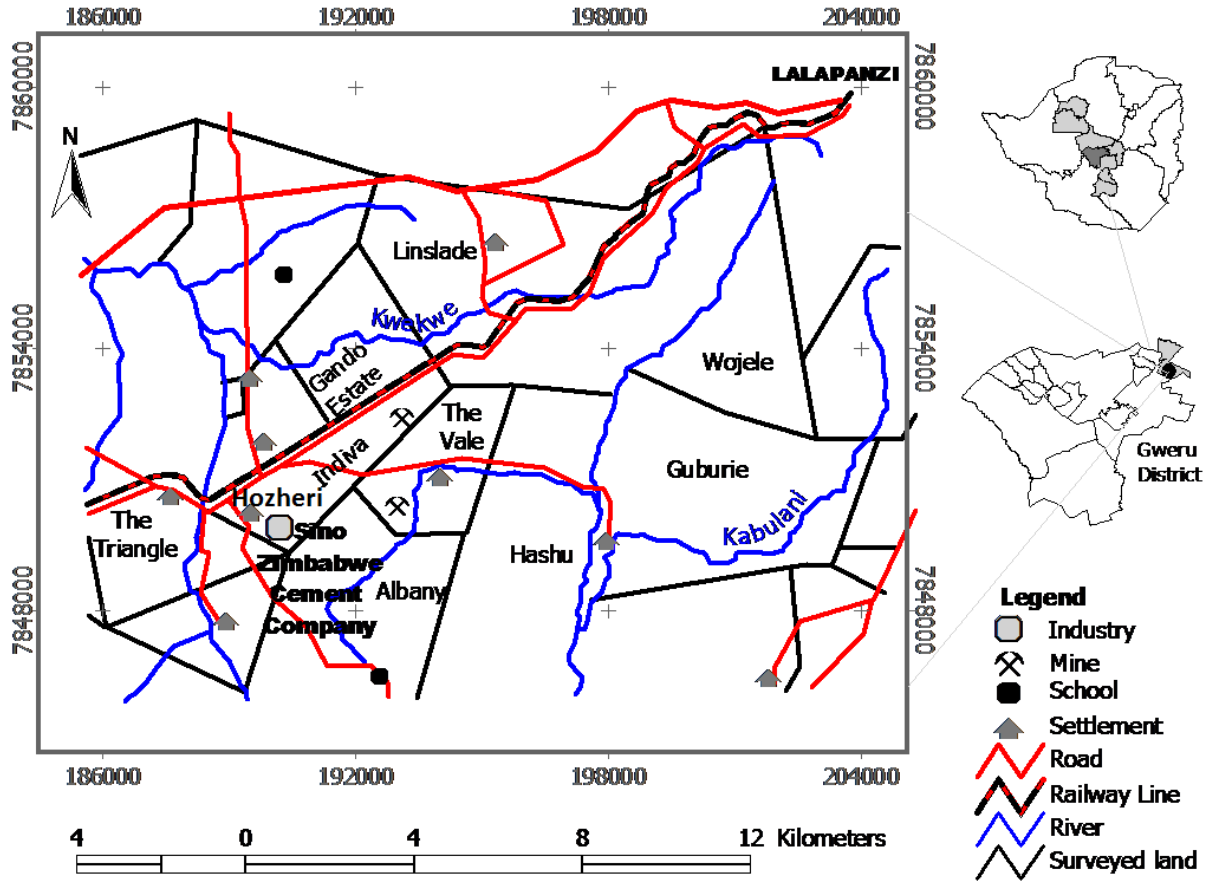




Plate 1: Sections of Grate Cooler Section (Source: SZCC S.H.E 2011 December report)

Physical Characteristics

Sino-Zimbabwe Cement Company community falls under natural farming region 3 which is a semi-intensive farming region. Rainfall is moderate amounting to 650-800mm. This area experiences mid-season dry spells which makes it marginal for maize tobacco and cotton. Temperatures which are experienced at SZCC range from 26 degrees to 37 degrees. The land is mostly covered with open broad leaved deciduous forest Thomas (1960).

Socio economic characteristics

The residents at Sino-Zimbabwe Cement Company are mainly resettled farmers who are A1 and A2 farmers who depend on farming for sustaining themselves. Major crop grown around SZCC is maize and some of the farmers practice livestock rearing which include keeping cattle, goats, sheep and chickens. Some of the locals at SZCC are employed at Sino Zimbabwe Cement Company and most of the workers reside in Gweru.

1.5 Limitations of the study.

The study incurred challenges when approaching employees and management during the data collection process as some of the workers and management were still uncertain of the political climate. The researcher was treated with suspicion even after clarifying purpose of the research. The sample population was attained but this could have compromised the depth of information that could have been gathered as some of the respondents who reserved their comments were those who have worked for the company since the company opened in 2000.

CHAPTER TWO LITERATURE REVIEW.

2.1 An Overview of Cement Production

Cement is the most common construction material used in the world .According to Vagt (2003), cement is the principal ingredient in concrete .The production of cement has many stages in its production .The first stage being quarrying to extract raw materials such as lime stone. During the first stage of quarrying blasting is used when operating machinery, the blasting however damages the country side and the surrounding communities will be affected by noise as blasting produces a lot of noise. Cement manufacturing releases carbon dioxide in the atmosphere both directly when calcium carbonate is heated producing lime and carbon dioxide and also indirectly through the use of energy . The amount of carbon dioxide emitted by the cement industry is nearly 900kg of carbon dioxide for every 1000kg of cement produced. This implies that the production of cement produces a lot of carbon dioxide which is a greenhouse gases.

According to Harley (2010) ,the limestone is combined with clay ,ground in a cluster and fed into the additive silos .Sand , Iron and bottom ash are then combined with the limestone and clay in a careful controlled mixture which is ground into a fine powder in a 2000hp roller mill. The fine powder is heated as it passes through the pre-heater tower into a large kiln .In the kiln the powder is heated to 1500degrees Celsius. This creates a new product, called clinker is combined with small amount of marbles .The clinker is combined with small amounts of gypsum and limestone and finely ground in a finishing mill. The mill is a large revolving cylinder containing 250 tonnes of steel balls that is driven by a 4000 hp motor .The finished cement is ground so fine that it can pass through a sieve that will hold water .The cement manufacturing process consists of many simultaneous and continues operations using some of the largest moving machinery in manufacturing.

The real Dilemma facing the sector is tied to an opportunity cement is produced in an intensely hot flame, hot enough to convert many combustible hazardous wastes into harmless end products .Properly handled and applied to appropriate type of hazardous wastes , the combustion can be carried out thoroughly and safely .

2.2 Accidents record - World wide

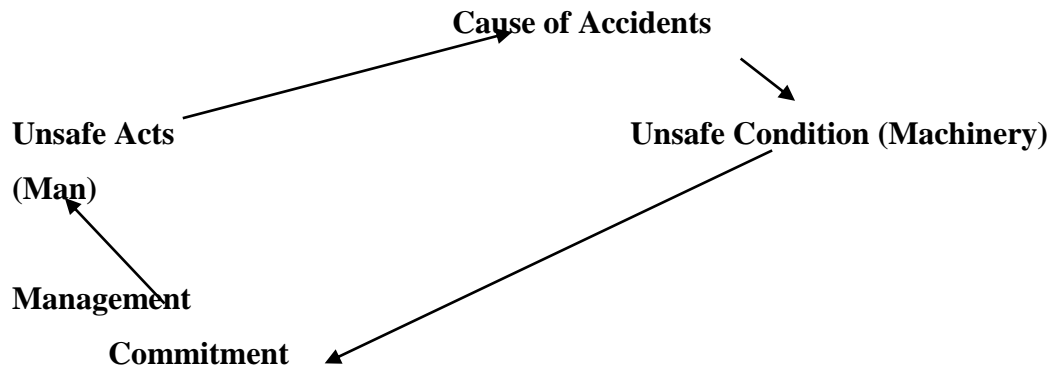
The International Organisation for Labour (ILO) estimates that globally 2.3 million women and men succumb to work-related accidents or diseases every year. This corresponds to over 2.02 million due to unsafe acts according to H.W. Heinrich's principle.

The cement industry provides direct employment for an estimated 850,000 workers worldwide (William ,2010).The cement manufacturing industry is labor intensive and uses large scale and potentially hazardous manufacturing processes especially at Grate Cooler . The industry experiences accident rates that are high compared with some other manufacturing industries. There are a number of hazards inherent to the Grate Cooler process. Some examples for health are exposure to dust and high temperatures, tripping and noise exposure and some examples for safety, falling / impact with objects, hot surface burns; and transportation (Xiao, 1995). These mainly impact on those working within the Grate Cooler Section, although health hazards can also impact on other sections such as Cement Mill, Slag drier, Packing and Warehouse (Vestbo, J 1990). All accidents (or nearly all, if one considers that there are some natural phenomena that we either cannot guard against or choose not to guard against) result from human error. This is because humans govern and accomplish all of the activities necessary to control the risk of accidents.

Humans influence other humans in the process – not only do humans cause accidents (unintentionally) by making errors directly related to the process itself, but they also cause errors by creating deficiencies in the design and the implementation of management systems (i.e., we make errors in authorities, accountabilities, procedures, feedback, proof documents, continual improvement provisions) (Veronen,U 2001).

A better understanding of how, why and when human factors become involved in accidents enhances our ability to make predictions about the role of human factors and helps to prevent accidents (Satar,B 2001). A number of models have been put forward that attempt to describe the part that human factors play in accidents. Therefore, human errors have to be anticipated in design and safety management systems (SMS).

Figure 2.1 Sequence leading to injury.



Source: Rasmussen, 1994.

2.3 Operational definitions

- **Human Error:** the errors that are made during direct interface or direct influence of the process.
- **Human Factors:** aspects of the process and related systems that make it more likely for the human to make a mistake that in turn causes or could cause a deviation in the process or could in some indirect way lead to the increased probability of an accidental loss ().
- **Management systems:** the administrative controls an organization puts in place to manage the people and workflow related to the process under consideration, and so these inherently attempt to control human factors Negligence ,(Rundom T,2000)
- Negligence is forgetfulness or disregard of a critical activity or process. Negligence may be a conscious or a subconscious occurrence. This may be due to failure to observe basic safety rules of instructions or to maintain equipment (Safar, B. 2001).
- A simple way to view human factors is to think about three aspects: the individual, the job and the organisation and their impact on people's health and safety-related behaviour. All three are interlinked and have mutual influence .



Figure 2.2 Human Factor elements

Source: (Veronen U, 2000)

In the context of risk control, American S.H.E experts highlighted the importance of human factors in accident causation in the late 80's (American Health and Safety Executive 1989):

In the Grate Cooler section human factor is an important contributing cause in at least 90% of all industrial accidents (Ale, 2006). While purely technical errors and uncontrollable physical circumstances may also contribute to accident causation, human error is the paramount source of failure as shown in Fig.2.3 below.

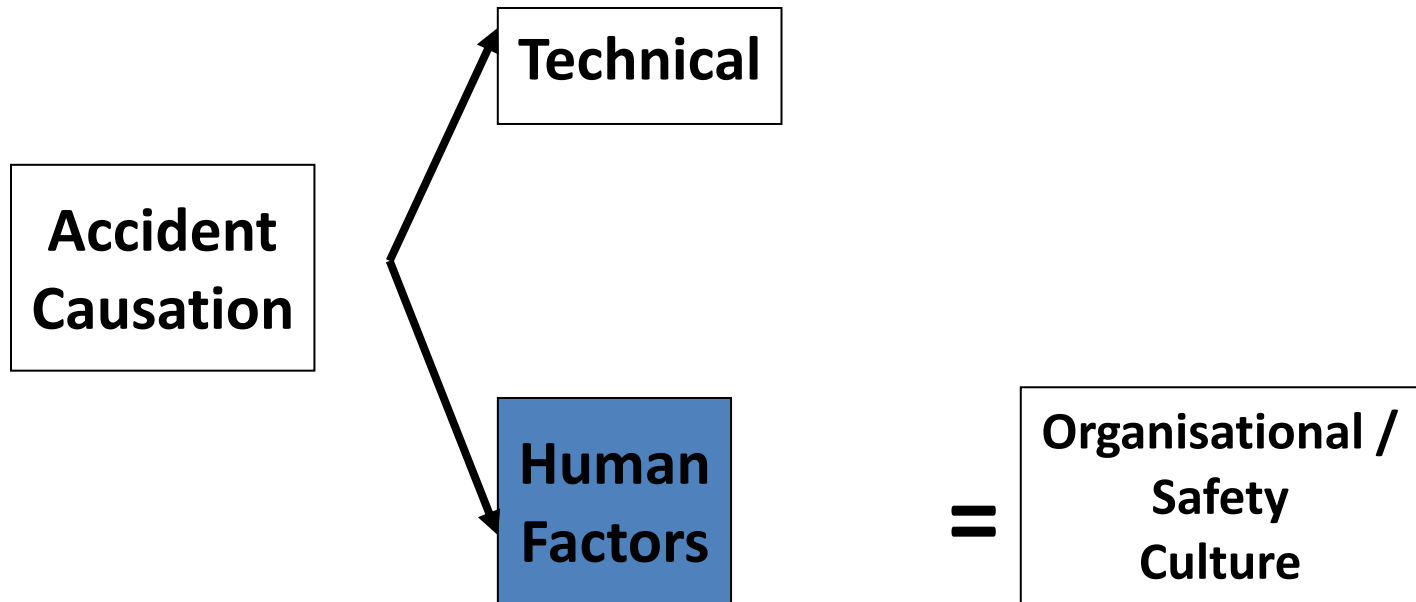


Figure 2.3 Safety culture cycle.

Source: NIOSH 2013 Safety Hand Book.

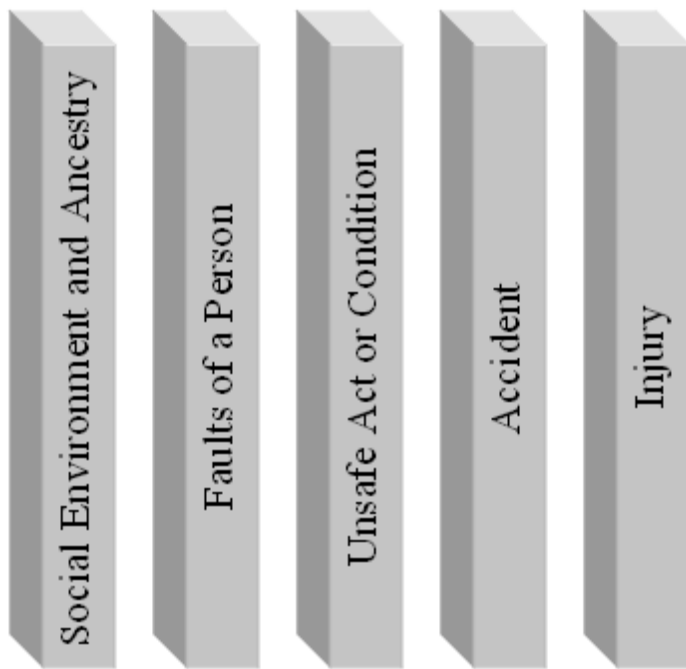
2.4 Theories of Accident Causation

There are several major theories concerning accident causation, each of which has some explanatory and predictive value (Beale, T 2001). The domino theory developed by H. W. Heinrich, a safety engineer and pioneer in the field of industrial accident safety, Human Factors Theory Accident/Incident Theory, Epidemiological Theory, Systems Theory ,The energy release theory, developed by Dr. William Haddon, Jr,of the Insurance Institute for Highway Safety, Behavior Theory, Accident theories scope of an investigation. They describe the scope of an investigation.

2.4.1Heinrich's Domino Theory

According to Heinrich, an "accident" is one factor in a sequence that may lead to an injury. The factors can be visualized as a series of dominoes standing on edge when one falls; the linkage required for a chain reaction is completed (Geller, ES 1999). Each of the factors is dependent on the preceding factor According to Heinrich; an "accident" is one factor in a sequence that may lead to an injury. The factors can be visualized as a series of dominoes standing on edge when one falls; the linkage required for a chain reaction is completed. Each of the factors is dependent on the preceding factor, (Feyer 2009)

Figure 2.3 1932 First Scientific Approach to Accident/Prevention - H.W. Heinrich



Source: Heinrich 1936

Heinrich's Dominos – The Process

A personal injury (the final domino) occurs only as a result of an accident (Ball, PW 2006). According to Heinrich an accident occurs only as a result of a personal or mechanical hazard, personal and mechanical hazards exist only through the fault of careless persons or poorly designed or improperly maintained equipment, faults of persons are inherited or acquired as a result of their workplace environment, the environment is where and how a person was trained and educated (Greenshany et al 1997).

Heinrich's Domino Theory – Critical Issues

The factor preceding the accident (the unsafe act or the mechanical or physical hazard) and it should receive the most attention. Heinrich felt that the person responsible at a company for loss control should be interested in all five factors, but be concerned primarily with accidents and the proximate causes of those accidents (Kirwan B, A 1994). Heinrich also emphasized that accidents, not injuries or property damage, should be the point of attack. An accident is any unplanned, uncontrolled event that could result in personal injury or property damage. For

example, if a person slips and falls, an injury may or may not result, but an accident has taken place (Satar, B 2001)

Heinrich's Domino Theory – Corrective Action Sequence

(The three “E”s)

- **Engineering**

- Control hazards through product design or process change

- **Education**

- Train workers regarding all facets of safety

- Impose on management that attention to safety pays off

- **Enforcement**

- Insure that internal and external rules, regulations, and standard operating procedures are followed by workers as well as management (Veronen, U 2000).

2.4.2 HUMAN FACTORS THEORY

Heinrich posed his model in terms of a single domino leading to an accident. The premise here is that human errors cause accidents. These errors are categorized broadly as:

- ***OVERLOAD***

- The work task is beyond the capability of the worker.

1. Includes physical and psychological factors.

2. Influenced by environmental factors, internal factors, and situational factors.

- ***INAPPROPRIATE WORKER RESPONSE***

- To hazards and safety measures (worker's fault)

- To incompatible work station (management, environment faults)

- ***INAPPROPRIATE ACTIVITIES***

- Lack of training and misjudgment of risk.

But the structure of this theory is still a cause/effect format.

2.4.3 ACCIDENT/INCIDENT THEORY

Extension of human factors theory. Here the following new elements are introduced:

- ***Ergonomic traps***

- These are incompatible work stations, tools or expectations (management failure).

- ***Decision to error***

– Unconscious or conscious (personal failure)

- **Systems failure**

– Management failure (policy, training, etc.).

2.4.4 EPIDEMIOLOGICAL THEORY

Epidemiology

– This field studies relationship between environmental factors and disease and can be used to study causal factors in a relationships (Institute of medicine USA, 2006). The two key elements are:

1 Predisposition characteristics

- Tendencies may predispose worker to certain actions.

Situational characteristics

- Peer pressure, poor attitude, risk taking.

Together these characteristics can cause or prevent accidents that a person predisposed to a given situation or condition may succumb to.

2.4.5 BEHAVIORAL THEORY

- Often referred to as behavior-based safety (BBS). There are seven basic principles of Behaviour Based Safety:

– Intervention.

– Identification of internal factors.

– Motivation to behave in the desired manner.

– Focus on the positive consequences of appropriate behavior.

– Application of the scientific method.

– Integration of information.

– Planned interventions.

2.5 High Cost of Negligence at Grate Cooler Section.

The economic costs of occupational and work-related injuries and diseases are rapidly increasing (Hutchins, E 1995) The ILO 2012 expert says that "while it is impossible to place a value on human life, compensation figures indicate that approximately 4 per cent of the world's gross domestic product disappears with the cost of diseases through absences from work, sickness

treatment, disability and survivor benefits." The Gross Domestic Product (GDP) lost in work-related injuries and diseases is more than that of total GDP in Africa, Arab States and South Asia together and more than all official development assistance to the world's developing countries (Bagnera, 1991).

Coverage for occupational safety and health varies widely in different parts of the world at Grate Cooler section, says the ILO 2012 , with, for example, workers in Nordic countries enjoying nearly universal coverage while only 10 per cent or less of the workforce in many developing countries is likely to enjoy any sort of coverage (Lees ,FP 1996). Even in many developed countries, coverage against occupational injury and illness may extend to only half the workforce.

Kotter and Heskett (1992) suggest that visible felt leadership can affect the bottom line and productivity of an organization in three ways. When management and employees are united, each understands why their work is vital and necessary to the organization. Thus, strong communication, both from management to employees and vice versa, is vital. Secondly, the motivation of employees, recently referred to as “engagement” (Bakker & Schaufeli, 2008), can favorably impact business outcomes (Harter, Schmidt, & Hayes, 2002). Lastly, strong cultures enhance performance by supplying structure and control without the need of an overbearing establishment of rules and other formalities. These components can contribute to additional organizational profitability within a positive safety culture by reducing injuries and the related costs

Employee surveys are used to examine organizational culture. In a recent review, Jung et al. (2013) identified 70 instruments for measuring safety culture at Grate Cooler section. These surveys measure employee attitudes and perceptions across different dimensions of the culture. Twenty-six major dimensions (e.g. ethics, rewards, development, felt leadership, goals) were identified within those instruments. Cement manufacturing industries who monitor and effectively intervene upon their culture generally improve the work environment for their employees. Visible Felt leadership increase employee perceptions of their safety culture may be associated with similar positive benefits in terms of reduced injuries and associated costs

(Whitting, C 2002). Likewise, there are negative consequences involved in a non-existent or poorly structured safety culture at Grate Cooler (Reason J 1990).

2.6 Safety Culture

Safety culture, like organizational culture, does not have a universal definition. Lee and Harrison (2000) define safety culture as the values, attitudes, beliefs, risk-perceptions, and behaviors as they relate to employee safety. The Health and Safety Executive of the United Kingdom defined it as:

The safety culture of an cement manufacturing industry is the product of individual and group values, attitudes, perceptions, competencies and patterns of behavior that determine the commitment to, and the style and proficiency of, an organization's health and safety management (Stephen ,J 1997) Cement industries with a positive safety culture are characterized by communications founded on good management visible leadership , by shared perceptions of the importance of safety and by confidence in the efficacy of preventive measures (as cited in Gadd & Collins, 2002,). Guldenmund (2000) proposes that visible felt leadership is “[the] aspects of the organizational culture which will impact on attitudes and behavior related to increasing or decreasing risk”. Safety, increasing employee perceptions of their safety culture may be associated with similar positive benefits in terms of reduced injuries and associated costs. Likewise, there are negative consequences involved in a non-existent or poorly structured safety culture.

Management concern for safety. The most prevalent construct identified in every survey reviewed was the perception of management/supervisors’ attitudes and behaviors around safety (Flin et al., 2000). This includes management consideration of employee safety, care for employees, and enforcing safety policies and regulations within their respective business and industry. Dollard ,(2010) found evidence that positive safety culture values can permeate an organization if top management leads safety efforts by communicating, visiting workplaces and exhibiting the importance of safety. Branham (2010) suggested leadership (management and supervisors) should spend more time on the floor with employees, much like football coaches are on the field with their players.

Training. Training was defined as a program that includes all necessary safety information, adequate practice, and consistency. In a more recent meta-analysis, Christian, Bradley, Wallace, and Burke (2009) found that selecting and training safe workers can increase dispositional factors related to safety culture (e.g. safety knowledge, safety motivation). This, in turn, can aid in decreasing the number of accidents and injuries within the workforce. Safety specific training also demonstrates the company places a priority on safe work practices (Christian et al., 2009).

Visible Felt Leadership. (Hale, T 2010) emphasize that components of the accident management need to be consistently applied from top management and safety professionals. Top-down workplace visits is necessary to show mid-management and frontline workers that a proper safety initiative is vital for organizational success (Dollard & Bakker, 2010). Examples of good visible felt leadership is found in the regular communication of safety goals from management to employees and certainty that incident reports are regularly reviewed and shared with employees.

Personal responsibility for safety. Harvey, T, (2002) defined personal responsibility as the “perceived responsibility for involvement in safety issues” (p. 23). Harvey et al. found that workers tend to feel less responsibility than managers/supervisors. Perhaps because of this, Guldenmund (2000) gave little attention to the construct. However, personal responsibility does appear in surveys by Sleeman A, 1995. Personal responsibility means workers are accountable for their own safety, and management is accountable for reducing their workers’ risky behavior, as is part of their job description.

2.7 Effectiveness of risk management system in the prevention and control of accidents causation at Sino-Zimbabwe Cement Company.

In this study the researcher aimed to evaluate accident causation in the Grate Cooler section at Sino-Zimbabwe Cement Company from 2005 to 2013.

2.7.1 Risk management system

Risk is the measuring stick for this potential, which may be defined as the probability that harm will occur within a certain period (Grozdanovic, M 2001). Exposure to high levels of high temperatures irritates the skin and the worker performance. Longer term exposure could lead to occupational stress. Exposure to high concentrations can lead to death as well. (Kim J.W 2003)

Risk management may be defined as the reduction and control of the adverse effects of the risks to which an organization is exposed. Risks include all aspects of accidental losses that may lead to any wastage of the organizations (Mc Afee 2008), societies and environmental assets. The assets involve personnel, materials, machinery, procedures, products, money, and natural resources (soil, water, energy, natural areas), (Zimolong, B. & Elke, G. 2004)

The Occupational Health and Safety Assessment Series (OHSAS) 18001 provide the mechanism for occupational health and safety management. It helps organizations in the systematic inspection and measurement of the degree of their suitability, as well as training employee to understand their role in the health & safety system (Wen, Ching, and Hung 2010). The (NIOSH 2008) indicated that the management approach of the ISO standards are based on generic management principles which are derived from different theoretical and organizational perspectives. The elements of the systems are considered to present 'best practices' of successful enterprises (Kim J.W 2003). They are designed to be used by organizations of all sizes and regardless of the nature of their activities. The key elements of a generic management system are integrated in the management control cycle based on ISO 14000 series designed for an OHS management system (Lees, FP 1996)

Effective OHS management means developing, coordinating, and controlling a continuous improvement process by setting and adjusting OHS standards (Ale, R. 2006). Formulation of an OHS policy addresses the preservation and development of physical and human resources and reductions in financial losses and liabilities. OHS planning is an organizational approach which emphasizes prevention and involves risk identification, evaluation, and control. (Zimolong, B. & Elke, G. 2004)

Proactive planning is preferred in OHS not reactive planning. Proactive planning means that hazards are identified and risks assessed and controlled according to a systematic plan, before anyone or anything could be adversely affected (Conlin, I 2008). The allocation of OHS responsibilities to line managers, team leaders and self-managed work groups serves as an important tool to foster the integration of OHS into the daily work activities (Zimolong, B. & Elke, and G. 2004).

Establishing and maintaining control is central to all management functions including OHS. Checking and corrective actions are the final steps in the OHS management control cycle and part of the feedback loop needed to enable the organization to maintain and develop its ability to control successfully risks (Geller, ES 1999). Both qualitative and quantitative measures provide information on the effectiveness of the OHS system. Hutchins, E 1995 supported this and emphasized that learning from experience is supported through performance reviews and independent audits.

When work is associated with health hazards, it may cause occupational accidents. It is said in developing countries where work is becoming increasingly mechanized, a number of work processes have been developed that treat workers as tools in production, putting their health and lives at risk. (WHO, 2001)

2.7.2 Risk management process (Work Cover Authority NSW 2006)

The OSH Regulations contain a specific requirement for employers to undertake a risk management process.

This involves a three-step process to:

- Identify hazards
- Assess risks of injury or harm arising from each identified hazard; and
- Control risks through implementation of control measures to eliminate or reduce them.

The risk management process should be undertaken to ensure employers comply with their 'duty of care' obligations to provide a safe workplace (Rundmo, T .2000).

The risk management process should be conducted and monitored on an ongoing basis to ensure control measures are working and no new hazards have been introduced. For example, conducting it when new machinery or plant is introduced, modifications are made to existing plant or machinery or changes are made to systems of work (William, B.2010).

Workers and, where they exist, safety and health representatives must be consulted on safety and health matters. Their involvement in the risk management process is important, as they are most likely to know about the risks associated with their work (Stephenson, J.1997).

OHS risk management involves 3 stages: hazard identification, risk assessment and elimination or control (Feyer, 2009). The aim is to eliminate or, if this is not possible, to control the risk in order to reduce the severity of these risks (Geller, ES 1999). Risk management should be integrated into the organization's philosophy, culture, policies, practices and plans rather than be viewed or practiced separately, or in isolation. (Pittsburgh, PA NIOSH Jan 2012)

Management's responsibility is to ensure that hazard identification takes place at all stages of product service or delivery, from design to manufacture, supply and product use. Supervisors should support this process by involving all employees in the hazard identification process to ensure success (Beale, T 2001).

Hazard identification means finding all potential and existing hazards and recording them. It requires an organization-developed system that brings hazards to the attention of management, preferably before they cause harm. Hazards can be identified by a combination of systematic and incidental methods. (Pittsburgh, PA NIOSH Jan 2012)

2.8 Systematic Hazard Identification

Systematic methods of identifying hazards are those that are planned and undertaken on a regular basis (Ball, PW 2006). These include:

Workplace inspections

Regular inspections of the actual workplace and its processes often use a combination of checklists, observation and consultation with employees. Frequently undertaken by OHS committees or OHS representatives and often includes relevant managers and supervisors as appropriate (Geller, Z .2000).

Consultation

Consultation arrangements should be documented and can occur with employees through OHS committees, OHS representatives, or other agreed arrangements. The OHS Regulation states consultation with employees carrying out the tasks, should take place during the hazard identification process. The Manual Handling Code of Practice states that the people who perform the job are often in the best position to recognize manual handling problems and offer practical solutions.

Incidental Hazard Identification

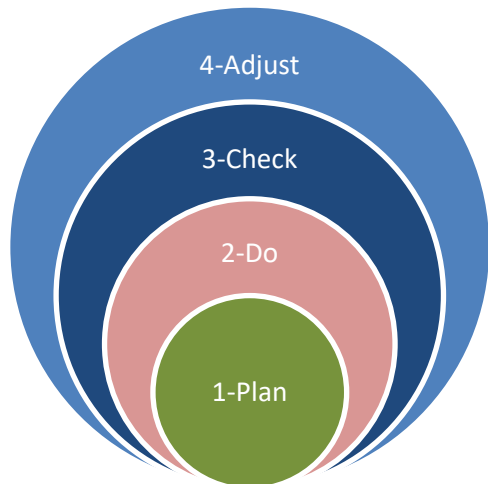
Hazards may be brought to notice outside systematic methods. This is through more informal and incidental methods of identifying hazards (Guldenmund, 2000). These include:

Complaints: where an employee brings a workplace hazard to the attention of a supervisor or manager by telling them personally, or in writing.

Observation: where a supervisor, manager, employee, OHS committee or OHS representative may observe a workplace hazard.

Different industries and companies use different approaches and Risk management has become a conscious and important part of industry's responsibilities (Harter et al 2002).Several models have been suggested to specify and classify the elements required for sound risk management. The approach drawn from quality management, as developed in the last decades in many companies and often based on the ISO 9000 series (ISO 1987), uses the Deming Cycle, which is a model with four steps, representing a feedback loop, as follows:

Figure 2.5. **Deming Cycle: a feedback model with four steps**



Source: (Hale, 1985)

This has been used as the basis for the identification of necessary actions to solve quality problems, (Braham, 2010). A variant of this approach is the risk assessment and control cycle (Hale, 1985 and Hale et al., 1997) which can be used for occupational safety, health and

environmental problems during plant operations or (re)design of installations or production lines (Diaz and Cabrera, 1997). This cycle is also known as the “problem-solving cycle.

2.9 Effective Leadership in the Workplace

History is replete with examples of great African-American leaders. Civil rights icon Martin Luther King Jr. and the great abolitionist Frederick Douglass are excellent examples of the true competencies and characteristics of leaders of the past. (Hale, T 2010). Today, the need for strong workplace visible felt leadership is again becoming a front-and-center topic, especially in workplaces.

It’s important to understand the difference between leaders and managers (Harvey, T 2002). Managers are task oriented. They supervise and direct workflow for maximum efficiency safety issues on, therefore they tend to be more concerned about the process and the results, rather than about the employees and their individual needs (NIOSH, 2008). Leaders, on the other hand, are concerned not only about goals, but also about the people who are involved in the process.

Because communicating and implementing a vision involve visiting the workers. True leaders are relationship-focused, (Phillips et al 1993). They must inspire and motivate their followers .A dynamic leader not only possesses high moral standards, but operates with a high sense of ethics and integrity, preferably for the good of the employees and the organization to reduce accidents (Harvey, T 2002). Leaders take risks and understand the importance of change. When one sees a company with a truly sustainable safety culture, another factor comes into play—one shared by every company that has ever made the list of the world’s safest companies (Hutchins, E .1995). That factor is felt leadership.

2.10 Felt leadership defined.

Felt leadership is respect through action for the well-being of people. Felt leadership is a public proclamation of an organization’s commitment to caring about people (Harvey, T 2002). It is a building block in constructing trust and real-world relationships among employees, When leadership felt is demonstrated within an organization in the area of safety, a cultural transformation can and will occur (Ale ,2006). More importantly, that transformation is sustainable because it becomes part of the fabric of the company and the environment in which it

operates.

To be more specific, felt leadership:

- Is easily observable.
- involves all levels of employees.
- Clearly demonstrates belief in safety.
- Makes a positive impression on employees.
- Demonstrates a personal commitment.
- Pervades the organization.
- Affects all levels of employees.

2.11 Felt leadership as part of safety management system.

Ball 2006, pointed out that felt leadership is a critical part of a safety management system. The leadership elements include strong management commitment, safety policies and principles, challenging goals and plans and high performance standards. Organizational or structural elements include implementation of safety performance management techniques and use progressive motivation (Feyer, 2009). Operational elements include effective communications, continuous training and meaningful auditing and re-evaluation processes.

Figure 2.6: Twenty two elements of safety



Figure source: Conlin, 2008
2.12 Top –bottom up approach of VFL.

Strong, visible management commitment is the basic component of a successful safety management system, and this commitment must exist at the top, permeating all levels of the organization (Beale,T 2001). To achieve the best safety results, the leaders must believe that safety is as important as any other business parameters such as quality, productivity and cost (Christian et al 2009). Top management must remember that example, posture, attitudes and behavior will be seen as its level of commitment with respect to safety themes. What they say, speak and write must be reflected in the things they do.

2.13 Felt leadership

Most companies uses 10 felt leadership principles to guide training and consulting employees on their path to felt leadership and safety greatness:

- be visible to the workplace.
- be relentless about time with employees.

- Recognize your role as manager.
- develop your own safety functioning skills and pass them along to the organization.
- Behave and lead as you desire others to do.
- Maintain a self-safety focus.
- Place continuous emphasis and clarity around safety expectations.
- Show a passion for ZERO injuries, illnesses, and incidents.

Felt leadership goes far beyond talking about safety; it is about behavior. Here are several specific actions in which top management must be personally involved:

High potential and serious incident investigations, including the review of reports to ensure appropriate communication to prevent recurrence.

Reporting of all injuries and significant incidents

2.13.1 A Felt Leadership framework.

Felt Leadership Framework defines the behavior range needed to influence people. Leaders set standards and expectations by communicating with their staff in 3 modes, as appropriate in different situations. (Grozdanovic, M .2001). While the ultimate goal is always injury prevention, the required leadership behavior can range from inspiration whenever possible, to agreement, or even enforcement, if necessary. The following chart depicts this framework:



Source: Greenspan, 1999

Safety excellence is a journey. Injury reduction, and ultimately elimination, requires an organization from the CEO to the bottom of the organization to move from a reactive state to interdependency 'Creating a great safety culture is an evolution not a revolution in reducing accidents. To keep this journey top of mind every day requires felt leadership that has a clear vision and a clear understanding of where the company is on the safety continuum. A great company is filled with leaders who believe deeply in safety. A great company is led by someone who personifies this commitment to making sure that employees go home safe to their families. A great company believes that the goal is always ZERO.

The first step in felt leadership is acknowledging that safety is a core business value and integral to the very existence of the organization. This acknowledgement has a profound effect on

employees; with felt leadership, managers can help change the statistics so that workers will not die in a work-related accident each day.

A great company is filled with leaders who believe deeply in visible Felt Leadership. A good company is led by someone who personifies this commitment to making sure that employees go home safe to their families. A great company believes that the goal is always ZERO. The first step in felt leadership is acknowledging that safety is a core business value and integral to the very existence of the organization.

CHAPTER THREE METHODOLOGY

3.0 Introduction.

The chapter details the methodological framework of the study and the research design which was implored in the research. The size and important features of the study population were examined. Sampling procedures in coming up with the study sampling techniques are outlined and justified in this section. The methods in data collection, reliability, sources of error, analysis and presentation will be discussed below.

3.1 Research Design

The study design which was employed in this research was a cross sectional study .Cross sectional design is good in establishing the prevalence of a conclusion on situation. In this case, it will give a conclusion of the accidents occurrence at the window period from January 2005 – February 2014.The advantages of cross sectional studies is that they use cost effective and do not require a lot of time and resources. With the limited time of the Masters in S.H.E program it was appropriate to select this design .However Cross Sectional study design are not very good in establishing causality .This weakness was catered in this study by doing a comprehensive review amongst management, employees and all the sections at the Grate Cooler. The research was helped by two research assistants.

3.2 Study population

The study population consisted of 165 employees at Grate Cooler Section.

3.3 Reference Population.

The reference population for the study was all workers in the cement manufacturing industry.

3.4 Sample

The sample was made up of 92 workers at the Grate Cooler. It also included seven heads of departments.

3.4.1Sampling method

A stratified random sample method was used for questionnaire survey and purposive sampling for interview based questions. This enabled the researcher to get equal representation from all sections of the study. In each section, random sample of fifty percent of the workers was selected, as shown by the diagram 3.1 below.Coloured ball were randomly picked from a bawl.

Table 3.1 The Population and Sample Size Selection

Section	Breakdown	Total Number of employees.	No of employees relevant to the study.
Coal Mill	321 Section	3	1
	322 Section.	12	6
	323 Section	8	4
	324 Section	4	2
Electrical	Fan Section.	6	3
	Distribution Boundary	2	1
	Substation	6	3
Cooler	Principal maintenance Engineer	1	1
	Mechanical Instruments.	24	12
	Rotary kiln.	16	8
	Planning	12	6
		1	1
Operations	Production Manager	1	1
	Shift Foreman	4	2
	Control room operators.	6	3

	Operators.		
	Plant Inspectors.	6	3
		16	8
Technical team	Chemical Engineer.	1	1
	Assistant Chemical Technician.	1	1
	Cooler patrons.		
	Coal Plant.	4	2
	Mill	8	4
		8	4
S.H.E Department	Industrial Nurse	1	1
	Assistant S.H.E Officer	1	1
	S.H.E Reps	22	11
Engineering	Engineering Manager	1	1
total		165	92

Source: Sino-Zimbabwe Cement Company 2013.

According to Babbie, E (2001) the advantage of stratified random method was that the sample achieved greater precision than a simple random sample, the strata had been chosen so that members of the same stratum were similar as possible in terms of the characteristic of interest. The greater the differences between the strata, the greater the gain in precision. A final advantage that stratified random sampling was that it guaranteed better coverage of the population.

3.5 Potential sources of Bias.

3.5.1 Exclusion criteria.

Casual, Housekeepers and Engineering department workers were excluded from the study because the workers only do piece work and maintenance job upon request or equipment breakdown or plant shutdown. All workers who worked for less than three month were excluded for the study and some employees who had severe social and medical problems .Some Casual employees which were not formally and fully inducted this group was also exclude from the study with regards to questionnaires, interviews, and document review because inclusion of the group was going to affect the results of the study.

3.6 Data Collection.

Data collection was done through questionnaires, interviews, observations and secondary data review (Records, S.H.E accident register) in order to assess the accident trends. The questionnaire was designed to gather information with regards to the effectiveness of the existing management control systems in preventing occupational, safety and health hazards associated with factors that contribute to accident causation in the Grate Cooler section. The questions were focused on the implementation of policies, plans, Visible Felt leadership and procedures with regards to Grate Cooler risk assessment, Visible Felt Leadership, inspection, maintenance and occupational safety and health issues. In this study, focus group discussions were conducted to help identifying areas to be used in designing the questionnaire for study participants. A pre-tested interviewer administered questionnaire was used to collect information from study participants on demographic characteristics, administrative factors, engineering factors, correct and consistent use of PPE. Pre testing of the instrument was done to; determine if the language used was easy to understand from the respondent's view, determine whether questions were appropriate, determine time needed to administer the questionnaire, determine clarity of questions and to check the validity and reliability of the questionnaire.

3.6.2 Interview.

The table below show the people who were interviewed on the study and the reasons for the interview.

Table 3.2 interviewed people.

Department	Person to be interviewed Sample	Reasons for the interview
Production	Production Manager	To evaluate the effectiveness of existing management systems in preventing accidents at Grate Cooler Section and assess S.H.E systems.
Engineering	Engineering Manager	To assess Engineering control measures at Grate Cooler Section.
Finance	Finance Manager	To establish the cost of accidents at Grate Cooler Section.
Human Resources.	Human Resources Manager	To evaluate the effectiveness of existing human resource policies including recruitment and selection, development and training, occupational safety and health in preventing accidents.

Source: Sino-Zimbabwe Cement Company 2013.

3.6.3 Observation

An observation checklist guide was used to triangulate information collected using other data techniques in particular examining the causes of accidents in the Grate Cooler. On participant

observation involved the systematic observation, recording, description, analysis and interpretation of people's behaviour with regards to safety and health at Grate Cooler Section. Grate Cooler operators, maintenance artisans and Electrical were purposively selected as shown in Table 3.4 in order to determine the extent to which laid down procedures and work instructions were being followed in preventing accidents. The observation was good at explaining what was going on at a particular point in time at Grate Cooler section. The presence of the researcher did not influence the situation being observed since the participants were fully aware of the purpose and benefits of the study of which they wanted to be part of the solution in safeguarding their safety and health as well. The observation was time consuming and the four shifts had to be observed particularly the evening shift where supervision was generally less compared to day shift. The maintenance work observed was mainly on Cooler Section

Table 3.3 Observation sample and purpose

Department	Persons to be observed	Reasons for the observation
Operations	Cooler Operators	To observe safe behaviour with regards to adherence to operational instructions (Behaviour based safety)

Operations Maintenance	Raw mill Operators Artisans	To observe safe behaviour with regards to adherence to maintenance plan, maintenance instructions and regulatory requirements and to check Grate cooler safety devices
Electrical	Electrical artisans	To observe electrical unsafe acts and conditions.

Source SZCC. 2013

3.6.4 Document Review (Secondary data)

Review of Company Accidents records and S.H.E accidents tape root investigations

The researcher reviewed the Company Accidents records and S.H.E accidents tape root investigations as well as clinic attendance statistics so as to gather more information of factors contributing to accidents at Grate Cooler section.

Hakim (1982) argued that in answering research questions or meeting their objectives, few researchers considered the possibility of re-analysing data that have already been collected for some other purpose. The document review included checking some policies, procedures, work instructions, reports, registers, records, log books, log sheets, manuals and plans of the organization whether they were adequate and being effectively implemented in meeting set objectives of the organization as well as occupational safety and health requirements. The records were useful as evidence of system implementation with regards to the effectiveness of control measures and predictability and avoidance of possible future failures. The documents and records which were reviewed included quality policy, safety, health and environmental policy, production and maintenance plan and targets, operational manual, procedure manual, , standing instructions, defect book, log sheet, Audits findings and monthly Visible Felt Leadership checklist. The reports were found useful in trend analysis and legal requirements for continuity of reliable and dependable safe operation. The records were verified during observation to confirm system implementation. The advantages of secondary data were that it was less expensive and time serving since the data had already been collected. Re analysing secondary data led to unforeseen or unexpected new discoveries. The disadvantages could have been the suitability, reliability and credibility of the data which was overcome by physical verification where possible.

3.7. Sources of Error.

In this study the bias was going to occur during data collection as the researcher was the head of S.H.E department, also through field observation which enabled the researcher to gather more information there was the chance of bias because the research was going to notice what was interested to him also the presence of the researcher was going to influence the situation that was

being observed but a thorough training of research assistants was conducted to mitigate the above mentioned bias.

Using information available such as Clinic register ,accidents register ,Visible Felt leadership log sheets helped the researcher because the technique was inexpensive as the data was already available and it allowed the researcher to examine accidents trends over the past years .Although some of the information was not easily accessible because of ethical issues concerning privacy but the researcher was able to clearly explain to the key informants the main thrusts of the research which was only for academic purposes only. Also the issue of missing cases of short duration- cases of short duration were likely to be missed , Seasonal bias – problem under study could exhibit different characteristics in different seasons of the year this was solved by targeting employees who were more than three months engaged by Sino-Zimbabwe Cement Company. Mostly tarmac bias- study areas are often selected in accessible areas but the researcher works for the case study area this assisted the researcher in terms of financial resources and time consuming.

The disadvantages which were overcome included observer bias which Delbrige and Kirkpatrick (1994:43) cited as the greatest threat to reliability, needing researchers separation from common sense knowledge and life experiences in interpretation. The presence of the researcher did not influence the situation being observed since the participants were fully aware of the purpose and benefits of the study of which they wanted to be part of the solution in safeguarding their safety and health as well.

3.8 Validity and reliability.

The questionnaire was pre tested at Sino- Zimbabwe Cement Company on workers who were injured at Grate Cooler and those who were not injured to test for validity of the questionnaire and corrections made as necessary. The reliability of the data collection process was ensured by having only the researcher and assistants administering the questionnaires. In this study the data collection tool was meant to measure causation of accidents at Sino-Zimbabwe Cement Company. The questionnaire was designed in English as most of the employees had five O “Levels. Validity was ensured by first pre testing the tool and checking whether the results was relevant The reviewing and analysis of the questions with the help of the research mentor was done so as to improve the content, criterion and face validity of the research instruments.

3.9 Data analysis

The data which was collected using the questionnaire was analysed and interpreted using a statistical package for social science (SPSS) and the relevant Grate Cooler regulations, standards and good engineering practice for the interviews, observation and document review. The advantages being that SPSS could handle large volume of data compared to other packages such as excel and easy to analyses the same. It allowed multiple analysis including running frequencies of different variables at the same time and was good at giving summative information of data being analysed. The variables were fifty (50).The frequency tables and cross tabulations were exported to excel for sound graphical presentations. The cross tabulations linked relationships between different variables. The first step was to design entry template on Sphinx since it was easier to create and capture the data, viewing a question at a time followed by pretesting of the template to ensure that it ran properly without altering the data. The data was then entered and cleaned in order to remove errors possibly due to data entry and finally running frequencies and cross tabulations. The only challenge was a few incomplete questionnaires constituting less than one percent of the total questions and had to focus on proportions to take the error of omissions or missing values. The descriptive and inferential statistics were used in data analysis. (Saunders, Lewis, Thornhill, 2000)

Summary

This chapter was on the methodology and the data collection tools used in achieving the research objectives. The next chapter is on results and discussion made from the data that was collected.

CHAPTER FOUR RESULTS AND DISCUSSION

4.0 Introduction

The chapter contains the results and the discussion made from the data which was collected to answer the research questions and meet the objectives of the research. The descriptive and inferential statistics were used in data analysis. The collected questionnaire data was analysed using a program known as Statistical Package for Social Sciences (SPSS). The advantage being that SPSS could handle large volume of data compared to other packages for instance excel.

4.1 Response rate

The table 4.1 below shows a breakdown of the questionnaire responses. Ninety two questionnaires were distributed and eighty nine (**n=89**) were returned. Three were unable to respond resulting in a response rate of **96%**. (**n=89**). The table below highlight the response rate of employees at Grate Cooler section.

Table 4.1 Questionnaire Response Rate.

section	QUESTIONNAIRES DISTRIBUTED	QUESTIONNAIRES RETURNED	Response rate
Coal Mill	45	45	100%
Electrical	10	9	90%
Cooler	35	33	94%
Operation	2	2	100%
Total	92	89	96%

Source: Primary data.

The Table 4.2 below shows a breakdown of the interview response rate. Seven (**n=7**) interviews were conducted as targeted with a **100%** response rate.

Table 4.2 Interview Response Rate.

Interviewed	Target	Conducted	Response rate
Production Manager	1	1	100%
Engineering Manager	1	1	100%

Finance Manager		1	1	100%
Human Resources Manager		1	1	100%

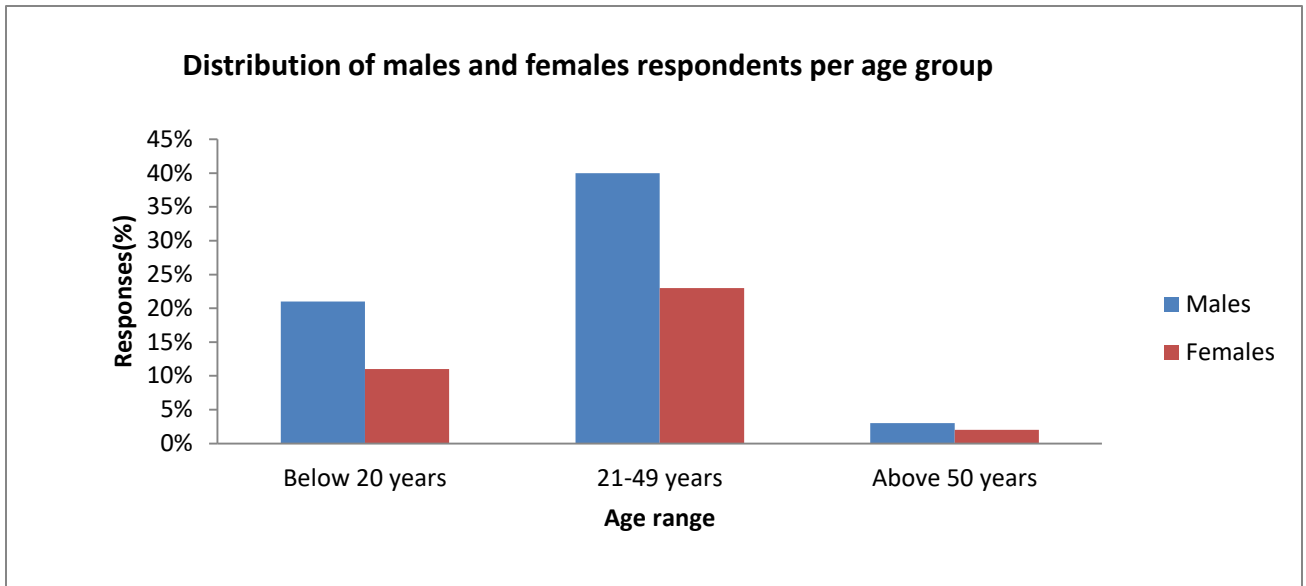
Source: Primary data.

4.2 Demographic characteristics

Questionnaires were issued to 92 respondents. Out of the 92 respondents, 65% (n=60) were males and 35% (n= 32) were females. Males outnumbered females probably because nature of the jobs at Grate Cooler section which is heavy and require a lot power. This finding concurs with Dekker (1993)'s view that males are generally considered to be workers who does heavy tasks at workplaces. The other factor was that perhaps the only few people who happen to be employed by Sino Zimbabwe Cement Company are males. The age group which had the highest percentage of respondents was the 21-49 years age group which had a percentage of 63% . The reason why this age group had the highest number is because 21-49 years represents the economically active group therefore they were eager to answer the questionnaires. The 20 years and below age group had a response percentage of 32%.The percentage of the respondents of the below 20 years age group was very low since this represents the age group of the young who are still going to school. Therefore the company is following its recruitment policy which stipulates that the company only recruits workers of above 20 years if it is in permanent positions.

The age group with the least percentage of respondents was 50 years and above which had a percentage of 5%. The reason why this was so is because the jobs at Grate Cooler section requires workers who are fast and energetic.

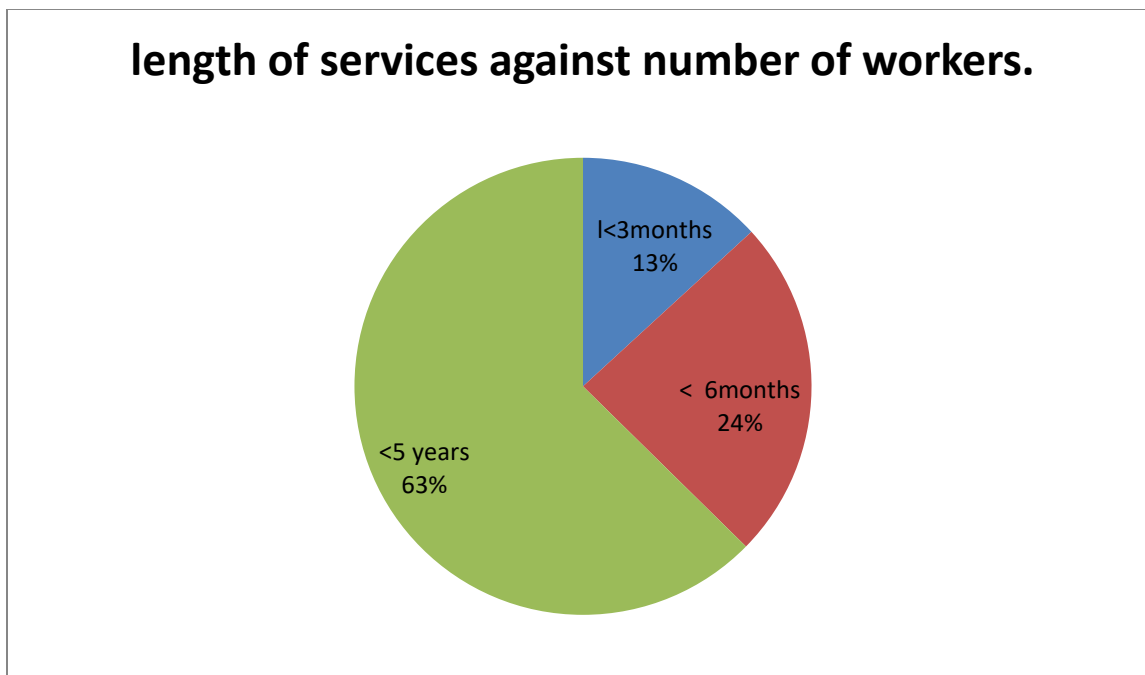
Figure 4.1 below shows the number of respondents for each age group.



Source: Primary data.

According to the respondents 63% had worked for more than five years and above, 24% worked for less than six months and workers who worked for less than three months were only 13 %.

Figure 4.2 below show length of service against number of workers.

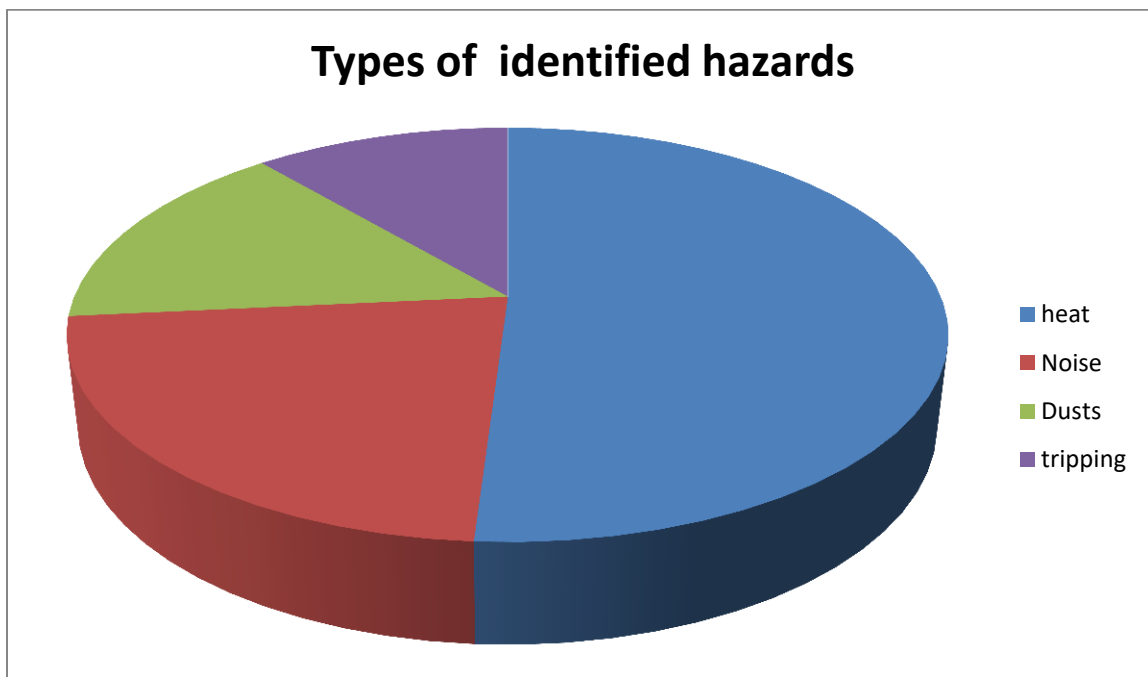


Source: Primary data.

4.3 Identification of hazards.

Out of the 89 respondents ,50% (n=45) of them answered that heat is the major hazard at Grate Cooler section this correlates with one of the causes of accidents as fatigue because when an employee is exposed to high temperatures the body is dehydrated as a result the worker becomes dizzy and weak which results in fatigue .However the respondents also identified Noise 22% (n=20) ,Dusts 15% (n=14) and tripping 11% (n=10) as other hazards at the Grate cooler section .The hazards are diagrammatically highlighted by the pie chart below:

Figure 4.3 Types of hazards identified.



Source: Primary data.

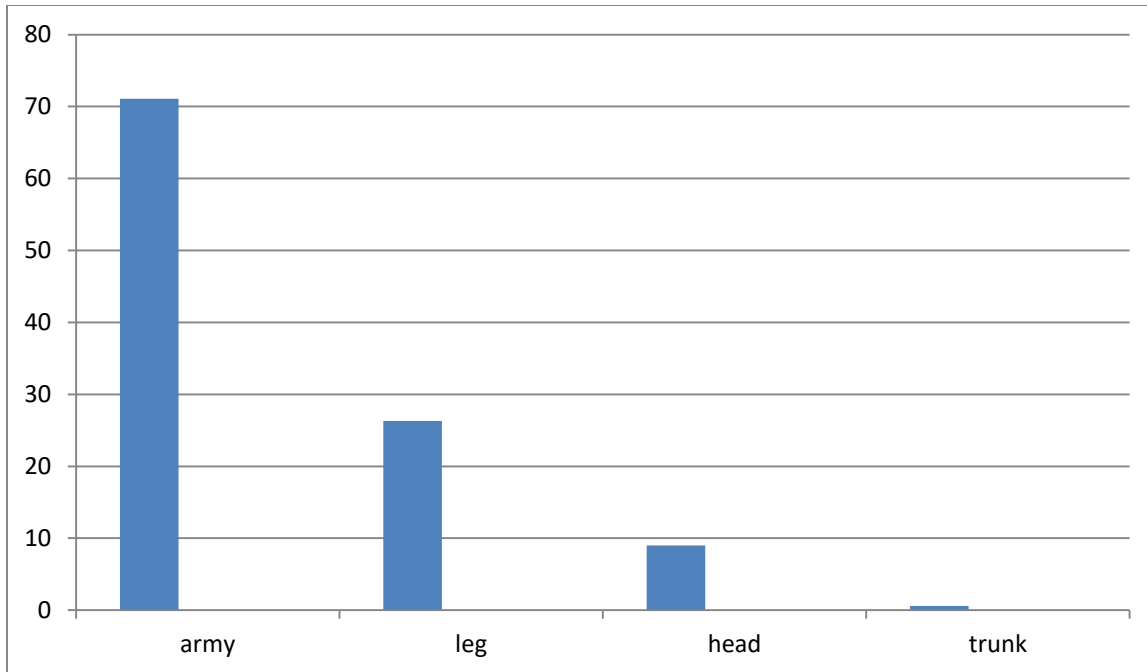
The respondents also highlighted that some of the hazards that are found at Grate Cooler section such are slipping and fall, electrocution, Repetitive motion and Ergonomic injuries. One hundred percent (n=7) of the semi –structured interviews reported that hot clinker is one of the major hazard which correlates with nature of the rotary kiln equipment that is found at the Grate Cooler section. According to (NIOSH. Work 2002) the kiln is a cylindrical vessel, inclined slightly to the horizontal, which is rotated slowly about its axis. As the kiln rotates, material gradually moves down towards the lower end, and may undergo a certain amount of high temperatures which can be above 1200 degrees Celsius. The hot gases may be generated in an external furnace

which can burn employees. Twenty two percent of the respondents indicated that noise is also another hazard found at grate cooler. This can also tally with the company Hygiene measurements results which were observed at the company Clinic which reveal that the noise levels at Grate Cooler section was 120 DB which is extremely above noise limit levels of 90DB (NSSA, On guard 2010). This hazard correlates with the causes of accidents in which European Agency for Safety and Health at Work, *Research on work-related stress*, 2000 expressed that exposure to noise at work can harm workers' health. The most well-known effect of noise at work is loss of hearing, a problem observed among Grate Cooler employees. However, noise can also exacerbate stress and increase the risk of accidents. Noise can lead to accidents by making it harder for workers to hear and correctly understand speech and signals; masking the sound of approaching danger or warning signals (contributing to work-related stress that increases the cognitive load, increasing the likelihood of errors and accidents).

4.4 Most common occupational injuries at Grate Cooler

As illustrated by figure 4.2 below, the majority of cases (71.1%) had severe injuries occurring on the arms, followed by leg injuries at 26.3%, injuries on the head accounted for 9% and injuries on the trunk only contributed 0.6% of all injuries.

Figure 4.4 Occupational injuries by body part at Grate Cooler section.



Source: Clinic accidents register.

Subsection of Part B. Number of Lost Time injuries from 2005 to 2013.

72 % of the workers at Grate cooler section said they were injured at the section and most of the respondents were involved in Lost Time Injuries. According to Clinic accident register most of the employees were given more than three days off duty. Only 28% responded that they were not injured at Grate Cooler section .About 2% of the respondents indicated that two employees were killed at Grate Cooler as a result of high temperatures this correlates with one of the identified cause of accidents as high temperatures. Also the semi-structured respondents indicated that every month the company is losing \$3000 to\$3500 as a result of injuries at Grate Cooler section and all the cost cover the medical bills of the injured workers. The high number of injured and workers correlates with Clinic accident register’s number of lost time injuries. The figure 4.5 below shows number of Lost Time injuries at Grate Cooler Section from 2005 to 2013.

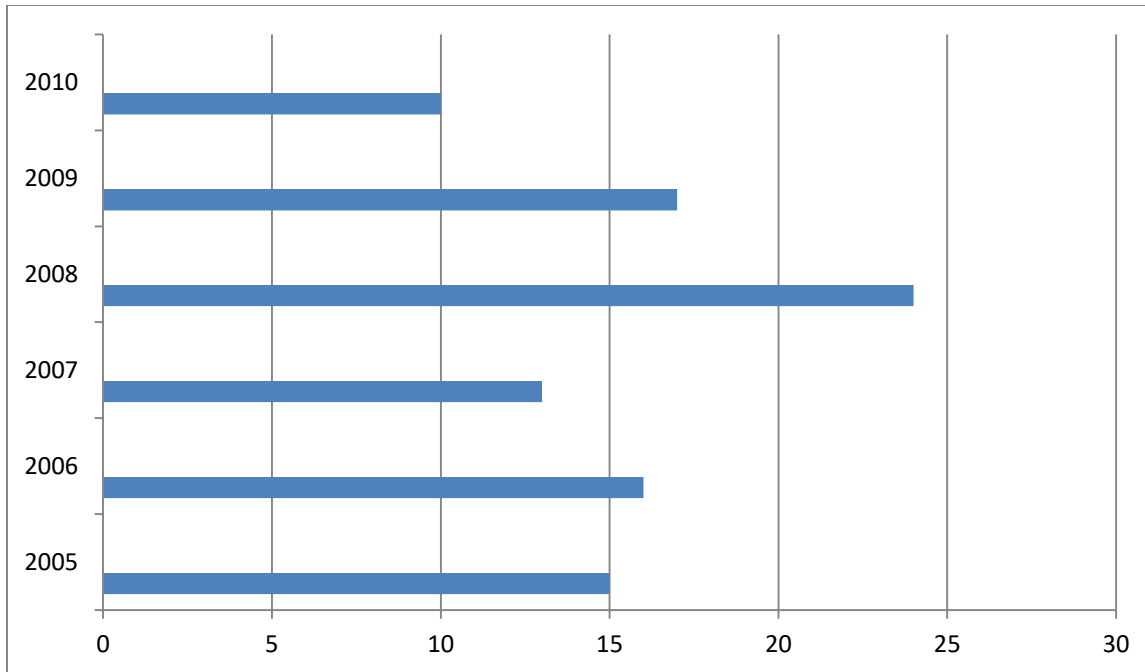


Figure 4.5 Number of Lost Time injuries at Grate Cooler section 2005 to 2013. (Source: Clinic accidents register)

4.5 Causes of accidents at Grate Cooler section

Responses towards the causes of accidents.

One of the items in the questionnaire asked the workers if there have the problem of sleeping on duty .Table 4.3 below shows the responses of the Grate Cooler workers.

Table 4.2 Grate Cooler employees' responses towards the problem of sleeping on duty.

Responses	Number of respondents	%
Yes	7 (n=89)	7%
No	79 (n=89)	88%
Sometimes	3 (n=89)	3%

Source: Primary data.

79% of the respondents highlighted that they do not sleep on duty ,7% of the workers respondents that they sleep on duty and 3% said sometimes the workers sleep on duty which gives a figure of 10% of the workers sleep on duty ,in terms of accidents causation the ten percent is a big figure which can cause accidents at Grate Cooler and it is important to note that most of the Grate Cooler employees are on shift work ,as most of the respondents were asked during the night shift so one might say the 10% respondents were from night shift However according to NIOSH 2013 , shift work does create potential productivity advantages but also has many inherent risks. Some of the most serious and persistent problems shift workers face are frequent sleep disturbance and associated excessive sleepiness. Sleepiness or fatigue in the work place can lead to poor concentration, absenteeism, accidents, errors, injuries, and fatalities. The issue becomes more alarming when you consider that shift workers are often employed in the most dangerous of jobs, such as Grate Cooler Section. The issue of fatigue correlates with one of responded question on the causes of accidents at Grate cooler. Also about 57% of the semi-structured interviews indicated that workers sleep on duty especially on night shift and 42% for the semi-structured respondents said the workers do not sleep on duty. When the researcher conducted his observations during the night he observed seven workers sleeping on duty which represents 7% (n=89) of the respondents. However one can say sleeping on duty is one of the causes of accidents at Grate cooler because the smaller percentage presented will tally with the semi-structured responds which indicated that two or three employees are injured per week at Grate Cooler section.

Research question: In your own opinion what is the cause of accident at your section?

The respondents were requested to indicate the cause of accident. The result showed that out of 89 respondents that have experienced accidents in the workplace, 59 % (n=53) of them indicated that the accidents were caused by their friend's negligence, as compared to other factors such as machine/equipment used 12% (n=11), nature of the work 10.1 % (n=9) and their own negligence 7% (n=6). Unsafe environment 6% (n=5) and other factors 6 % (n=5) made up less percentage as the cause of accidents in the respondents' workplace (Table 4. 3). This finding indicated that human factor was the major cause of workplace accidents; as such accidents were mainly caused by co-workers. In this aspect, Sino-Zimbabwe Cement Company should play an important role in enhancing the awareness of their OSH practices at the Grate Cooler section in

order to avoid workplace accidents. Table 4.4 below show the response rate on causes of accidents:

Table 4.3. The response rate on the causes of accidents

Response	Number of respondents	%
Machine /equipment	11 (n=89)	12%
Friend's negligence	53(n=89)	59%
Your own negligence	6 (n=89)	7%
Unsafe environment	5 (n=89)	6%
Other factors	5 (n=89)	6%

Source: Primary data.

4.6 The Effectiveness of Risk Management System at Grate Cooler Section from January 2005 to December 2013

The factors associated with the effectiveness of risk management system at Grate Cooler Section from January 2005 to December 2013 were evaluated and the results were as illustrated in table 4.5 below.

4.6.1 Risk management system at Grate Cooler Section

A total of 89 questionnaire respondents were interviewed and Table 4.5 below summaries the distribution of respondents who responded to issues on existing risk management systems at Grate Cooler section.

Table 1 .4: Risk management systems at the Grate Cooler section.

Variable	Percentage (%) (n =89)
Trained in OHS	
Yes	64
No	36
Participated in risk assessment process	
Yes	9

No	91
OHS Meetings	
Yes	99
No	1
Follow the control measures of HIRA	
Yes	98
No	2

Source: Primary data.

Only 64% of the questionnaire respondents were recorded as those who trained in risk management where they covered mostly Hazard Identification and Risk Assessment and Standard Operating Procedures. While the remaining 36% did not receive training therefore they were not empowered adequately to deal with SHE management issues. The semi-structured interview respondents concurred with the questionnaire respondents that trainings on HIRA were being done. Records of the trainings were available with the Safety Health and Environment office as evidenced by the availability of the records with the SHE department. One of the notable finding of the study is that those who were said to be have being trained were just a small fraction of the company workers. This concern was even echoed by some semi-structured respondents who indicated that the rate at which trainings were being conducted was slow and by the time some workers would receive treatment more harm would have happened.

4.6.2 Workers' Involvement in Risks Assessment

On the involvement of workers in risks identification in the workplace the findings of this study indicated that the majority of the questionnaire respondents (91%) were not involved. When asked why they continue to have high injury frequency rate at the Grate Cooler the semi-structured interview respondents gave the following as the possible causes:

- These training started recently sometime during 2013.
- The smooth flow of the training program was disturbed by the lack of financial support at some time therefore not everyone have been trained so far.
- The more experienced workers tend to resort to short cuts in order to meet the targets not doing the job as per Standard Operating Procedures.

- The nature of the business-cement manufacturing is prone to dust environment .This concurred with one of the identified hazard as dusts.

Both the questionnaire and semi-structured interview respondents concurred HIRA was being done freely but the semi-structured interview respondents gave a variety of how often the HIRA was being done. The responses varied from dangerous task, departments, depending with the supervisor or Head of department and some just said every task. In Health and Safety such variation are a demonstration of poor risk management system because as key informants they have given uniform responses.

Levy and Wegman (2000) stressed that the education and advice concerning specific work hazards were essential. Results of this study showed that the workers were being trained on safety and health issues unlike the study findings by Shafik, (2012) where cement companies did not give periodic training to workers about the occupational safety hazards. According to the information from the questionnaire and interviews which were analysed, training on HIRA was being done as evidenced by 64% of the respondents who confirmed the trainings. Although records were available with the SHE department they were not clear enough to indicate which topics were covered and the depth of the trainings which were done to the workers. Lack of such important information when matched with the findings of the questionnaire survey where the respondents could not confidently remember what they were trained on demonstrated that SHE department should be having some challenges in safe guarding the workers' safety and health.

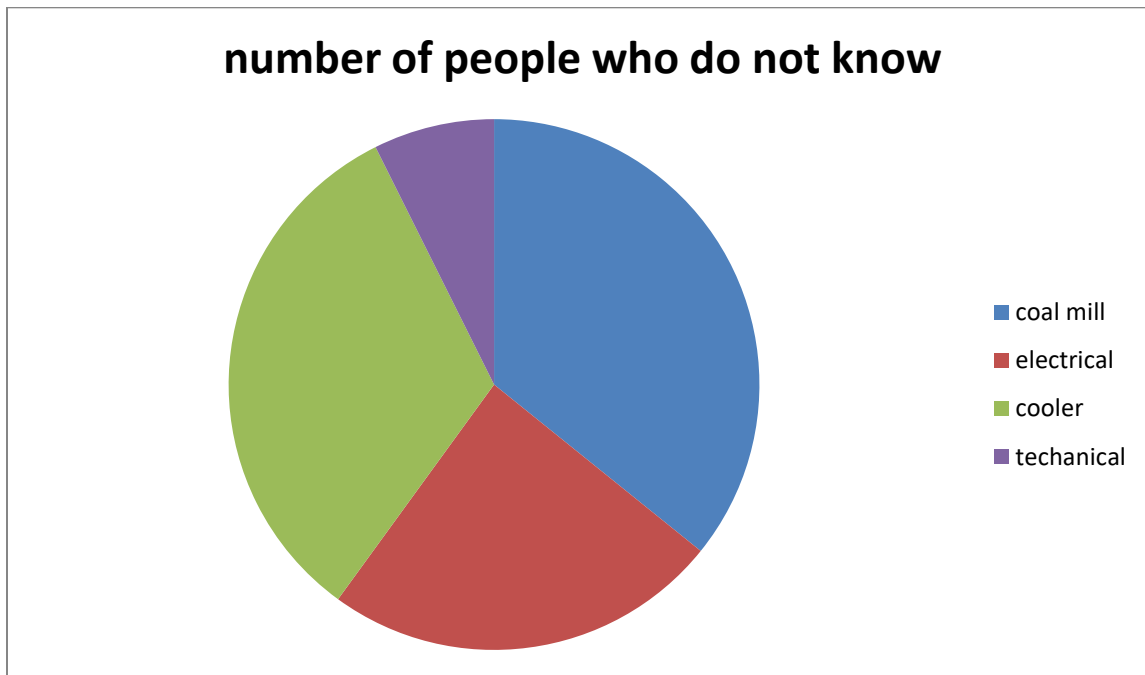
4.6.3 Risk Assessment Processes

It was also noted in this study (table 4.5) show that very little was done at the SZCC in involving workers in risk assessment process. If workers participated in risk assessment processes and complimented to OHS trainings, workers would be empowered to safeguard their health and safety and improve production as well as saving company resources by reducing hours lost due to accidents. There was one major component in S.H.E which was established to be properly done at the SZCC which was availability of SHE representatives in all departments. Every department at the company had SHE representatives who attend monthly meeting on behalf of the workers and in turn conduct such meetings at their respective departments. Such meetings and training assisted in discussing SHE matters. Research showed that meetings were done and

every department had SHE representatives although the majority of the workers could not explain the HIRA training which were done.

One of the items in the questionnaire asked the respondents at the Grate Cooler section if they know the effectiveness of risk assessment program, the following were the **answers: coal mill 36%, electrical 25%, cooler 33% and technical 7%**. Through the response from the questionnaire, the findings revealed that the company does not have proper management system. According to Holmes, N. (1999) ,if the risk assessment process – the start of the health and safety management approach – is not done well or not done at all, the appropriate preventive measures are unlikely to be identified or put in place and Nichols, T., Dennis, A., & Guy, W. (1995) supported the view by saying proper risk assessment includes, among others things, making sure that all relevant risks are taken into account (not only the immediate or obvious ones), checking the efficiency of the safety measures adopted, documenting the outcomes of the assessment and reviewing the assessment regularly to reduce accidents at places like Grate Cooler section. Figure 4 .6 show number of people who do not know the effectiveness of the risk assessment program.

Figure 4 .6: Number of people who do not know the effectiveness of the risk assessment program.



Source: Primary data.

4.6.4. SHE Trainings

Some of the semi-structured interview respondents registered concerns that some of the long serving workers were not using the Standard Operating Procedures yet they accounted for the majority of the work force demonstrated lack of required SHE knowledge. Lack of knowledge could be that probably if trainings were done, they did not yield the expected impact. Risk assessment trainings should be properly done as indicated by Stupe (2002) that when training workers, management should explain the reasons why risk assessments must be performed correctly. People are much more likely to follow risk assessments exactly when they understand why they are important. Furthermore Stupe (2002) adds that, sharing *demonstrates* that management care about the worker and his or her success. He argues that this helps develop the worker's risk assessment knowledge and enhances his or her ability to contribute to reduce accidents.

4.6.5. SHE Trainings challenges

The semi-structured interview respondents agrees that trainings were been done, but it was found that these trainings had not covered all the workers as only 64% had been trained. They argued that there is an inadequate staff to handle Safety, Health and Environment issues. Although trainings were ongoing, observations were that workers could not confidently explain what they had been trained on, which meant the training was not effective. This study noted that the Employer should provide necessary information, instruction, trainings and supervisions on risk assessments, while keeping the extent of workers competence in mind. This contention is also postulated by Zimolong & Elke (2004) in developed countries such Australia risk based approaches are rooted in law and trainings in risk management and accredited by regulators in many states result in more standardized risk management.

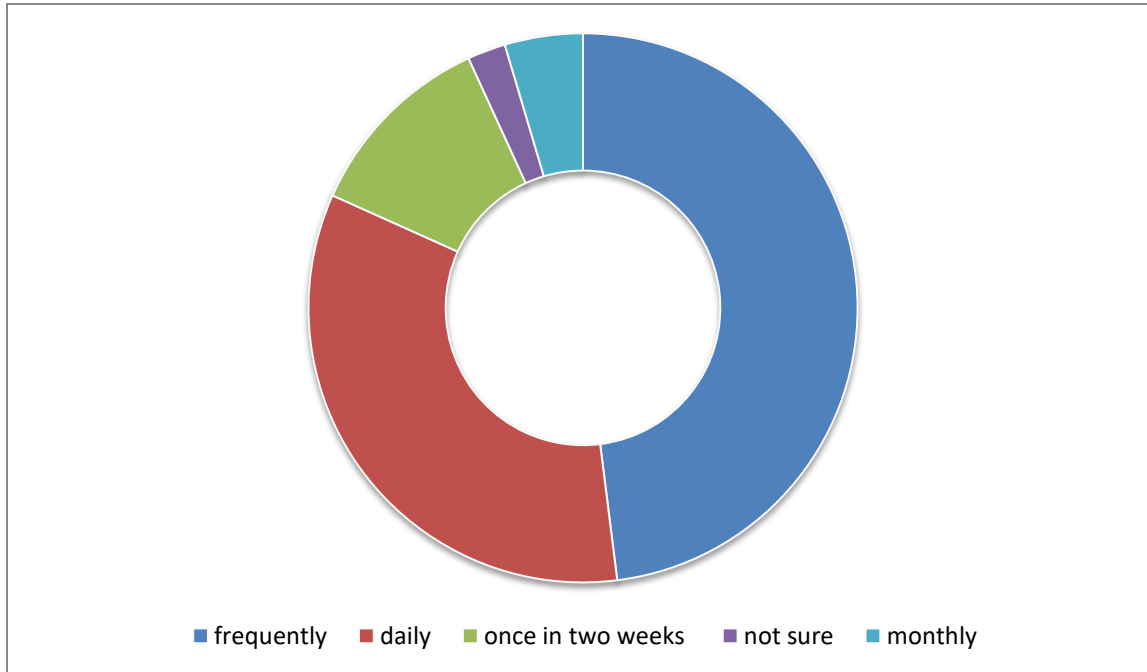
4.7 Visible Felt Leadership.

Research question: How often does management visit your workplace?

As the question concerning how often does management visit Grate cooler section, the respondents were required to write the relevant answer. The questionnaire revealed that 47 % (n=42) said the management frequently visit their workplace this concurred with the 42% (n=3)

of the semi- structured interview which indicated that they visited the Grate Cooler section eight times a day .However 33% (n=30) responded that the management visits daily, 11.2 % said once in two weeks, 2.5% monthly and 2.2% not sure. The summary of the management visits is shown by the Figure 4.7 below:

Figure 4.7 .The response on management visits.






Source: Primary data.

Research question 6: Types of Incentives Received When Complying with All Safety Rules and Regulations

As to the question concerning types of incentives received when complying with all safety rules and regulations, respondents were required to tick the relevant answers. Results showed that among the choices, no incentives top led the list (n=55), followed by salary increment (n=21), others (n=9), an extra day of leave (n=4). None of the respondents indicated that they have received recognition certificate or were given the incentive to go overseas/locally for training courses when complying with all safety rules and regulations. This finding suggested that the company is probably less interested in giving out incentives to their employees even when the employees have complied with all safety rules and regulations. This could cause the employees to be demotivated when complying with the safety rules and regulations as a result this can contribute to causes of accidents at Grate Cooler. However the questionnaires response also

revealed that management is committed with the Safety ,Health and Environment issues this correlates with the frequency visit by management to the Grate cooler .However the 47 % grate cooler visit according to findings is far below a well-established visible Felt Leadership program hence it can be concluded that the management might not recognizing that accidents can be eliminated by including and involving workforce .By the use of visible felt leadership – a process which encourages directors ,and management to visit sites such as Grate Cooler section and talk to employees and greater worker participation indicates that the company will be moving towards a culture of interdependence where everybody looks out for each other .Lack of visible Felt Leadership reveal that the management is not dedicated to the full involvement of safety representatives and safety committees .In terms of accidents prevention Visible Felt leadership contribute tremendously to overall safety standards and performance through consultation, innovation and involvement of employees. To underpin this it clearly indicated that a comprehensive health and safety management system is not in place across all operations. This concurred with NIOSH 2013, Visible Felt Leadership Report which revealed that were there is Visible Felt Leadership accidents are reduced.

Figure 4.8 Data in SPSS format, MS Excel format and Analysis output file

Data in SPSS format	Data in MS Excel format	Analysis output file
Occupational SA -1SAV 	 Chaitezvi data.xls	 FREQUENCIES. Doc.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS.

5.0 Introduction

The results were discussed in chapter four and substantiated with reference to the literature review. In chapter five conclusions were drawn and recommendations were made.

5.1 Conclusion.

Based on the findings of the study a number of conclusions were drawn. The study established that:

- The majority of the workers and workers have clearly indicated that heat is the major hazard at Cooler section, followed by noise and dusts respectively. The heat as the major hazard correlates with one of the causes of accidents which is stress because when employees are exposed to high temperature they can be dehydrated and become dizzy which lead to heat stress which contribute to accidents causation. However other respondents highlighted that some of the hazards which are found at Grate Cooler section are slipping, fall, electrocution, repetitive motion and Ergonomic injuries. Noise was also indicated as another hazard found at Grate Cooler section, the most well-known effect of noise at work is loss of hearing, a problem observed among Grate Cooler employees.
- The findings indicated that human factor was the major cause of workplace accidents as such accidents were mainly caused by co-workers.
- The findings also revealed that the company does not have proper risk management system.
- One of another significant finding was that although workers were being trained on HIRA still not much had being covered. Such a situation is not accepted it compromises the workers' safety and health. Lack of health and safety information predisposes workers to suffering from occupational diseases. On the other hand the company itself will fail to realize its profits through expected meaningful production.
- The risk management system was found to be weak hence the high prevalence of respiratory diseases. The company was not certified to any standard of Safety, Health and Environment Systems which are ISO 14001 and OSHAS 18001
- To underpin this, it clearly indicated that a comprehensive risk management system is not in place across all operations.
- There is no proper visible Felt leadership at the Grate Cooler section, it was clearly revealed that management is not dedicated to the full involvement of safety representatives and workers in S.H.E issues the top-down approach in managing safety.

However in terms of accidents prevention programs, Visible Felt leadership contribute tremendously.

- The existing hazard identification and risk assessment, together with existing management systems were rated not effective in preventing accidents or property damage and addressing accidents causation at Grate Cooler Section.

5.2 Recommendation.

The study recommended that:

Rewards and recognition. Rewards and recognition are important for safety management systems if they adequately reinforce safe behavior while punishing at-risk behavior, (William, B .2010). Rewards and recognition were defined as a fair incentive and feedback system that encourages employees to work safely. A fair system includes not rewarding employees who fail to work in accordance with safe procedures (Veronen, U 2000). An example of rewards and recognition comprises of employees who work safe then benefit from better performance reviews, and those who are not safe do not get the same recognition. Another example is the celebration of safety achievements in work units (Kim J .W 2003). However, the recognition of safety milestones is only productive if it does not inhibit incident reporting. Geller (2000) suggests celebrating milestones such as a specific number of incident reports or safety audits. However according to Locke, 2000 most cement industries in China do not recognize and rewards hence accidents are very high at Grate Cooler Section.

Employee engagement. Dollard and Bakker (2010) suggest that employee engagement in Risk management at work can lead to positive organizational outcomes, such as fewer work-related injuries, if employees have adequate resources. It is empowering for employees to be involved in their work processes and associated safety processes (Conlin I 2008) Branham (2010) suggests a workforce is engaged when individuals promote safe behaviors and actively reduce workplace hazards. Interestingly, safety culture is more correlated with worker engagement than worker compliance with rules and procedures (Christian et al., 2009). As such, Podgórski (2006) suggests that a good risk management has a mechanism for employee engagement.

Incident reporting and analysis. The findings of Nielsen, C (2006) suggest reporting minor injuries and near-misses are associated with decreased long-term injuries. Computer-based or traditional paper-based reporting procedures can be used to track these reports. Nielsen et al 2006, advocate that employees should not only report minor or near incidents, but they should also have an opportunity to offer suggestions for preventive measures. Incident reporting and analysis may also be related to both management concern and employee involvement; however, most suggest it is primarily a SMS factor (Nielsen et al.).

Safety, Health and Environmental standards such as ISO 14000 series and OSHAS 18000 series should be sincerely implemented.

One of another significant finding was that although workers were being trained on HIRA still not much had being covered. Such a situation is not accepted it compromises the workers' safety and health.

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Appendix 1

Questionnaire for Grate Cooler employees.

Instruction to the respondents:

Participation in this research is voluntary and anonymous, that is, no names will be required on this form. Please tick against the appropriate response in the space provided where appropriate. Please do not write your name, your responses will be confidential. Your co-operation will be greatly appreciated.

Part A: Demographic characteristics

Tick in the appropriate box

1. Sex : Male Female
2. Age : 20 years & below 21 -49 years 50 years and above
3. Marital Status : Single Married Divorced Widowed
4. Educational Qualifications : None Primary level Secondary Tertiary
5. What is your employment status?
(a) Permanent (b) Temporary
6. Length of service at Sino-Zimbabwe Cement Company : < 3months <6 months
< 5years and above

7. Section where employed : Coal mill Electrical Cooler Operations
Technical

Part B: Identification of occupational hazards.

1. Which is the main type of hazards that you are aware of in this section?
2. Please list the other hazards that you are aware of in your section
3. Do you consider the following as constituting important hazards that could harm the health and safety?

- | | | |
|------------------------|------------------------------|-----------------------------|
| (1) Noise | yes <input type="checkbox"/> | No <input type="checkbox"/> |
| (2) Dusts | yes <input type="checkbox"/> | No <input type="checkbox"/> |
| (3) Heat | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| (4) Tripping | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| (5) Slipping and Fall | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| (6) Electrocution | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| (7) Repetitive motion | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| (8) Ergonomic injuries | Yes <input type="checkbox"/> | No <input type="checkbox"/> |

4. Does the organization have an identified and written down lists of the hazards at the Grate cooler.

5. Does management communicate hazards to you Yes No

6. If yes how does the management communicate to you?.....

7. What should you do if you notice a hazard?.....

Subsection of Part B: Number of injuries.

1. Have you ever experienced an occupational injury during the period January 2005 to December 2013
Yes No
2. If Yes was the injury : (a) Medical Treatment Case
(b) Lost Time Injury
3. How many Lost Time Injuries have you had to date:
1 2 3 4 I don't know

Part C Causes of accidents.

1. Do you sometimes have a problem of sleeping on duty?
Yes No Sometimes
2. Have you ever been diagnosed with a sleeping disorder?
Yes No
3. What time did the accident occur?
Day Night
4. Do you know your S.H.E Policy?
Yes No
5. Were you ever briefed on this Policy since joining the company?
Yes No
- If Yes, an management commitment that you know from the policy.....
6. Do you think this policy is adequate?
4. Do you section has planned preventive maintenance programmes that you know?.....
5. In your own opinion what do you think was the likely cause of the accident?
(a) You experienced.....

.....
(b) That was experienced in your section by other workmates.....
.....

In your own opinion what are the causes of accidents at Sino- Zimbabwe Cement Company?

- a) Fatigue
- b) Stress
- c) Slips
- d) Tripping
- e) Working long hours
- f) Lifting
- g) Repetitive motion
- h) Collision
- i) Workplace violence

Section D Administrative Factors.

1. What is your view about S.H.E systems?

Poor Average Good Very Good

2. What improvements to the S.H.E system do you think can be made at this organization?

3. Did you do pre-employment medicals before you started working for SZCC?

(a) Yes No

4. How often do you go for medical examinations?

(a) Every 3months (b) every 6 months (c) yearly
(d) Other specify

5. Have you ever received pre-employment training on the use of equipment you are currently using?

(a) Yes (b) No

6. Have you ever been injured as a result of the equipment you are currently using?

Yes

No

7. Are workers involved in S.H.E issues decision making?.....

8. Do you have standard operating procedures or specific safety instructions relevant to the section?.....

Section E: Visible Felt Leadership at Grate Cooler.

1. How often does management conduct S.H.E site tour inspections at Grate Cooler Section?

.....

2. Does management recognize the sphere of influence as leaders?.....

If so how?.....

3. How does management acknowledge success?

4. Does management encourage and reward innovation?

If so how?.....

5. What form of S.H.E communication do management use?.....

6. Do they rely on Safety professionals to manage safety?.....

7. In your opinion, do you think that management makes serious efforts in enforcing the S.H.E standards of the organization?

8. Overall, how would you rate management commitment?

Low Average High

Appendix 2:

Key Informant Interviewer guide

Semi Structured Interview Questions

Sino-Zimbabwe Zimbabwe Cement Company Management

Section A: Effectiveness of risk management system (Management).

My name is Lancelot Chaitezvi I am a student at Midlands State University studying for a Bachelor degree in Geography and Environmental Studies (Honours). I am carrying out a research on the factors contributing to accident causation at the Grate Cooler Section the case of Sino Zimbabwe Cement Company

Are the workers at Sino-Zimbabwe Cement Company formally trained on HIRA?

Yes No

If yes, is there a record of all training and induction programs undertaken?

In your own opinion why are HIRA procedures failing to control factors causing accidents at Grate Cooler Section?

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

How effective is the risk assessment program at this company?

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

What is the importance of holding pre-task risk assessments?

.....
.....
.....
In your own opinion do you think workers S.H.E issues are safely guarded by this company?

.....
.....
.....
What can be done to improve occupational health and safety management system at Grate Cooler section?

In your opinion is management at all levels visible in the plant and is the management committed to occupational health and safety issues?

.....
.....
.....
Do safety representatives at Grate Cooler have adequate time to carry out their duties?

.....
.....
.....
Is the process effective.....

Has the Grate Cooler section ever been convicted of an occupational health and safety offence?

Yes No

At what stage are workers at Grate Cooler Section given safety induction?

.....
Do you undertake regular critical equipment safety inspections at Grate Cooler section?

Has the management prepared standard operating procedures or specific safety instructions relevant to the section.....

Are the employees regularly provided with information on company health and safety performance?

.....

Do you think occupational health and safety management system at Grate Cooler section is effective enough to control factors which contribute to accidents at Grate Cooler section?

.....
.....

Have management of SZCC put in place adequate control measures to address risk assessment issues at Grate Cooler Section?

Discuss.....
.....

In terms of communication which of the following principles do you use?

- (a) Individual Job Orientation, (b) Proper Job instruction , (c) Key Point Tipping and (d) Job Coaching.

If so, can explain more on the principle.....

Section B: Workers level of responsibility

Are you satisfied with how the workers use their PPE which they are issued?

.....

Is there a procedure in place which is used by employees to report hazards at Grate Cooler Section?

Yes No

If Yes, what is the procedure.....

Are employees involved in decision –making over S.H.E issues?

.....

Are the rights of the workers to refuse to work on areas that are unsafe?.....

Section B: Visible Felt Leadership at Grate Cooler Section.

1. How often do you conduct S.H.E site tour inspections at Grate Cooler Section?

.....

2. Do you recognize your sphere of influence as a leader?.....

If so how?.....

3. How do you acknowledge success?

Do you encourage and reward innovation?

If so how?.....

4. What form of S.H.E communication do you use?.....

5. Do you rely on Safety professionals to manage safety?.....

Section C: Causes of occupational hazards at Grate Cooler.

1. Name five potential occupational hazards at Grate Cooler section?

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

2. What are the causes of accidents at Grate Cooler section?.....
.....

.....
.....
3. Does management have preventive maintenance programmes for sections at Grate Cooler.....
.....

4. Does the section have adequate work standards for Grate Cooler Section?

Yes No

If yes what are the standards.....
.....