OCCUPATIONAL HAZARDS, INJURIES AND ILLNESSES ASSOCIATED WITH GOLD MINING. A CASE OF RENCO MINE, ZIMBABWE

By

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APPROVAL FORM

The undersigned people certify in writing that they have read and recommend a dissertation entitled, **Occupational hazards, injuries and illnesses associated with gold mining. A Case of Renco Mine, Zimbabwe** to Midlands State University by MunyaradziMutekede in partial fulfilment of Bachelor of Science Honours Degree in Geography and Environmental Studies.

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DEDICATIONS

This research project is dedicated to my beloved parents, sisters and brothers for their indefatigable support they offer for the completion of this dissertation.

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ABSTRACT

The main objective of this study was to assess the occupational hazards, injuries and illnesses associated with gold mining at Renco Mine. Field observations, interviews, questionnaires and secondary data sources obtained at the company SHE department were data sources used by the researcher. A purposive sampling technique was employed in choosing the General Manager, SHE manager, Mine captain and the Human Resources Manager for interviewing as key informants. Stratified random sampling technique was used in sub dividing Renco Mine employees into different departments. 120 respondents were then randomly selected from the different departments to be a representative of the whole population. The hazards that were identified during the research included physical, mechanical, psychosocial and chemical hazards. It was also discovered that these hazards were jeopardizing the lives and welfare of workers at Renco Mine since they resulted in injuries for example lacerations, amputations, contusions, fractures and burns as well as illnesses like stomach problems, high cough, asthma, back problems and tuberculosis. It was revealed that the company had put in place measures like OSH training and auditing, SHE talks and meetings, dust suppression equipment as well as PPEs to prevent employees from falling victims of occupational hazards. The study recommends that Renco Mine management should adopt off the job training of SHE representatives and supervisors as well as adequate provision of PPEs to all its workers which are suitable for a specific job.

LIST OF ACRONYMS

APA	American Psychological Association
BBS	Behaviour-Based Safety
HAVS	Hand-Arm Vibration Syndrome
ILO	International Labour Organization
NIHL	Noise-Induced Hearing Loss
NSSA	National Social Security Authority
NIOSH	National Institute of Occupational Safety and Health
OSH	Occupational Safety and Health
OSHAS	Occupational Safety and Health Analysis System
PPE	Personal Protective Equipment
SHE	Safety Health and Environment
SI	Statutory Instrument
SWP	Safe Work Procedures
TB	Tuberculosis
WHA	World Health Assembly
WHO	World Health Organization

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CHAPTER 1: INTRODUCTION

1.1BACKGROUND TO THE STUDY

The rapid transformation in working conditions has undoubtedly contributed to a myriad of occupational injuries and illnesses to all workers. Gold mining is no exception to these occupational injuries and illnesses since it involves the use of tools and equipment as well as working platforms that are potentially dangerous. The development of Occupational Safety and Health (OSH) legislations such as the International Labour Organization (ILO) Convention on Safety and Health in mines of 1995, the Factories and works Act 1996, Public Health Act 2002,PneumoconiosisAct 1971 and the OSH standards for example OSHAS 18001: 2007 were necessitated by the needto protect the health and safety of workers in all occupations. The International Labour Organization (2001) defines Occupational Health and Safety as the promotion and maintenance of the highest degree of physical, mental and social wellbeing of workers in all occupations.

According to Hartman (1992), mining is the extraction of valuable minerals or other geological materials from the earth usually from an ore body, vein or seam. It is an earliest occupation which has long been regarded as difficulty and prone to injuries, diseases and fatalities. Falls of ground have historically been the leading causes of loss of life in mines. Recent changes in technology have reduced the number of Occupational Safety and Health problems but however, when accidents take place they frequently result in severe consequences (Stellman and McCann 1998). Kazem (2012) contends that the use of heavy equipment and electrical apparatus, entrance to confined spaces, working on unstable platforms, risks of rock falls and working in noise and dust environments are some of the most prominent hazards that present a number of health problems to mine workers that range from minor injuries to fatal accidents.

According to Lehtinen and Joronen (2011), mining and its activities has lately been the main area of consideration as a result of recent incidences. Of note is the successful rescue of thirty three miners in Chile in 2010 and on the other side of the spectrum, thedeath of twenty nine miners in New Zealand from a blast in the same year. The Wankie coal mine disaster in 1972 was one of the worst ever mining disaster with four hundred and twenty six fatalities. Mining work therefore, falls into the category of perceived dangerous occupations (Dumet 2011). This means that safety measures have to be taken in the accomplishment of activities related

to mining. Given mining's hazardous nature, the need for development of state of the art OSH systems has long been recognized. The ILO convention on Safety and Health in mines of 1995 number 176 has long been adopted by various countries as OSH legislation.

Mining involves the use of tools and materials that present a multitude of safety and health problems to those involved in mining operations. Brauer (2006) notes that working in mines and carrying out mine tasks exposes a worker and at times other people not directly connected with work to risks such as the risks presented by the use of explosives, pebbles and dust generated in the course of activities. The majority of people who are employed in the mining sector are prone to various physical, chemical, mechanical, biological and psychological risk factors (WHO 2003). Occupational hazards, injuries and illnesses create both human and economic costs. ILO (2001) estimates that about 5% of the world's gross domestic product is lost due to occupation injuries and diseases.

Chimamise *et al* (2010) contend that despite the considerable efforts in many countries to protect the lives and welfare of workers, occupational accidents are continuing to increase. Occupational accidents and diseases present a considerable economic burden on individuals, employers and the society at large (Dwiwayo and Mutetwa 2012). Tadevera (2011) is of the view that costs due to accidents such as lost income, damaged equipment and lost time can be easily expressed in monetary terms. However, most of the economic consequences of occupational accidents such as reduced market competitiveness, reduced worker morale and disruptions to various working procedures are to a greater extent hidden and difficulty to quantify (Leigh et al 1999). It is against this background that this research focuses on the Occupational Safety and Health hazards, injuries and illnesses associated with gold mining with particular reference to Renco Mine.

1.2 Statement of the problem

Failure by employers to invest in occupational safety and health and adopt a systems approach to ensure the safety and health of their workers is resulting in increased occupational accident occurrences. The number of accidents at mining work in Zimbabwe that resulted in deaths and serious injuries increased substantially since the year 2008. In 2012, there were 5 141 serious occupational injuries which have resulted in 103 deaths. In year 2011 there were 4 158 serious work related injuries recorded, in 2010 there were 4 410, 3 810 in 2009, as well as 3 122 serious injuries in 2008 (NSSA 2012). These statistics show that there is a sharp increase in occupational accidents at mining work in Zimbabwe.

Gold mining companies are also contributing a significant proportion to these accidents since they are reported cases of Occupational Safety and Health problems that are arising in gold mining operations. Nevertheless, the nature and causes of these accidents with particular reference to Renco Mine has not been researched on and documented. Therefore, this research seeks to identify the types of occupational hazards associated with gold mining and to establish the nature of injuries and illnesses they cause as well as to examine the measures that are being put in place to ameliorate occupational injuries and illnesses at Renco Mine.

1.3 Research Objectives

General objective

To assess the occupational hazards, injuries and illnesses associated with gold mining at Renco Mine.

Specific objectives

To identify the types of Occupational Health and Safety hazards at Renco Mine.

To establish the nature of injuries and illnesses among Renco Mine workers

To examine the measures that are put in place to ameliorate occupational injuries and illnesses at Renco Mine.

1.4 Justification

In light of the challenges highlighted in the background statement, this research is of paramount importance to Renco Mine employees since it will raise awareness to the concerned workers on the possible risks and hazards they are facing. Sound knowledge of the hazards and risks help them to demonstrate a sense of commitment and adherence to the stipulated operational codes of practices thus ensuring a safe and health workplace.

The identification of the occupational hazards that the mine workers are being confronted with will assist Renco Mine SHE department in the proper designing of the work environment so as to control the effects of those hazards. The project is also essential to the SHE department of Renco Mine since they will have a chance to review the safety and health measures like OSH training and the provision of Personal Protective Equipment (PPEs). Therefore, this research is essential since it guarantees safe and health working conditions if occupational hazards are effectively controlled.

The research would also assist companies in planning and designing for safety and health issues. NSSA (2012) assert that the tracking of occupational hazards would therefore result in the general reduction in the burden of work related injuries and diseases. The research would also help the SHE department of Renco Mine in identifying old and new safety and health problems that require additional research and preventative efforts. The study will add a vital dimension to the existing body of knowledge on safety and health issues which if ignored, can affect negatively the company' s reputation and its profits if fatalities and injuries persists.

1.5 Description of the study area

Physical characteristics of the area

Renco Mine is a gold property found in Masvingo District. It lies within latitude 20° 37"33"S and longitude 31° 9" 59"E and therefore is located approximately seventy five kilometres South- East of Masvingo town. The company has been started in 1983 in the communal lands of Nyajena by the Rio Tinto Foundation. It occupies an area between Mavugwi and Muchibwa mountains and therefore it is four hundred and sixty meters above sea level.

The geology in the area is predominantly igneous rocks mainly granite and isolated pockets of dolomite. The abundance of granite rocks has led to the formation of sandy- loamy soils (Nyamaphene1991). According to Mungandani*et al* (2012), the area is classified under agro ecological region four and receives an annual mean rainfall ranging from four hundred and fifty to seven hundred millimetres. The rain season starts in November and end in April (Department of Meteorological Services1981). However mid-season droughts and severe drought spells are a characteristic feature of the area. Rainfall is erratic, unreliable and unevenly distributed across the area.

The Department of meteorological services (1981) note that the area receives temperatures ranging from about 15°C in winter to about 30°C in summer. Vegetation on the mining site is predominantly gum trees and orchards of mangoes and oranges. However miombo ecosystems dominate the area with *brachystegiaspeciformis* and *julbernadiaglobiflora* found in large quantities. Some isolated *terminaliasericea*and *acacia* tree species are found along Mutilikwe and Bangala dam. A broad array of invasive alien species like *lantana camara* dominates the riverine ecosystems. The existence of Mutilikwe and Bangala dam supports vast amounts of aquatic life like fish, crocodiles and hippopotamus.

Social- economic characteristics

Most of the miners are Chewa, Tonga and Nyasaland speaking people from Malawi but Shona speaking people commonly known as *Vajena* occupied the surrounding rural communities. The communal people are involved in growing maize, groundnuts, sorghum and rapoko as well as rice growing mainly in the vlei areas commonly known as dambos by the local people. Cattle are used as a form of wealth by local people and as a form of drought power whilst goats, sheep and poultry are being used to supplement their diet. Most of the miners and rural communities engage in fishing activities and boating especially during the weekends.

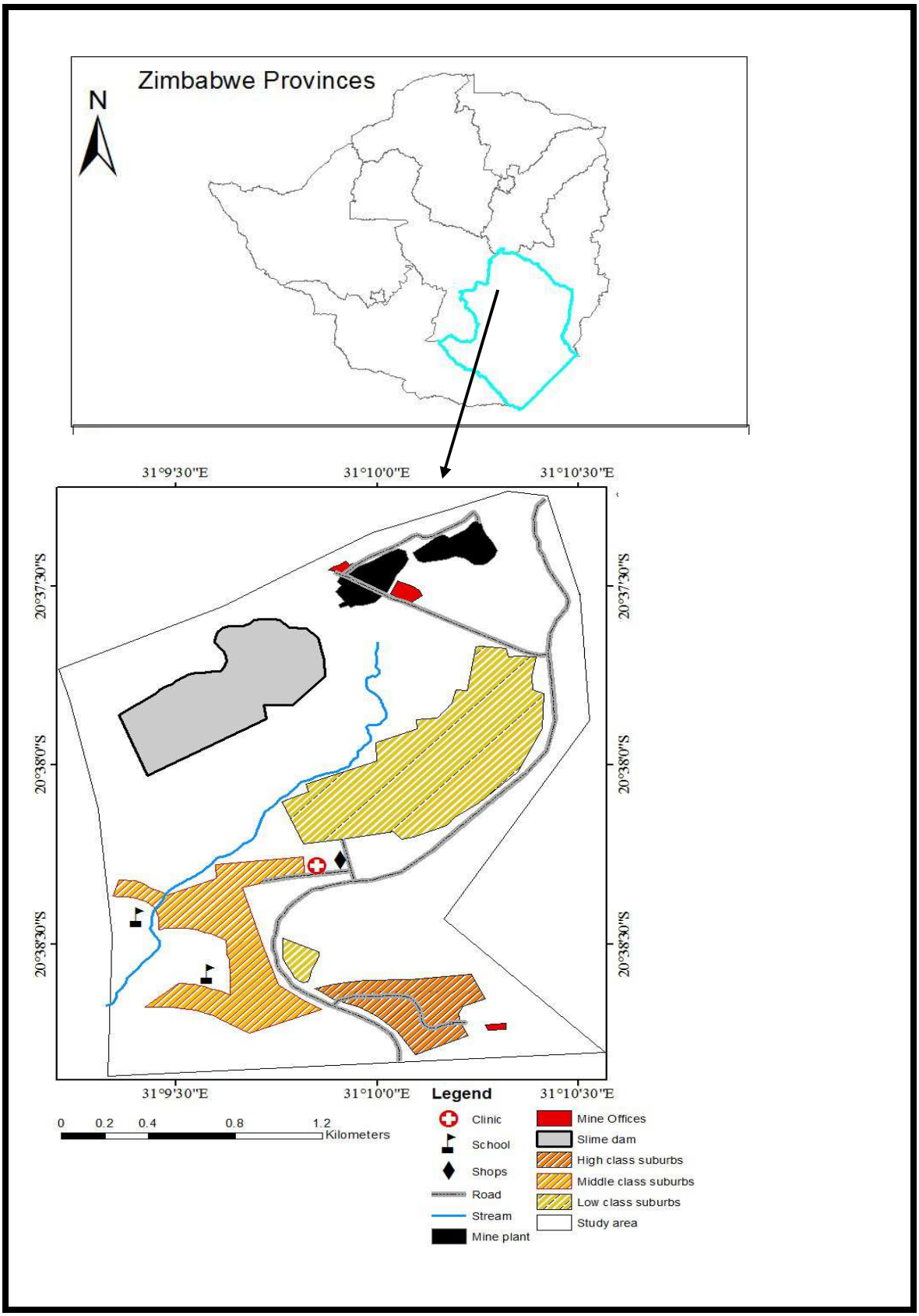

FIGURE 1.1: MAP OF RENCO MINE

CHAPTER 2: LITERATURE REVIEW

2.1Overview of the state of the mining sector in terms of health and safety.

According to ILO (2001), Occupational Safety and Health aim at the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations. The research and regulation of Occupational Safety and Health (OSH) is relatively a recent phenomenon (WHO 2003). As labour movements arose in response to worker concerns in the beginning of the industrial revolution, the employee's health began to be considered as a labour related issue. According to Leigh *et al* (1999) 100 million occupational injuries occur throughout the world each year. Some of these occupational injuries end up as fatalities. Chen and Zorigt (2012) contend that 150 000 non-fatal accidents are reported each year and an estimated 200 workers lose their lives at mining work in Britain. Two million mine workers suffer from work related illnesses in Britain. In America the OSH administration has made significant efforts in the general reduction of injuries, fatalities and illnesses in mining operations by enacting the OSH Administration Act. According to Chen and Zorogt (2012) occupational injuries and illnesses in mining operations in America has declined by 36% between 1992 and 2003. Murray et al (2000) note that the investigation of occupational exposures and illnesses is weak in South Africa notwithstanding efforts of the Department of Mineral Resources to maintain registers of the South African mining occupational diseases databases initiated in 1998. Mining workers in Zimbabwe are also at high risk of contracting work-related illnesses and injuries. The injury rate among mining workers in Zimbabwe was 131/1000 exposed workers per year as of 1998 and this figure rose to 789/1000 workers in 2008 (NSSA 2012). Stellman and McCann (1998) contend that although the mining industry only accounts for 1% of the global workforce, it is responsible for about 8% of the fatal accidents at work.

2.2 Occupational hazards: An overview

A hazard only represents the potential to cause harm (NSSA 2012). Occupational hazards can result in illnesses, injuries, disability as well as fatalities. Occupational hazards need to be controlled since they are an economic burden to the world as a whole. The most important issue is to control hazards so as to avoid a number of safety and health risks to the workers. This can merely be accomplished through training employees to identify hazards as well as training them the ways of assessing and controlling those hazards. Occupational hazards are therefore increasingly becoming an issue of concern at global, regional as well as at local

levels since they pose a gigantic threat to a large proportion of the world's working population.

According to (ILO 2001), occupational hazards can be divided into health hazards and safety hazards. Health hazards are those hazards that result in the development of illnesses or diseases. However, safety hazards are those hazards that cause accidents at workplaces which results in physical harm to the workers. The duration of exposure and the toxicity of the safety and health hazards determine the nature of the injuries and illnesses to the exposed workers. Hazards can also be rated according to the severity of the harm they cause. A major hazard being one with the possibility to cause a critical damage or death.

2.3 Occupational Safety and Health hazards in mining companies.

Mining practices generate numerous conditions that have huge consequences on human safety and health. These safety and health problems emanate as a result of biological, chemical, psychosocial and physical risk factors.

2.3.1 Physical hazards

Dust

The mining process involves breaking the rock or removing the soil. These activities generate a lot of dust and pebbles. These dust and pebbles can be a nuisance and they can also be harmful to the worker's body. According to Stellman and McCann (1998), free crystalline silica is the most abundant compound in the earth's crust and consequently is the most common airborne dust that miners face. Respirable particles are formed whenever silica bearing rock is drilled, blasted and crushed into fine particles. Dust and pebbles can physically harm employees or may lead to physiological harm. Dust may get into the eyes of the workers involved if Personal Protective Equipment (PPEs) are ineffectively used. Dust and pebbles may also interfere with vision and this increase the chances of accidents occurrences and it can also affect the skin causing all kinds of skin problems. Moreover, dust can also lead to occupational health problems if inhaled. Prolonged exposure to mining dust containing silica can result in silicosis which is a typical pneumoconiosis that develops insidiously after years of exposure. Exposure to silica is also associated with an increased risk of tuberculosis, lung cancer and some autoimmune diseases. NSSA (2012) assets that some dusts when inhaled can contaminate the blood leading to damage to other parts of the body such as the brain and the nervous system.

Noise

Noise also presents a fairly common workplace hazard. It is all unwanted sound which causes annoyance and interferes with efficiency, induces stress and disturbs concentration (Stellman and McCann 1998). Donoghue (2004) highlighted that noise is ubiquitous in mining and it is generated by powerful machines, fans, blasting and transportation of the ore. Higher noise levels hinder communication resulting in accidents. Controlling noise levels has proven difficult in mining and Noise-Induced Hearing Loss (NIHL) remains a common health problem. The primary health effect of prolonged exposure to high levels of noise in the work place is the development of occupational deafness or Noise-Induced Hearing Loss. Noise-induced hearing loss can be temporary or permanent. WHO (2003) notes that noise has contributed about 13% hearing loss worldwide. It can be controlled at the source by identifying the source of noise and replace or remove the noise machinery or part of the machine. The use of silencers and vibration isolation can also be done to reduce high noise levels. The mining industry is most affected by noise due to the use of huge machinery for example jackhammers and locomotives.

Heat

Donoghue *et al* (2000) point out that heat and humidity are encountered in deep underground mines where the virgin rock temperatures and air temperatures increase with depth. Surface mining may be associated with solar heat or cold weather whereas underground mining is associated with hot temperatures most of the time (Campbell *et al* 1983). The principal source of heat in underground mines is from the rock. Other sources of heat stress include the amount of physical activity workers are doing, the amount of air calculated, ambient air temperatures, humidity and the heat generated by mining equipment principally diesel powered (Stellman and McCann 1998). These conditions take a heavy toll on the exposed worker's body and they affect attention and concentration and thus increasing the risk of more accidents occurrences. Bell (1983) argues that hot environments results in the worker's body losing more water and salts leading to collapse. Heat stress can cause head stroke, cramps, exhaustion and rashes. Workers near hot surfaces are at risk of burns. Dehydration may also result from over exposure to heat. Preventative efforts like an adequate ventilation system, cooling high temperature machinery, limiting physical activity and regular fluid intake can reduce occupational illnesses and injuries arising from exposure to heat.

Ionizing radiation

Stellman and McCann (1998) promulgate that radon gas can be liberated from rocks during the blasting process or it may also enter a mine through underground streams. It is a gas and therefore it is airborne. Though not perceived by a normal human eye, radon and its decay products emit ionizing radiation some of which have enough energy to produce cancer cells in the lungs.

2.3.2 Mechanical hazards

The tools and machinery used in undertaking mining operations can cause a number of negative health effects to the workers. Many machines used in carrying out mining tasks involve moving parts, sharp edges and hot surfaces which have the potential to cut, stab, crush, struck or wound workers if used unsafely. Mining machines may also indirectly result in deaths and injuries to the exposed workers in cases where a worker slips and falls upon a sharp or pointed object. (Heyns *et al* 2000)

Vibration

Vibration is separated into two well defined categories, whole body vibration and hand transmitted vibration (Griffin 1990). Whole body vibration result in back problems, gastrointestinal and reproductive system disorders. Hand arm vibration is a form of vibration where the hand is in contact with the vibrating piece of equipment. According to Heyns *et al* (2000), prolonged exposure to vibration lead to hand arm vibration syndrome a chronic and progressive disorder that affects the vascular, neurological and musculoskeletal system. The early stages of hand arm vibration syndrome are characterized by blanching of the fingers, tingling and loss of sensitivity when touching. This health effect can progress to loss of effective hand function and necrosis of the fingers. Machinery like jackhammers and heavy vehicles used in mining operations cause significant illnesses like hand-arm vibration syndrome and back pain to most of the exposed workers. Vibration also affects the musculoskeletal system and results in severe destruction to the tendons, muscles, joints and nerves (Campbell *et al* 2002).

Fires

The mobile equipment used in mining activities contains large quantities of highly flammable diesel, lubricating oils and hydraulic fluids (Bickel 1987). The energized electrical equipment that are used in mining operations also presents an elevated fire risk. Mitchell and Burns

(1979) argue that materials or fluids coming in contact with hot exhaust or engine parts or an electrical fault can quickly erupt into a fast spreading fire that can result in severe destruction to machinery and to the exposed workers., Hanson (2010) assert that management should ensure that their health and safety management plans include a fire protection plan in cases where there are risks of fire at any mining operations.. The plan should take into consideration the potential sources of fire and the precautions to be taken to protect workers against fire outbreaks as well as the evacuation procedures to the safe havens. Mining inspections should include fire safety checks to ensure that all fire precautions are in place and that nothing that will burn is in contact with a potential ignition source. Campbell *et al* (2002) advocate that fire extinguishers should be sited at places where flammable materials are stored and at conspicuous positions close to any machinery or equipment that gives rise to fire risks. Electricity also poses risks to many works since it results in accidents and fires. Electrical injuries can be divided into four categories namely fatal electrocution, burns, electric shock and falls caused by contact with electric energy.

2.3.3 Chemical hazards

Many chemicals are used in mining operations in particular in laboratories. Explosives which are used to break the rock are made of chemical materials which if not properly managed cause illnesses as well as physical harm to the exposed workers. According to (Elliot 1981), these chemicals can enter the body through inhalation by breathing in dust, gas fumes or vapour through the mouth or nose. They can also enter the body by way of absorption through the skin. In underground mines where ventilation is in adequate, chemicals cause various health problems including lack of oxygen, skin and eye problems. When toxic chemicals enter the body, they cause long term health effects for example headaches, tiredness, dizziness and loss of breadth. Smoke or fumes from smelters affect air quality and thus cause respiratory problems. Moran (2000) argues that chemical substances for example cyanide are used as a solvent for metals like gold in hydrometallurgical processes. Exposure to high levels of cyanide damages the heart and brain and can lead to death. Low level exposure of long periods to cyanide result in breathing difficulties, chest pain, vomiting, blood changes, headaches and enlargement of the thyroid gland.

2.3.4 Psychosocial hazards

Lehtinen and Joronen (2011) contend that psychosocial hazards are related to the way work is designed, organized and managed as well as the economic and social context of work. These

hazards are also associated with psychological and physical injury or illnesses. The mining operations are associated with long working hours. Many workers travel long distances and may be away from homes for many days or even weeks. Loneliness and isolation can therefore be experienced. These situations cause anxiety in many workers and their families and many people are adversely affected in their personal lives. Violence in the mines arises from different situations including mobbing and bullying. Places of work may be the most important sources of health stresses if workplace operations have not been studied thoroughly and the associated health hazards have not been eliminated or controlled. According to the American Psychological Association (2007), the feeling of job insecurity, poor work life balance, poor remuneration and long working hours as well as unrealistic job expectations cause severe stress which may increase workers' vulnerability to other forms of work place hazards. Prolonged stress can raise the risk for developing chronic and costly diseases for example heart diseases, diabetes and cancer. Stress can also lower the immune system and play a role in a person's susceptibility to more colds, flu and other infectious diseases.

2.3.5 Biological hazards

Mining is also associated with poor working conditions, with the limbs exposed to biological hazards. (Driscoll *et al* 2005). Among the various dangers involved are the risks of snakebites and injuries. Bacteria, virus, fungi and blood borne pathogens also present significant hazards to mine workers.

2.4 Importance of mining on socio economic development

Mining is very vital to socio economic development since minerals are a form of export revenue for the governments. According to Chen and Zorigt (2012) about 75% of the Mongolians' exports is generated from exporting minerals. Mining is also fundamental to socio economic development since it generates revenue for the government through taxation. Products from mining are a form of raw materials for other manufacturing industries. It is also vital for infrastructural development like roads, schools and hospitals as well as banks which can benefit the local community.

Mining is a basis of the Zimbabwean economy since it makes a substantial contribution to economic activities, employment creation and foreign currency earnings. Masawi (2010) stipulates that the mining sector contributed 47% of the Zimbabwe's total growth rate of 8.1% in 2010. There is no hesitation that the mining industry is playing a vital role as a back bone of socio economic development of the Zimbabwean economy. The management of

OSH in the mining sector should be at the forefront of any mining plans since they present a huge economic burden for individuals and the society at large. Proper management of OSH would result in the enhancement of socio economic development of a country in the sense that unnecessary expenditure due to occupational accidents would be reduced, productivity increases as well as high profits would be attained. Therefore, OSH management is a necessity in the mining sector for the attainment of socio economic development of a nation.

2.5 Measures adopted to reduce OSH problems in mining industries.

2.5.1 Occupational Safety and Health legislations

There are many guiding documents in various countries ranging from policy to legislations pertaining to mining and mining activities and dealing in particular with the safety and health of workers. At the international and regional levels, health and safety in mines is covered under the convention on Occupational Health and Safety in International Labour Organization (ILO) and in World Health Assembly (WHA). Lehtinen and Joronen (2011) assert that the ILO convention on Safety and Health in mines of 1995 number 176 has long been adopted by various countries as OSH legislation. The knowledge generated in this sector specific process should be used to further OSH in general terms and the knowledge generated within mines and ministries should be shared to ensure that the principles of sound OSH management are mainstreamed.

In Zimbabwe, the mines and minerals operations are controlled under the Mines and Mineral Act of 1990. This Act comprises of the management regulations Statutory Instrument (SI) 109 of 1990 which emphasize on the appointment of SHE managers, strict use of personal protective equipment, accident reporting and the provision of medical fitness and certificates. All these pieces of legislations were developed in a bid to ameliorate or to reduce occupational accidents and illnesses and abate all the costs that emanate as a result of these accidents and illnesses.

The National Social Security Authority (NSSA) OSH division has been set to stimulate OSH through the formation and maintenance of an active Occupational Health and Safety (OSH) culture based on comprehensive accidents and illnesses preventative systems at all workplaces. The government regulates workplaces through the use of the Factories and Works Act chapter 14:08 and the Pneumoconiosis Act chapter 15: 08. The Factories and works Act is responsible for the registration and control of factories, ensuring industrial

hygiene and to carry out inspections of work places so as to identify hazards and to determine the opportunities for improvements. The Pneumoconiosis Act provides for the notification of any worker suffering from pneumoconiosis. The Act also prohibits any person suffering from pneumoconiosis from further working in dust environments. NSSA has been mandated to be the implementing arm of the Ministry of Labour and Social services. It carries out OSH inspections and keeps records of occupational accidents and fatalities of all work places in Zimbabwe. NSSA endeavours to help in ensuring the safety and health of workers through education programs, inspections of workplaces, enforcement of safety and health regulations and offering advice on the most appropriate safety and health system for a particular company or organization. It encourages companies to go beyond the minimum requirements of legislation and put in place comprehensive occupational safety and health management systems.

2.5.2 Occupation Health and Safety standards

Hazard control aims at the elimination or minimization of the risks associated with an identified hazard. Tadevera (2011) contends that hazard control is a fundamental element of an effective OSH management system and helps in reducing all the economic and social costs associated with occupational accidents and therefore boost employees' morale as well as the company's reputation. Occupational Health and Safety management systems have been designed to comply with OSH legislation. Managers are the corner stone when it comes to hazard management in any type of industry. They must be equipped with adequate knowledge and skills for them to deliver good OSH practices to their fellow workers and design an accident free work place. The specification OSHAS 18001: 2007 has been developed as a recognizable safety and health management standard against which management systems can be assessed and certified. It provides an organization with a structure approach to planning and implementation of OSH management systems. Kausek (2007) notes that OSHAS 18001: 2007 requires the systematic and formal identification of workplace hazards, the assessment of risks associated with those hazards and identification and implementation of controls to minimize those risks. An effective hazard management system relies on a thorough integration of management plans throughout the entire management organogram as well as the shop flow workers. Therefore, management should demonstrate a sense of commitment to the SHE policy, at the same time employees should strictly follow the operational codes of practices provided to them (ILO 2001). This will subsequently reduce accidents and fatalities at work places.

OSHAS 18001: 2007 operates on the basis of policy, planning, implementation and operation, checking and corrective action as well as management review. This process will results in continuous improvements if these stages are followed properly (Kazem 2012). The standard gives a framework to assess occupational hazards related to the various processes, equipment and chemicals used as well as hazards that are related to the work environment and the risks associated. The standard demands companies to establish a Safety Health and Environmental management program to reduce the risks associated with work place hazards. According to Grobler (2002), the setting of targets through the SHE policy and the ongoing internal and external audits will result in continuous improvements.

In light of the OSH problems, employers have the primary responsibility for ensuring work place safety through adhering to safety regulations, ensuring boilers and machinery are safe and ensuring machinery that require safety guards are fitted. Employers should also provide employees with protective clothing and ensure that employees use them all the time. They should also educate staff on safety precautions and procedures as well as putting systems in place to ensure that safety precautions and procedures are complied with. The employees need to adhere to the established safety and health procedures and policies, wear protective clothing and equipment provided to them and bring to the management's attention any safety and health hazards and press for the necessary steps to be undertaken to minimize those risks.

2.6 Challenges to effective OSH structures in the mining sector of Zimbabwe.

There is little conjunction of OSH issues with business plans in the mining companies. Business objectives are typically aligned with production and amplified profits rather than investment in OSH for the betterment of the mining workforce. Most mining companies in Zimbabwe are failing to recognize OSH as a cornerstone for socio economic development. Investment in OSH requires hefty financial resources which might be a problem to the Zimbabwe mining companies which are already under budgetary constraints. Large amounts of financial resources are required to fund OSH management programs like training, adequate provision of PPE, purchasing sophisticated equipment for use in administrative hazard control and for providing remuneration packages for personnel responsible for OSH management. However, spending money on protecting the lives and health of staff is essential expenditure since it has socio economic benefits in the long run.

Low literacy rates especially on the general mining workers is also a major challenge hindering successful OSH management in the mining sector of Zimbabwe. Most of the

general workers in mines are unable to read and understand safety precautions like OSH signs even if they are provided by the company. They may end up being involved in an accident simply by failing to read and understand safety precautions. According to NSSA (2012) there is lack of concern on the part of employers for the safety and health of their employees. On the other hand, employees are also reluctant to follow the safe work procedures resulting in many accidents in mining operations.

CHAPTER 3: RESEARCH METHODOLOGY

3.1Research design

According to Yin (2003), a research design refers to the basic plan or strategy of the research that describes how, when and where the data is to be collected and analysed. The researcher used a descriptive case study research design in order to achieve the research objectives. A descriptive case study research design helps in gaining adequate insight and an in-depth analysis of the types of occupational hazards and how they result in the occurrence of injuries and illnesses with specific reference to Renco Mine. A case study approach confined the researcher to the mentioned area of study. The researcher adopted qualitative research approach which provides room for obtaining more in-depth information about such aspects as workers beliefs, attitudes and behaviours towards health and safety issues on the mining site. Primary sources of data such as interviews with key informants, questionnaires and direct observations help in soliciting information necessary for the study. Secondary data from safety and health documents kept by the company SHE department were also vital data sources necessary for this research study.

3.2 Target population

Burns (1997) defines the target population as the aggregate or totality of the objects or individuals regarding to which inferences were made in sampling study. Renco Mine is currently employing one thousand two hundred workers. Renco Mine employees were the target population for the study. They include Renco Mine management team, underground miners and plant and engineering personnel as well as the mining services department. The study focused on people who work at Renco Mine because they are the ones who are exposed to the huge suffering emanating from work place hazards and therefore they are able to provide accurate information pertaining to work place hazards, injuries and illnesses that they are facing. The management team is targeted since they have a better knowhow of the whole operations and the conditions with the potential to cause harm. They also have a better knowhow of the nature of the injuries and illnesses associated with gold mining with particular reference to Renco Mine. The management team was also targeted since they have the records of all the diseases that affect all the workers and the causative agents of those afflictions. Underground miners, plant and engineering personnel were targeted since they are the ones who are responsible for all the various processes and activities involved in gold

mining. They are aware of the various occupational hazards that are associated with gold mining throughout the entire stages of gold mining activities.

3.3 Sampling criteria

A sample size is a representative part of the population from which the empirical analysis is drawn (Stoker 1989). The researcher therefore employed a survey technique in sampling respondents and gathering data necessary for the research study. Sampling is the inclusion or exclusion criteria for certain components from a population. Stratified random sampling technique was used in this research to obtain a sample which was going to be a representative of the whole population. It involves sub division of staff members into smaller homogeneous groups to get a more accurate representation before sampling. Renco Mine employees were divided into four different sub groups and then the researcher calculated 10% of employees in each and every department to represent the whole populationTrochim (2006) points out that 10% is the benchmark and minimum size required to reduce errors and ensure equal and fair representation.

Table 3.1: Illustration of sample size determination.

DEPARTMENT	NUMBER OF EMPLOYEES	SAMPLE SIZE
Administration	387	39
Engineering	118	12
Plant	156	15
Mining	539	54
Total	1200	120

The sub division of Renco Mine employees was done in order to obtain a detailed data about occupational hazards, injuries and illnesses in all the different departments since these people interact with different activities. The simple random sampling technique was then employed in choosing the respondents from administration, plant, mining and engineering departments. The assumption was that all employees have similar traits and conditions and each one of them was believed to have represented the whole group. Purposive sampling technique was also employed in choosing key informants like the SHE manager, General Manager, Human Resources Manager and the Mine Captain for interviewing. These people were selected since they are the most relevant and knowledgeable people in the issues pertaining to occupational hazards, injuries and illnesses associated with gold mining at Renco Mine.

3.4 Data sources

The researcher used both primary and secondary data sources to obtain data for the study. According to Best (1970), primary sources of data are defined as eye witnesses accounts or reports by an actual observer or participant in the event. Primary data was extracted from the field through observations, interviews and questionnaires. Secondary data is defined as data that already exists and include books, journals and magazines among others.

3.5 Research instruments

3.5.1Interviews

Interviews are oral questions by the interviewer and oral responses by the research participants (Creswell 2009). Semi-structured interviews using open ended questions were used by the researcher to solicit information on the types of OSH hazards associated with gold mining, the nature of injuries and illnesses as well as the measures that are put in place to prevent occupational accidents and diseases at Renco Mine. Interview guides were established by the researcher to ensure all the objectives of this research were covered. Basically, four key informants were interviewed by the researcher. These key informants include the company SHE manager, General Manager, Human Resources manager and the Mine Captain.

Table 3.2: Interviewed key informants and why they were interviewed.

Personnel to be interviewed	Reasons for being interviewed
General manager	The manager is the one responsible for the overall management of the company. Take part in planning and development process of the company' SHE policy. He is the one responsible for allocation of funds to be used for OSH management programs.
SHE Manager	He is the one responsible for managing all safety and health issues for the company. He keep all records of occurrences of occupational accidents
Human Resources Manager	The Human Resources manager is the one responsible for managing all the Human Resources of the organization and hence he bears all workers' complains be it safety and health issues. He is also experienced in gold mining hence knows some of the hazards that other employees are facing.
Mine Captain	The Mine Captain is the one responsible for blasting and hence knows all the conditions which might cause harm during that process. He has adequate knowledge on all the hazards, nature of injuries and illnesses that employees might face as a result of the blasting process if operating procedures are not properly followed.

The researcher booked for appointments with each mentioned key informant in a bid to reduce unnecessary delays and inconveniences. Open ended questions which provided a chance of probing further for greater depth in the respondent were employed in this particular case study. Responses from interviewees were recorded through note writing. The choice of

using interviews in data collection was that the researcher assumed there is a certain amount of knowledge already known or an understanding of the OSH hazards, injuries and illnesses associated with gold mining. Interviews were employed by the researcher in soliciting the required data since they are flexible in the sense that items may be modified as the interview process proceeds and the researcher could repeat or rephrase questions to enlighten the respondents. Interviews were also employed owing to their ability to attain data about personal feelings and perceptions about the extent to which occupational hazards have presented work related safety and health problems to the employees.

3.5.2 Questionnaires

Tuchman (1978) defined a questionnaire as a document containing questions designed to solicit information appropriate for analysis. Questionnaires for the study consisted of four sections: Section A, which has to do with demographic information, B, which has to do with the types of occupational hazards associated with gold mining, C, which aims to gather data pertaining to the nature of injuries and illnesses as well as D, which has to do with the measures that had been adopted to reduce OSH problems at Renco Mine. The questionnaires consisted of both open ended and closed ended questions. Open ended questions gave the respondents the freedom to decide the aspects, form, detail and length of the respondent's answer. The researcher used closed ended questions mostly to collect demographic data and on other questions which demanded the respondents to provide specific answers.

Questionnaires were administered to all the respondents who were sampled from all the departments since they have varied perceptions and technical knowhow with regards to the occurrences of occupational accidents, nature of injuries and illnesses. The simple random sampling technique was employed in choosing respondents from mining, plant, administration and engineering departments. These respondents were chosen using the lottery method. The researcher wrote codes which represented the number of workers per each department on small pieces of paper. Codes were used because they maintain the respondent's self-confidence rather than the use of names. These papers were put in a hat and the employees had to pick these pieces of paper. An employee who picked a paper with a code within the demarcations of the sample size in that department was deemed an eligible member to participate in the research. The researcher personally administered the questionnaires to help in interpreting the questions in cases where the respondent does not

understand. Questionnaires were employed in carrying out this study since they are relatively easy and inexpensive to formulate, analyse and communicate the findings.

3.5.3 Observations

Direct observations were carried out to back up and validate information obtained from interviews, questionnaires and secondary data sources. Observations brought about a correct record of what is happening on the ground and assisted in gathering data that has been left out by respondents. These observations assisted the researcher in gaining a close familiarity with the workers and the various working processes associated with gold mining. Observations were carried out guided by the company SHE manager. The researcher moved across different departments with the intention of having a great insight on differences in working environments and the types of occupational hazards found in each and every department. On spot observations of the various equipment, working platforms and all the processes involved in gold mining were carried out so as to get adequate knowledge on the possible sources of work place hazards, injuries and worker illnesses. Observations were also intended at perceiving levels of protection of workers against occupational hazards in line with OSH regulations and standards in Zimbabwe. An observation checklist was established to guide in hazard identification since it is an effective way of identifying occupational hazards.

3.5.4 Secondary data sources

Secondary data is data that already exists and include official statistics of accidents occurrences, their frequency, their nature, types of diseases some of the employees are suffering from as well as the measures that management is putting in place to control workplace hazards in a bid to prevent workplace injuries and fatalities. Secondary data sources were employed by the researcher as vital data sources since they have a pre-established degree of validity and reliability which need not to be re-examined by the one in use of such data (Fling et al 2004). Hence secondary data was gathered from the safety and health documents kept by the company SHE manager. The internet was also employed in supplementing data from written records provided by the company SHE department. The internet was used in obtaining information about occupational hazards associated with gold mining and the occurrence of accidents and illnesses relative to the nature of the hazards in the mining industry.

3.6 Data analysis and presentation

Robson (2002) defines data analysis as a process of inspecting, transforming, cleaning and modelling data with the goal of highlighting useful information. Qualitative data from interviews, questionnaires, observations and secondary data sources was analysed using the grounded theory. The key points from the collected data were marked with a series of codes which were extracted from the text. The codes were grouped into similar concepts in order to make them more workable. Data was then categorized, tabulated and recombined to answer the initial research question. This data was diagrammatically represented in the form of tables, pie charts and bar graphs since they are easy to refer and they facilitate easy interpretation.

CHAPTER 4: RESULTSAND DISCUSSION

4.1 BACKGROUND INFORMATION OF RESPONDENTS

4.1.1 Sex composition of respondents

Table 4.1 shows sex composition of employees at Renco Mine who have been issued with questionnaires. Questionnaire responses showed that 93.3% of the total respondents were males and 6.7% were females. This indicates that Renco Mine was dominated by males at the expense of women. Findings from field observations revealed that women occupied office positions which are less strenuous whilst males are involved in all the laborious work.

Table 4.1: Sex composition of respondents.

SEX	FREQUENCE	PERCENTAGE
MALES	112	93,3
FEMALES	8	6.7

4.1.2 Age group of respondents

From the 120 respondents, employees who were below the age of 30 were 18 and those who were between the ages of 30 to 40 were 22. Most of the respondents were between the ages of 41 and 50 which constituted 47 employees as well as ages 51 and above which constituted of 33 employees.

Table 4.2: Age group composition of respondents.

AGE RANGE	FREQUENCE	PERCENTAGE
Below 30	18	15
30 – 40	22	18,5
41 – 50	47	39
51+	33	27,5
Total	120	100

4.1.3 Working experience of respondents.

Table 4.3 represents responses of employees on their working period within Renco Mining Company. About 38.3% of all the respondents confirmed that they have been working for the company for a period between 11 and 15 years, 25.8% have been employed for a time frame between 6 and 10 years and 11.6% for a period below five years. 24. 3% of the employees have been working at Renco Mine for a period of 16 years or more.

Table 4.3: Employees' working experience at Renco Mine

Working experience	**Percentage**
Below 5 years	11,6%
6 – 10 years	25.8%
11 – 15 years	38.3%
16+ years	24.3%

4.2 OSH HAZARDS IDENTIFIED AT RENCO MINE

Figure 4.1 shows Occupational Safety and Health hazards that were identified at the mining, plant, engineering and administration departmentof Renco Mine. Findingsindicated that the types of occupational hazards at Renco Mine differ with departmental level.Most of the hazards were faced with the underground workers (mining department), plant and engineering personnel. Personnel who are being confronted with the least possible hazards were those who work under the administration department.As indicated on fig 4.1, the administration department was susceptible to chemical hazards since all the chemicals like cyanide, carbon and explosives used in mining operations were stored at this department. They were also risks of fire outbreaks since these chemicals can easily catch fire if adequate preventative measures are not undertaken. Surveyors and geologist in this department were prone to physical hazards like rock falls, heat and underground fires. They were also prone to underground gas explosions since they undertake much of their work underground.

Figure 4.1: Occupational Safety and Health hazards identified at Renco Mine

4.2.1 Health hazards identified in the mining department

Figure 4.2 indicates the proportions of physical, mechanical, chemical and psychosocial hazards that were identified at Renco Mine mining department.

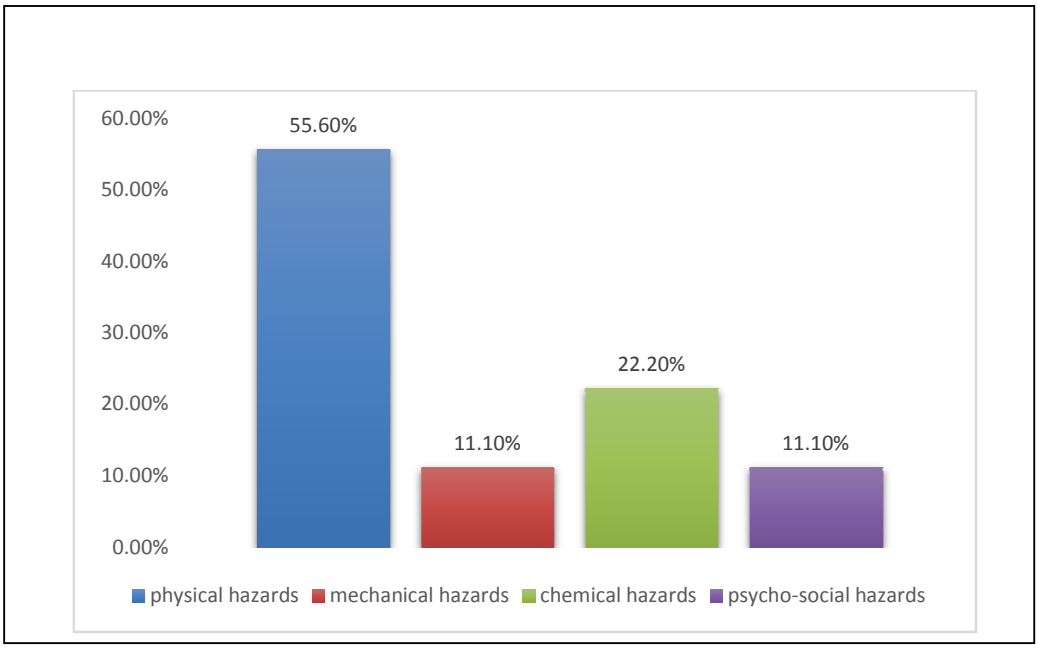

Figure 4.2: Health hazards identified in the mining department

About 55.6% of all the health hazardsthat were identified in the mining department were physical hazards. This shows that employees who work under the mining department were more prone to physical hazards than all other types of occupational hazards.Findings from questionnaires confirmed that physical hazards like dust and noise were the major health hazards affecting the underground miners. Most of the dust was generated during the blasting processes as well as during drilling and transportation of the mineral ore. Drilling was done using jackhammers and this process produces a lot of dust and noise. Underground moving equipment like locomotives and scrappers used for transportation of the ore generated a lot of dust if the ground is not wet and high noise levels which had the potential to cause a number of health effects to the exposed workers. Stanton *etal* (2001) notes that the largest quantities of airborne dust are often produced in a mine by blasting operations and mechanical mining systems including drilling, lashing, scrapping and loading. Poor lighting was also a health hazard to underground workers especially on night shifts. The underground working premises had no electric cables hence employees were provided with electric bulbs and batteries for use at night shifts for lighting. These bulbs cannot provide light for a great distance causing visual stress to employees which resulted in more accidents at this work place during night shifts. Heat was also a physical hazardaffecting the underground workers.Donoghue*et al* (2000) point out that heat and humidity are encountered in deep underground mines where the virgin rock temperatures and air temperatures increase with depth.

About 11.1% of the hazards that were identified in the mining department were mechanical hazards.Moving equipment like locomotives and scrappers that were used in taking out the ore had the ability to cause vibration problems to the users and other workers. Drillers were also more prone to mechanical hazards since vibrations were generated during the process of drilling. Chemical hazards accounted for about 22.2% of all the hazards that were identified in the mining department. Gases that were produced during the blasting process and underground chemical spillages had the ability to impart on employees' safety and health. Some of the employees confirmed that they were affected by occupational stress. Psychosocial hazards coveredapproximately 11.1% of all the hazards identified in the mining department. Respondents to questionnaires showed concern over job stress which had resulted from underground working conditions like low visibility, inadequate ventilation and heat.According to the American Psychological Association (2007) places of work may be the most important sources of health stresses if workplace operations have not been studied thoroughly and the associated health hazards have not been eliminated or controlled.

4.2.2 Safety hazards identified in the mining department

Table 4.4 represents the safety hazards that were identified at Renco Mine mining department. About 75% of all the safety hazards that were identified in the mining department were physical hazards whilst mechanical hazards only constituted almost 25%.

Table 4.4: Safety hazards identified at the mining department

Type of health hazard	**Percentage**
Physical	75
Mechanical	25

Findings from questionnaires revealed that underground rock falls threatened the lives of employees working under the mining department of Renco Mine. Explosives were used to break the rock and in the process a lot of broken rocks were released. These rocks had the possibility of resulting in injuries if workers trip or fall on them. Underground flooding and the water used for dust suppression created a slippery surface with the possibility of causing falls of employees resulting in injuries. Lehtinen and Joronen (2011) assert that there is a greater risk of slipping and tripping in underground operations due to wet conditions, poor

lighting and scattered rock fragments. Moving equipment like locomotives and scrappers that were used in taking out the ore had also the ability to crush or to produce wounds to the users and other workers.

4.2.3 Health hazards identified in the plant department

Figure 4.3 represents the types of occupational health hazards that were identified at Renco Mine plant department.

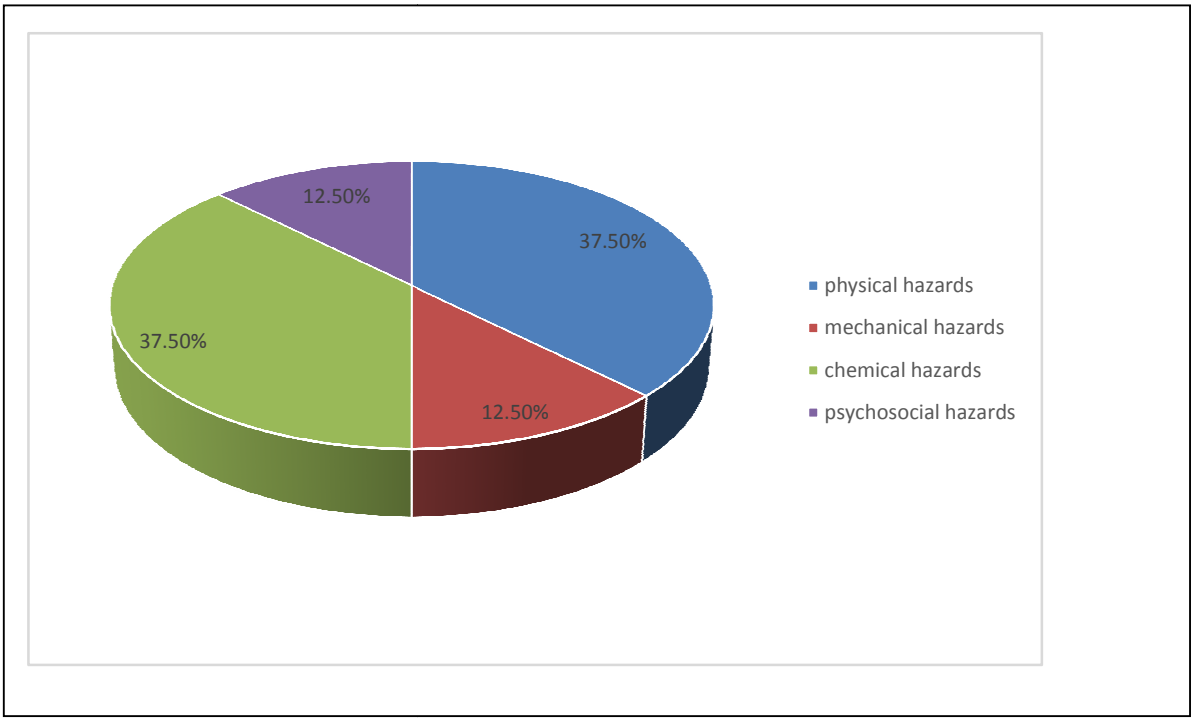

Figure 4.3: Health hazards identified in the plant department

About 37.5% of all the health hazards that were identified in the plant department were physical hazards. The plant area was a high noise area. Responses from interviews confirmed that high noise levels were produced during conveying and crushing operations. Donoghue (2004) highlighted that noise is ubiquitous in mining and it is generated by powerful machines, fans, blasting and transportation of the ore. Conveyer belts used in the plant area also generated a lot of dust. The dust originated at transfer points or when the conveyer belt experienced shakes when passing the idlers. Plate 1 shows the mineral ore containing a lot of dust in the plant area and a lot of hanging mining materials which contains sharp edges. Falling of those materials would result in severe occupational harm on the exposed employees. Large amounts of heat which were produced in the plant during crushing and smelting processes resulted in occupational health problems to the exposed workers.

Plate 1: Mineral ore with a lot of dust and hanging materials in the plant area.

Chemical hazards also constituted around 37.5% of all the hazards which were affecting the plant personnel. Carbon and cyanide were the chemicals used in mineral processing. Accidental spillages of those chemicals on skin or inhalation and ingestion of those chemicals resulted in health problems to the employees. Moran (2000) argues that chemical substances for example cyanide which is used as a solvent for metals like gold results in stomach, heart and brain problems as well as death. About 12.5% of all the health hazards identified in the plant department were mechanical hazards. Observations in the plant area revealed that employees lift up heavy equipment like pipes, spill bolts and 50 kilograms of crisp soda used in crushing and smelting processes. These employees were more prone to suffering from musculoskeletal problems. Psychosocial hazards constituted 12.5% of all the hazards found in the plant department. Findings from questionnaires revealed that occupational stress might endanger the lives of employees working under the plant department of Renco Mine.

4.2.4 Occupational Safety hazards identified in the plant department

Figure 4.4 indicates the proportions of physical and mechanical safety hazards that were identified at Renco Mine plant department. Mechanical hazards constituted a greater fraction of all the safety hazards that were identified in the plant department with 83% whilst physical hazards covered only 17%.

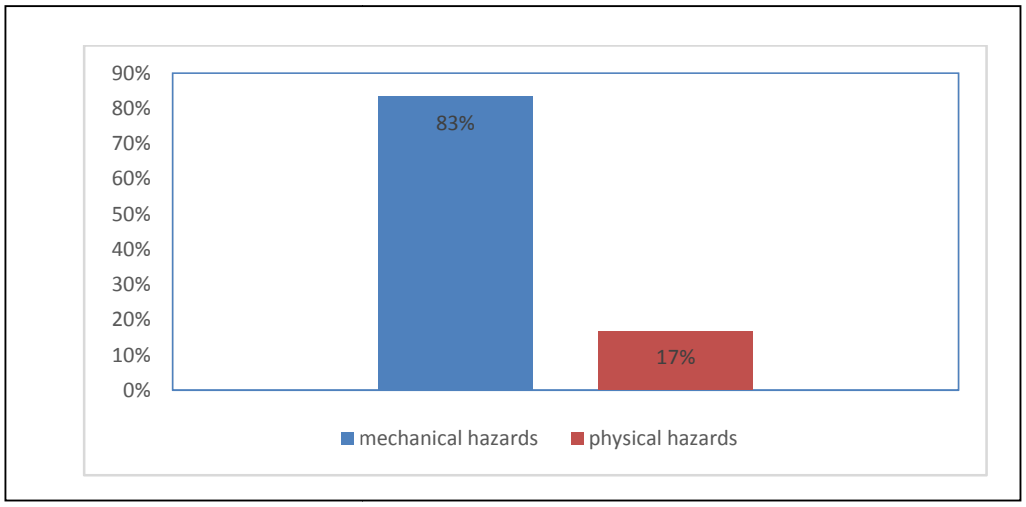

Figure 4.4: Occupational Safety hazards identified in the plant department

There were dangers of electric fires since high voltage equipment which were found in the plant areahad the potential to cause fire outbreaks. Harrison (2002) postulates that wooden roof support materials, the drive rollers and conveyer belts as well as naked electrical wires are the sources of fire ignition in mines. Plate 2 shows Renco Mine plant with naked electrical wires which might catch fire.

Plate 2: Renco Mine plant with naked electrical wires which might catch fire.

There were also dangers of being caught by crushers and conveyer belts in the plant department. Observations in the plant area revealed that employees use sharp edged materials like shovels in carrying out mining operations. Many machines used in carrying out mining tasks involve moving parts, sharp edges and hot surfaces which have the potential to cut, stab, and crush, struck or wound workers if used unsafely (Heyns *et al* 2000).

Observations in the plant area revealed that they were dangers of falling from heights since some of the employees carried out theirduties on top of the mining plant. They were also high chances of being struck by falling objects since some of the employees would be working on the surface whilst others on top of the plant as shown on plate 3.

Plate 3: Plant personnel working at heights and others on the surface.

4.2.5 Health hazards identified in the engineering department

Figure 4.5 shows the proportions of physical, chemical and mechanical hazards that were identified at Renco Mine engineering section.

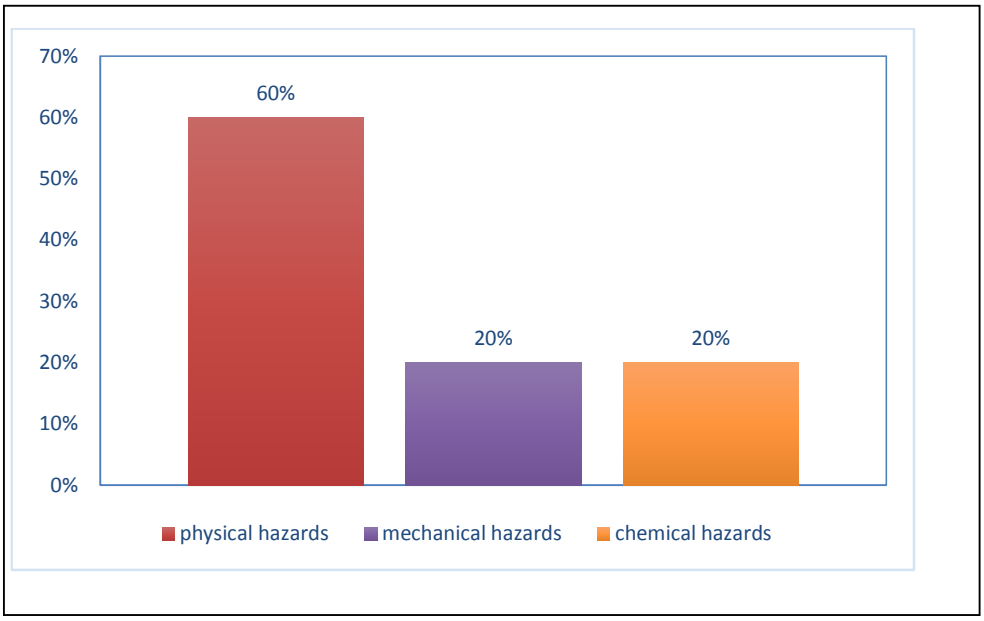

Figure 4.5: Health hazards identified in the engineering department

Physical hazards constituted the greatest fraction of all the health hazards that were identified in the engineering department with 60%. Exposure to welding fumes and ultraviolet light during welding threatened the health of boiler makers and fitters in the engineering section. On spot observations revealed that high noise levels were also generated in the engineering section during welding and other maintenance activities.Chemical and mechanical hazards were also other forms of workplace hazards that were identified in the engineering department. About 20% of all the health hazards identified in the engineering department were mechanical hazards. Lifting of heavy materials in the engineering section threatened the health status of those working under the engineering section.Chemical hazards also constituted almost 20% of all the hazards identified in the engineering section. Exposure to exhaust fumes, welding vapours and oil spillages used for lubricating mining equipment were the forms of chemical hazards affecting the engineering personnel.

4.2.6 Safety hazards identified in the engineering department

Table 4.5 shows occupational safety hazards that were identified at Renco Mine engineering department. Physical hazards covered a greater fraction of all the hazards that were identified in the engineering section with 60% whilst mechanical hazards covered 40%.

Table 4.5: Safety hazards identified in the engineering department

Type of hazards	**Percentage**
Physical	60
mechanical	40

Engineering personnel were prone to surface fires, electrocution and tailing dam failure. Mechanical hazards were from the use of sharp edged materials in the engineering department as shown on plate 4. These objects had the possibility of cutting or producing wounds to the exposed workers if they fall or stab on them. Vehicle accidents were also forms of mechanical hazards which threatened the lives of those working under the engineering section.

Plate 4: Some section of the plant area where boiler makers were carrying out maintenance work.

4.3 NATURE OF INJURIES

Interviews with the SHE manager of Renco Mine showed that accidents do occur every day but not all accidents are recorded at this working premise. Accidents which are recorded at this organisation were those which resulted in injuries whilst near misses were not recorded.

Findings from interviews indicated that about 32% of all accidents which occurred were near misses, 26% were first aid treatment cases, 22% were medical treatment cases as well as about 16% were loss time injuries. 2% of all the accidents that used to occur were fatal. Research findings also indicated that accidents of this type rarely occur at least once in two years and they mainly resulted from underground rock falls, trapping of employees in the tunnel and falling from heights in the plant area. Kazem (2012) notes that rock falls have historically been the leading causes of fatal accidents in mines.

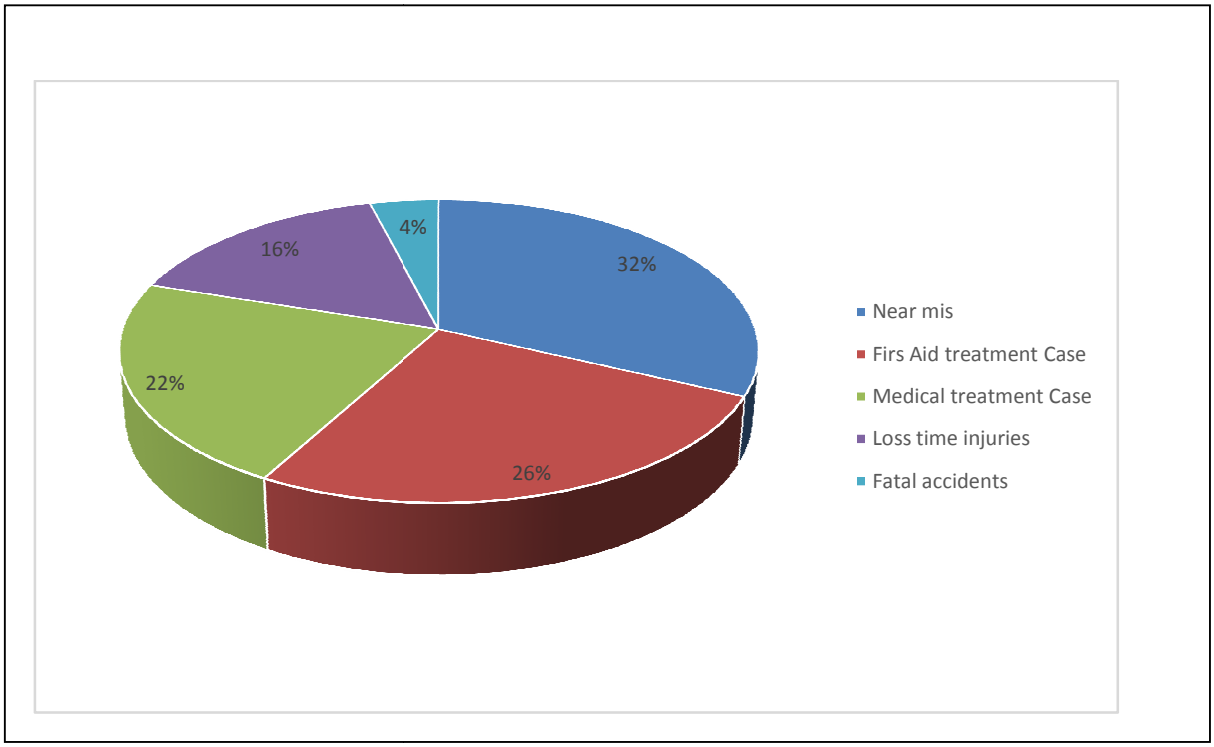

Figure 4.6: Nature of injuries at Renco Mine

4.3.1 Types of injuries identified among Renco Mine employees

Table 4.6 shows the types of injuries, their causes and employee body parts which were injured. Findings from questionnaires revealed that the use of sharp edged equipment, slipping and tripping on rocks, spillage of chemicals on skin and underground water spillages result in lacerations and contusions on hands, fingers, arm, knees and legs as well as on feet. Falls due to slippery surfaces and falling from heights result in fractures on employee legs, feet and hands. Research findings also revealed that the use of conveyer belts during gold processing result in amputations in palm and fingers of employees whilst electrocution and heat result in burns.

Table 4.6: Types of injuries, their causes and the body parts injured

Type of injury	Causes	Employee body parts injured
Burns	Electrocution Heat	Whole body
Contusion	Tripping on rocks Slipping on the mine surface Stuck by objects	Arm back knees hands legs head
Fractures	Falls due to slippery surface Fall from height Struck by falling objects	Hands Legs Feet
Amputations	Conveyer belt Struck by rocks Sharp objects like shovels	Hands fingers Palm
Lacerations	Rocks Sharp edged equipment Tripping and falls Slipping on the surface Contact with water flowing on underground mine surface Spillage of chemicals on skin	Hands Knees Legs Feet

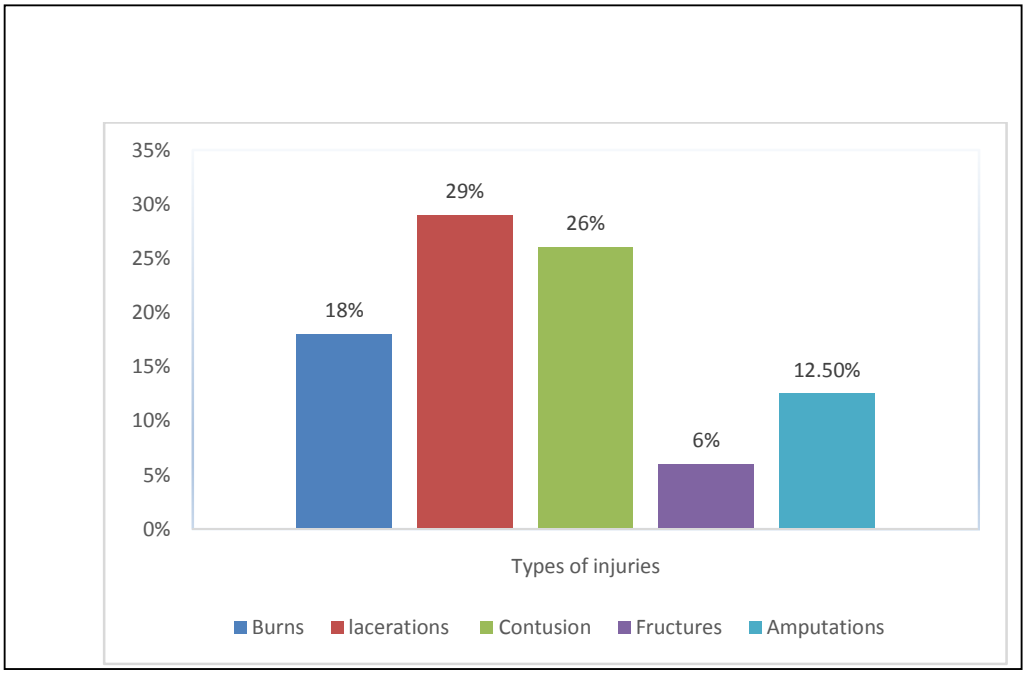

Figure 4.7: Types of injuries reported by Renco Mine employees

Figure 4.7 shows the percentage number of employees who have received medical treatment due to some forms of occupational injuries at Renco Mine. About 29% of all the respondents had received medical treatment due to lacerations on hands knees and legs, 26% suffocated from internal injuries in the back, legs, knees and arm whilst 12,5% received treatment due to amputations on fingers and palm. About 6% of the respondents had received medical attention on fractures on hands and legs whilst 18% have suffered from burns. Most of these employees were the miners and plant as well as engineering personnel since they used sharp edged mining materials, conveyer belts, tripping on underground rocks, slippery surfaces as well as falling from heights. These employees were also in high danger of being electrocuted especially boiler makers and fitters. They were also vulnerable to excessive heat from crushing and smelting processes as well as from underground working environment.

4.3.2 Types of illnesses affecting Renco mine employees

Gold mining is associated with a number of occupational illnesses to the exposed workers as indicated on figure 4.8. Findings from questionnaires revealed that Renco Mine employees were suffering from a number of illnesses with some of the employees confirmed of suffering from more than one illness.

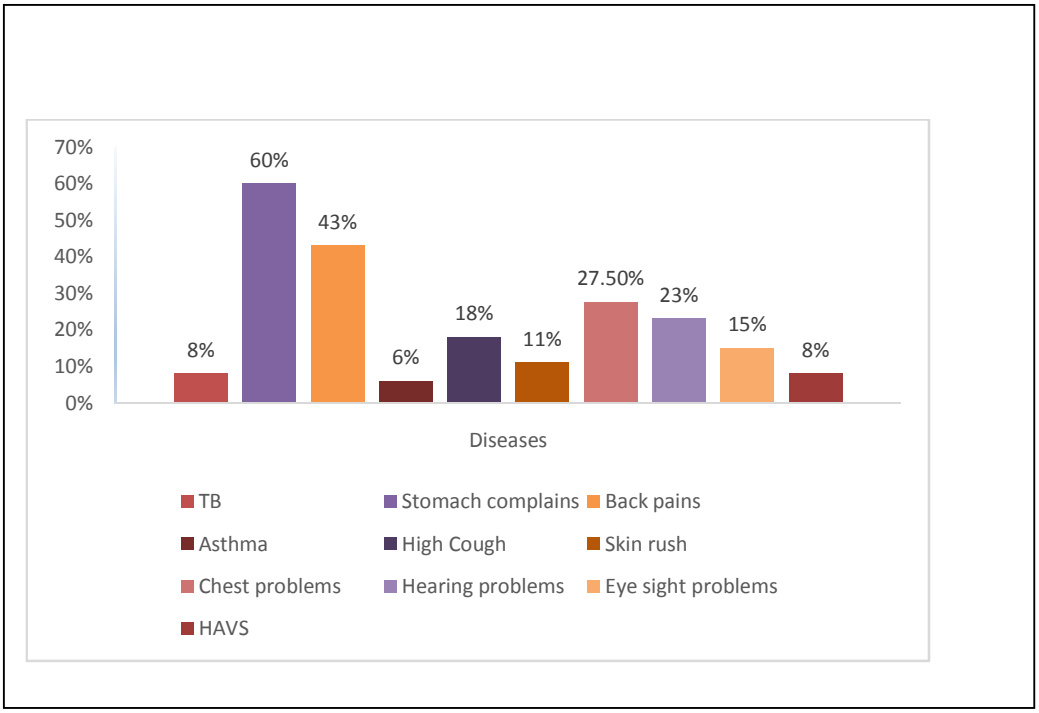

Figure 4.8: Occupational illnesses associated with gold mining

About 27.5% of all the employees who had been issued with questionnairesconfirmed that they were suffering from chest problems, 18% had problems of high cough. 8% of the employees had reported that they were suffering from Tuberculosis (TB), 11% on skin rash whilst 6% were suffering from asthma. High dust levels found in underground working premises and in the plant area was the causative agent of these occupational illnesses to most of the underground and plant personnel. Murray *etal* (2000) point out that exposure to airborne dust substantially increases the risks of TB infection to mine workers.High noise levels generated during welding, drilling, transportation, crushing as well as smelting operations can be blamed for causing hearing problems to around 23% of all the respondents. Amedofu (2002) notes that powerful machineries used in undertaking mining processes generates high noise levels which results in Noise-Induced Hearing Loss (NIHL) to the exposed workers. Almost 60% of all the respondents confirmed that they had received medical treatment as a result of stomach complains. Interviews with the SHE manager confirmed that stomach complains were caused by accidental swallowing of chemicals as well as occupational stress.Kusiak*etal* (1993) contend that an excess of mortality from stomach cancer has been found in Ontario gold miners due to exposure to arsenic, chromium, mineral fibres and diesel emissions. Jackhammers used in drilling operations and heavy equipment like locomotives and scrappers resulted in nearly 8% of the employees suffering from Hand- Arm Vibration Syndrome (HAVS) which had caused loss of sensitivity when touching on employees. 44% of the respondents confirmed of being suffering from back

pains. According to Heyns *et al* (2000), prolonged exposure to vibration lead to HAVS a chronic and progressive disorder that affects the vascular, neurological and musculoskeletal system. Findings from interviews revealed that activities like drilling operations required a lot of force to be exerted by the worker and therewere also lifting of heavy equipment in the plant area. These activities resulted in problems of back pains to most of the employees. About 15 % of all the respondents had problems of eye sight. Most of all the respondents who were associated with problems of eye sight were boiler makers and fitters since they were more exposed to ultraviolet light during welding as well as drillers due to their exposure to rock fragments.

4.4 MEASURES ADOPTED TO AMELIORATE OCCUPATIONAL INJURIES AND ILLNESSES.

In light of the occupational hazards associated with gold mining, the company of Renco Mine had endeavoured to formulate a number of preventative mechanisms in a bid to safe guard the lives and welfare of its workers. The company had employed a SHE manager who is responsible for managing all the safety and health issues of the organisation. The company had formulated a SHE policy which provided the steps undertaken by the company in reducing injuries, illnesses and fatalities in gold mining operations. It was the duty of the SHE department to identify hazards in all the working premises of the company and assess risks (testing their significance level) as well as formulating preventative measures.

Table 4.7: Assessment of risks at Renco Mine.

Significant level of hazards	**Description**
Non-significant hazards	These are hazards that might result in acute safety and health effects to the exposed workers.
Moderate	These are hazards that may result in some injuries and illnesses but the injuries are not as severe as those of significant hazards.
Significant hazards	These are hazards that result in critical injuries or death to the exposed workers.

There were accident registers in each and every department in which all the accidents that took place were recorded. This was in line with the General Regulations Number 263 of 1976 which required companies to have accidents registers and reports. The company had also appointed and trained OSH practitioners in each and every department. The appointments of OSH practitioners had been done in fulfilment of Statutory Instrument (SI) 68 of 1990 which requires companies to appoint SHE representatives for successful implementation of the SHE policy. OSH practitioners were responsible for hazard identification, provision of supervision to other employees on the steps to follow if a hazard is identified, reporting them to the SHE manager as well as recording all accidents occurred in that department. Findings from interviews revealed that the company's OSH issues were guided by the statutes OHSAS 18001 which aims at the achievement of zero occupational accidents at all workplaces through continuous improvements.

4.4.1 MEASURES ADOPTED TO REDUCE OCCUPATIONAL INJURIES

Occupational Safety and Health training

Table 4.8 represents the types of Occupational Safety and Health training courses and the percentage number of Renco Mine employees who had attended those training courses.

Table 4.8: Types of OSH training courses attended by Renco Mine employees.

Type of training	**Percentage**
Safety induction	100
BBS	86
Chemical handling training	42
SWPs training	88
First aid training	92

Findings from the research showed that all the employees had undergone OSH training. The company had adopted both competence and awareness training programs to reduce the number of employees who may be involved in occupational accidents that are associated with

gold mining activities. However, all forms of training provided to employees were on job training courses. All the respondents confirmed that they hadgone through safety induction training at the organisation. The SHE manager alluded that all recruited employees go through safety induction for two weeks prior to the commencement of work. Employees had undergone first aid training courses in which they were enriched with skills on how to provide medical assistance to those who may be injured during working operations before carrying the injured to the hospital.About 92% of all the respondents confirmed that they had gone through first aid training course. 88% of the respondents had undergone SWPs training, 82% BBS and 42% safe chemical handling training. Most of the respondents who confirmed that they had been trained on SWPs were from mining, plant and engineering personnel since they operated machinery like drillers, locomotives and scrappers. Machinery regulations 302 of 1976 requires employees who operate machinery to be trained hence the company is complying with this legislation. Employees who undertook drilling operations undergo drilling courses whereby they were being taught on how to operate drilling machines like jackhammers safely to reduce injuries that emanated as a result of using them. Chemical handling training was provided to those working within the management department and also to plant and engineering personnel.

Behaviour Based Safety (BBS) was also a form of training Renco Mine employees had undergone.Employees were taught on the dangers that might arise as a result of unsafe acts at the work place and therefore advocate for acts that are safe. Protective clothing provided to employees were used all the time provided the employeeswere at the working premises since failure could result in injuries or illness if an accident occur. In the same vein, all employees were prohibited to enter into confined space or a working premise if they were not sure if the environment is safe. Therefore, all workers took responsibility for their own health and safety.

Safe Work Procedures (SWPs)

Safe Work Procedures were meant to reduce OSH problems that can emanate as a result of improper following of operational codes of practices. Interviews with key informants revealed that the company had designed Safe Work Procedures and has embarked on awareness training campaigns to enlighten all employees on the proper job steps to be followed on specific tasks. Kazem (2012) states that occupational injuries and illnesses can be reduced by ensuring that employees understand and observe SWPs when operating

machineries. The company had made it mandatory that each and every employee should adopt Safe Work Procedures to reduce the dangers that might arise through using cross cutting procedures.

Safety meetings and talks

Table 4.9 represents the proportions of employees who had attended safety meetings and talks at Renco Mine.

Table 4.9: Percentage number of employees who attended SHE meeting and talks

Department	**Number of people sampled**	**Percentage of those who attended SHE talks**	**Percentage of those who attended SHE meetings**
Mining	54	100	18
Plant	15	100	48
Engineering	12	100	52
Management	39	100	60

Research findings indicated that safety talks and meetings were carried out by the organisation in creating an accident free work place. Safety talks were done fifteen minutes prior to the commencement of each and every work shift. These safety talks were held so as to remind workers to exercise safe work acts and to strictly follow the operational codes of practices. Table 4.9 shows that all the respondents were attending safety talks regardless of their operating section. Interviewees alluded that all workers were required to sign the safety talk attendants register. The SHE manager had the mandate to monitor the safety talks and not attending these talks will attract heavy punishments like retrenchments. Safety talks and meetings were held in fulfilment of SI 109 of 1990 which stipulates that safety meetings and talks are very vital in reducing injuries since personnel would stay abreast about their safety matters. The company employees made use of the safety complains book and suggestion books to log in their suggestions and complains in as far as safety and health issues were handled at the organisation. Their complains and suggestions assisted the company SHE department in making continuous improvements to the safety and health status of the

company hence reducing accidents at their work place. About 60% of the respondents in the management department confirmed that they had attended safety meetings, 52% from engineering, 48% in plant and 18% from the mining department. Safety meetings were being done once per month. These meetings were being attended by supervisors, SHE representatives and the company management.

Evacuation routes

Due to the fact that the underground working area was susceptible to roof collapse/rock falls and fires, the company had constructed multiple evacuation routes to protect the lives of exposed employees. Employees could easily get out of the mining premises if a rock falls and closes an entrance route of the mine using other entrance routes which are safe. Employees were also trained on the evacuation procedures to follow if a fire broke out on the working area.

Fire fighting equipment

Findings from field observations revealed that the company had set aside fire extinguishers to use in fire fighting. The company had put fire extinguishers of different sizes at all places which might experience fire outbreaks. Fire extinguishers were found at entrance of all offices, store rooms where explosives, carbon, crisp soda and cyanide and other mining equipment are stored, in engineering and plant area as well as on underground working premises. Field observations also revealed safety precautions on machinery and at working premises which might experience some hazards. This is in line with Electrical Regulations Number 304 of 1976 which call for the provision of safety signs on machinery and other electrical appliances.

Occupational Safety and Health auditing

Findings from interviews revealed that periodic OSH audits were done at Renco Mine by the company management and the Standards Association of Zimbabwe (SAZ). These OSH audits were done in quarterly phases totalling to four audits per year.

Table 4.10: OSH audits that were carried out at Renco Mine.

Period of the year	**Type of OSH audit**	**Rationale for auditing**
First quarter	Internal audit by the company management	This was done in a bid to identify the successes and failures of the company's SHE management programs as well as to adopt some management strategies for the attainment of the SHE policy.
Second quarter	External audit by SAZ	SAZ carried out this audit to find out if the company was complying with OSH standards as well as to find out the progress of the company in safety and health issues.
Third quarter	Internal audit by the company management	This was done in a bid to close up non conformities raised by the previous audits.
Fourth quarter	External audit by SAZ	This was done to review for continuous improvements.

Annual reviews of the company's SHE policy were carried out by the management of the company. These reviews were carried out so as to identify the effectiveness of the SHE policy and to make some amendments to the policy if necessary.

4.4.2 MEASURES ADOPTED TO REDUCE OCCUPATIONAL ILLNESSES

Underground ventilation

Air compressors were used by the company to suppress dust in underground operations and to aid in air supply. These compressors supplied air underground and removed used up air through a distribution network of hoses and underground pipes. Afro packs were sometimes

used by underground employees for air supply in cases where compressors failed to pump in adequate air. The company is complying with SI 288 of 1982 which requires employers to provide adequate ventilation to its employees. Some remnant rocks which stretched from the mine flow to the roof of the underground mine section were left to prevent the mine roof from collapsing.

Dust suppression

The company had resorted to control dust levels so as to reduce its safety and health effects to underground workers as well as to comply with SI 287 of 1982 which requires companies to formulate dust suppression mechanisms. The process of blasting was carried out whist workers were outside the mining area to allow the excess dust to settle. High velocity air was pumped in the mine to dilute the dust after the blasting operations a process known as dilution ventilation. Water was also sprayed in the underground working area to suppress all dust after blasting. Dust which was generated during drilling was reduced through injecting water in the drilling tunnels.

Occupational health monitoring

Findings frominterviews revealed that all employees are subjected to pre-employment medical exams. If a worker was found to have problems like headaches as well as cardiovascular problems, it implies that the chances of employability will be reduced. Therefore, the company could only employ those who were health. Periodic health check-ups were also done in order to identify the health problems that had affected the workers over their working period. They were done at annual basis to employees working in the plant, mining and engineering departments owing to their exposure to acids as well as high noise and dust levels. The company undertook medical check-ups on employees in fulfilment of the Public Health Act of 2002 which requires employers to carry out medical examinations on employees so as to know their health status. According to Murray *et al* (2000) medical monitoring is important for identifying diseases-causing jobs and work areas so that dust and noise reduction measures can be implemented.

The use of Personal Protective Equipment (PPEs)

Findings from observations revealed that the company provided safety clothes to its workers in a bid to reduce the risks associated with occupational hazards. Employees were provided with work suits and overalls for skin protection, helmets for head protection, gloves for hand

protection as well as gumboots and safety shoes for feet protection as shown on plate 5. Some other workers were also provided with goggles or glasses for eye protection.

Plate 5: Engineering personnel wearing their safety clothing.

The company provided PPEs to its workers in complying with SI 68 of 1990 which requires the employer to provide enough safety clothes to its workers. A walk through survey in the engineering and plant departments showed workers working without ear plugs, dust masks or filters and knee pads to those working in the mining section. In other ways the company was breaching SI 68 of 1990 since it is failing to provide adequate safety clothes to some of its workers in other departments.Interview with the SHE manager confirmed that safety clothes were provided to employees on annual bases. If an employee's safety clothes became torn to such an extent that they were not safe for use, the SHE manager would recommend that person so that safety clothes would be provided to him.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSION

Mining work is extremely dangerous regardless of its significance to socio-economic development. Its dangerous nature varies as per department in proportion to the nature of work, its location, types of machineries used as well as their quantity at that location and on the preventative measures put in place to reduce the effects of those hazards to the exposed workers. Most of the people who were more prone to occupational hazards were miners, plant and engineering personnel. This is because these people were more exposed to vast and huge machineries, chemicals and other physical factors like dust, rock falls and underground flooding which threatened their lives. Personnel who work under the management department were faced with the least probablehazards since they carried out office work most of the time which requires little movements and less machinery. It was also perceived during the research that physical hazards dominated a greater fraction of OSH hazards that were identified at Renco Mine in all the departments than all other hazards.

Occupational hazards that were identified at different departmental levels were found to have detrimental safety and health effects on the exposed employees. Lacerations, burns, fractures and amputations as well as contusions were found to be the types of injuries that threatened the lives and welfare of Renco Mine workers. It was revealed thatsome of the respondents had fallen victims to stomach problems, back pains, high cough, hearing, asthmatic, Tuberculosis, chest and eye sight problems as well as Hand-Arm Vibration Syndrome with most of the employees suffering from stomach complains as a result of occupational health hazards.

The company had embarked on Occupational Safety and Health training programs like safety induction, Behaviour-Based Safety, chemical handling, Safe Work Procedures and first aid training courses. Dilution, ventilation and water sprays were significant measures that were implemented by the company in dust suppression. Both internal and external auditing, medical fitness tests, safety meetings and talks were carried out at the company with the objective of creating an accident free work place. Personal Protective Equipment were also availed to workers though they are insufficient for employees in other departments. All these measures were adopted for the achievement of zero harm to employees of Renco Mine but however some casualties are continuing to occur.

5.2 RECOMMENDATIONS

Having synthesized the data extracted during direct observations, interviews and questionnaires as well as from the company SHE documents, it turn out to be clear to the researcher that there are some zones which call for the company management's attention if Renco Mine is to become an accident free workplace. The researcher therefore recommends that:

- Renco mine should provide adequate safety clothing to its employees. The company is currently providing safety shoes, overalls, work suits, helmets and gumboots. However, employees who work in noise environments like in engineering and plant should be provided with ear plugs for hearing protection. Those who work in the mining department need to be provided with dust muffs and knee guards. These safety clothes are vital in protecting the safety and health of the workers yet they were not present.
- It is also recommended that the company improves on underground lighting especially during night shifts. Lighting is fundamental since it reduces visual stress on employees and reduces high chances of accidents occurrences.
- Employees also need to be trained on the proper use of afro packs which have been set aside by the company for use in air supply in cases of emergency. This is because employees have proved to have inadequate knowledge on how they are being used in air supply.
- Renco Mine should also provide fluids at regular bases to plant and mining personnel since they are exposed to high levels of heat. Fluids will act as cooling systems hence reducing the chances of contracting occupational illnesses that may arise as a result of exposure to heat.
- The company should frequently change scrappers and washers used for mounting conveyer belts. This would reduce the amount of dust generated and released by conveyer belts since the use of defective scrappers and washers will result in large quantities of dust being generated.
- The company should also adopt off the job OSH training courses for SHE representatives and supervisors in all departments since this could increase their knowledge on hazard identification and control.

- Renco Mine Company should buy machinery for heavy workloads lifting to avoid manual handling. Failure to buy lifting equipment could result in more occupational health problems on employees.
- Employees were not reporting most of the accidents that occurred especially the minor ones because of fear of being retrenched. The company viewed most of the accidents as being caused by human error hence an employee's involvement in an accident is an offence. Therefore, it is recommended that the company management make improvements on how to handle workers who are involved in an accident for all the accidents to be reported.

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APPENDICES

APPENDIX A: INTERVIEW GUIDE FOR THE SHE MANAGER

1 How long have you been working at this company?

2 How do you establish safety management goals, objectives and targets at this company?

3 Are there any occupational hazards you have identified or witnessed throughout your working period?

4 How frequently are accidents occurring at this workplace?

5 Are those accidents minor, major or fatal?

6 Can you provide the nature of injuries and illnesses that emanate as a result of these workplace hazards?

7 What measures have you put in place to prevent OSH problems at this mining company?

8 What performance measures do you use to demonstrate the effectiveness of SHE management programs you have adopted?

9 Do you carry out safety and health auditing and safety talks?

10 What evidence is available to demonstrate that safety and health supervision at this company is effective?

11 What else can be done to protect the lives of workers at this company from occupational injuries and illnesses?

APPENDIX B: INTERVIEW GUIDE FOR THE GENERAL MANAGER

1 How long have you been working at this company?

2 Are there any forms of OSH complaints you had received from all the departments of Renco Mine

3 Are you aware of OSH hazards that employees are facing at this company?

4 Can you provide the types of these hazards and the departments which are being affected by those hazards?

5 Which department is affected most by these hazards?

6 What are the health effects on employees due to the prevalence of these hazards?

6 Have you ever encountered a huge accident at this company since you were employed here?

7 What were the effects of that accident to the workers involved and to the company as a whole?

8 What measures have you put in place to protect the lives of workers from these occupational hazards?

9 How do you demonstrate your commitment to the SHE management programs at this company?

10 Have all the employees attended OSH training?

11 What are your future plans in as far as OSH is concerned at this company?

APPENDIX C: INTERVIEW GUIDE FOR THE MINE CAPTAIN

1 How long have you been working at this company?

2 What conditions are favourable for blasting and why?

3. Which materials and chemicals are you using to break the rock?

4. Do these materials and chemicals have adverse safety and health effects to people who carry out that exercise?

5 What other types of OSH hazards workers are facing during blasting?

6 What safety and health effects came as a result of these occupational hazards?

7 What measures have been put in place to protect your lives from injuries and diseases caused by these OSH hazards?

8 What recommendations can you make in as far as safety and health issues are concerned that can help in protecting the lives of employees at this company?

APPENDIX D: INTERVIEW GUIDE FOR THE HUMAN RESOURCES MANAGER

1 How long have you been working at this company?

2 How do you understand by the term occupational accidents?

3 Have you ever noticed one before?

4 What were the effects of that accident to the workers involved?

5 Are you aware of any OSH effects that your colleagues are succumbing to as a result of working at a gold mine?

6 Have you ever heard of any OSH complains from workers at this company?

7 What are some of the measures that have been put in place to reduce occupational injuries and illnesses at this mine?

8 Have you ever attended OSH training since you were employed here?

9 What else can be done to achieve a safe and health workplace at this company?

APPENDIX E: QUESTIONNAIRE TO THE ADMINISTRATION DEPARTMENT.

My name is MunyaradziMutekede, a student at the Midlands state University doing an Honours Degree in Geography and Environmental Studies. I am currently carrying out a research on Occupational hazards, injuries and illnesses associated with gold mining at Renco Mine. You are required to assist in this research by providing your ideas. The information you provide will strictly be used for academic purposes only.

NB (TICK WHERE APPLICABLE)

SECTION A: Demographic information

1 Sex: ☐ Male ☐ Female

2 Age group

Below 30 ☐ 30 – 40 ☐ 41 – 50 ☐ 51+ ☐

3 Level of education

First degree ☐ Master's Degree ☐ PHD ☐

4. How many years have you been working under this department?

Five years and below ☐ 6 – 10 ☐ 11 – 15 ☐ 16+ ☐

SECTION B: Types of Occupational Safety and Health hazards

5 What are the major accidents and sicknesses that the company had faced?_____

_____

_____

_____

6 How do you identify OSH hazards at this mining company?_____

_____

_____

_____

7 What are the types of occupational hazards that you are facing?_____

_____

_____

8 State the types of chemicals that are being used in mineral processing_____

_____

9 If not properly handled do they have any potential adverse effects to the health of workers?

_____

_____

10 What materials are you using in undertaking the following processes?

Blasting_____

Drilling/hosting_____

b) State the occupational health problems that are arising from using these materials in mining processes._____

_____

_____

SECTION C: Nature of injuries and illnesses

11 May you please specify the types of injuries that you are facing as a result of the hazards you have identified above?_____

_____

_____

_____

b) What part of your body used to be injured?_____

_____

_____

12 May you please provide the types of diseases that you are suffering from as a result of working at a gold mine?_____

_____

_____

13 Are there any reported cases of communicable diseases? YES/NO

If yes specify the name(s) of the diseases_____

_____

_____

b) Are there any forms of preventative mechanisms of these communicable diseases?____

_____

_____

SECTION D: Measures that are put in place to ameliorate occupational injuries and illness

14 Are there any strategies that have been put in place to ameliorate the adverse effects of these hazards YES/NO?

b) If Yes specify the measures_____

_____

_____

15 Is the organization certified with OSH standards? YES/NO?

b) If YES provide the name of the standard(s)_____

If NO specify why_____

_____

_____

16 Do you attend safety and health training? YES/NO?

b) If YES specify forms of training you attended_____

_____

_____

17 How often are formal safety inspections done at this company?_____

_____

_____

18 What other ways can be introduced to control hazards so as to prevent work related illnesses and injuries._____

_____

_____

_____

THANK YOU

APPENDIX F: QUESTIONNAIRE TO THE MINING DEPARTMENT

My name is MunyaradziMutekede, a student at the Midlands state University doing an Honours Degree in Geography and Environmental Studies. I am currently carrying out a research on Occupational hazards, injuries and illnesses associated with gold mining at Renco Mine. You are required to assist in this research by providing your ideas. The information you provide will strictly be used for academic purposes only.

SECTION A: Demographic information

NB (TICK WHERE APPLICABLE)

1 Sex: ☐ Male ☐ Female

2 Age group

Below 30 ☐ 30 – 40 ☐ 41 – 50 ☐ 51+ ☐

3 Level of education

Non ☐ Primary ☐ secondary ☐ First degree ☐ Other ☐

4 How many years have you been working at this mine?

Five years and below ☐ 6 – 10 ☐ 11 – 15 ☐ 16+ ☐

SECTION B: Types of Occupational Safety and Health hazards

5 May you please specify name of your operating department?_____

6 Are there any occupational hazards that you are facing? YES/NO

b) If yes specify the types of those occupational hazards_____

_____

_____

7 Which materials are you using in drilling and taking out the ore?_____

_____

8 Do you suffer from the effects of noise and dust during this process? YES/NO

b) If Yes please state them_____

_____

9 Do you suffer from heat related stress at your working premises? YES/NO

SECTION C: Nature of injuries and illnesses

10 Have you ever suffered from any OSH problem since joining this company? YES/NO

If YES please specify the name of the disease(s)_____

_____

11 Are there any fatal accidents that you have witnessed since you were employed? YES/NO

b) If yes specify the causes of such accidents_____

b) How frequently are accidents of this type occurring?_____

12 What other health effects emerge from these hazards?_____

_____

_____

13 Are there any occupational health diseases that have started during your working period? YES/NO.

SECTION D: Measures that are put in place to reduce workplace injuries and illnesses.

14 Are there any forms of safety and health training that has been provided to you at this company?_____

15 Are there any forms of medical check-ups done to you? YES/NO

b) If yes how frequently are those check-ups done?_____

16 Have you ever attended safety and health meeting? YES/NO

b) If YES how many times per week?_____

17 Are there any OSH signs in your operating departments? YES/NO

18 Suggest other measures that can be put in place to safe guard the lives of workers at this mining premise._____

_____

_____

_____

THANKYOU

APPENDIX G: QUESTIONNAIRE TO THE ENGINEERING AND PLANT DEPARTMENTS.

My name is MunyaradziMutekede, a student at the Midlands state University doing an Honours Degree in Geography and Environmental Studies. I am currently carrying out a research on Occupational hazards, injuries and illnesses associated with gold mining at Renco Mine. You are required to assist in this research by providing your ideas. The information you provide will strictly be used for academic purposes only.

SECTION A: Demographic information

NB (TICK WHERE APPLICABLE)

1 Sex: ☐ Male ☐ Female

2 Age group

Below 30 ☐ 30 – 40 ☐ 41 – 50 ☐ 51+ ☐

3 Level of education

Non ☐ Primary ☐ secondary ☐ First degree ☐ Other ☐

4 How many years have you been working at this mine?

Five years and below ☐ 6 – 10 ☐ 11 – 15 ☐ 16+ ☐

SECTION B: Types of Occupational Safety and Health hazards

5 What do you understand by the term occupational hazards? _____

_____

6 What are some of the hazards you have noticed since you were employed here?_____

_____

_____

7 Which chemicals are you using in mineral processing?_____

8 Have you ever been faced with dangers of electric fires at this work place? YES/NO

9 Which materials are you using in carrying out your day to day mining activities?_____

_____

SECTION C: Nature of injuries and illnesses.

10 What are the occupational safety and health problems that can arise as a result of using these materials and chemicals in gold mining?_____

_____

11 Do you have difficulties in hearing? YES/NO

12 Have you ever suffered from respiratory problems? YES/NO

13 Have you ever received medical treatment on any of the following diseases during your placement at this company?

Stomach complains_____

Silicosis_____

Neck or back pain_____

Cardiovascular diseases_____

14 Have you ever received medical treatment due to occupational injuries at this workplace? YES/NO

b) If YES please specify the nature of those injuries_____

_____

SECTION D: Measures that are put in place to ameliorate occupational injuries and illnesses

15 What measures are adopted by the company to protect you from these injuries and illnesses?_____

_____

_____

16 What forms of OSH training have you attended?_____

_____

17 Are there any OSH signs in your operating sections? YES/NO

18 Have you ever attended any OSH talks? YES/NO

19 Do you think the measures that are put in place in your operating departments to deal with OSH problems are adequate to deal with the scale of the problem?_____

_____

20 Suggest other measures that can be employed to reduce occupational injuries and illnesses at this work place._____

_____

_____

THANK YOU

APPENDIX H: OBSERVATION CHECKLIST

Types of Occupational Health and Safety hazards

HAZARD	YES/NO	COMMENT
Safe access to work area		
Struck by a moving or falling object		
Falling from heights		
Slips, trips or falls		
Use of sharp objects		
Dust		
Noise		
Vibrations		

Measures that are put in place to ameliorate occupational injuries and illnesses

MEASURES	YES/NO	COMMENT
Adequate provision of PPEs		
Correct use of PPEs		
Safety signs on machinery		
Safe handling		