

**ASSESSMENT OF OCCUPATIONAL SAFETY AND
HEALTH STATUS IN SELECTED SAWMILLING
INDUSTRIES IN NAKURU COUNTY, KENYA**

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(Occupational, Safety and Health)

**JOMO KENYATTA UNIVERSITY OF
AGRICULTURE AND TECHNOLOGY**

2019

**Assessment of Occupational Safety and Health Status in Selected
Sawmilling Industries in Nakuru County, Kenya**

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**A thesis submitted in partial fulfillment for the Degree of Master of
Science in Occupational, Safety and Health in the Jomo Kenyatta
University of Agriculture and Technology**

2019

DECLARATION

This thesis is my original work and has not been presented for a degree in any other University

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DEDICATION

I dedicate this piece of work to the following dear ones. To my parents; My wife Lilian Kerubo, My Father, Mr. Zebedeo Mong'are Nyaanga and Mother, Mrs. Mary Kwamboka, brothers and sisters, relatives, friends who assisted in diverse ways to make this work and my studies in general a success. Finally, I dedicate this piece to Mrs. Elizabeth Mibey and Esther Moraa for their moral and spiritual support and encouragement.

ACKNOWLEDGEMENT

I would like to express my sincere gratitude to Prof. R. Kinyua Director, Institute of Energy and Environmental Technology for allowing me to undertake this work.

I am grateful to my supervisors Mr. Charles Mburu (Institute of Energy and Environmental Technology (IEET), JKUAT) and Professor Ciira Kiiyukia (Medical School, Mount Kenya University, Thika) for reviewing this thesis and for their valuable support and continuous encouragement in preparation of this scientific research. I would like to thank them very much for their supervision, guidance and assistance throughout the work of this thesis.

I wish to express my gratitude to the following Kenya Forest Service (KFS) for their support during field survey work in Nakuru County: Mr. John N. Kihara, Mr. Stephen Mugi.

I also wish to acknowledge the personnel of the sawmill industries for their valuable assistance and back-up in collection of the data on sawmilling in Nakuru County.

I would also like to thank my friends from the Institute of Energy and Environmental Technology (IEET), JKUAT batch 2013 and my friend Justin Ondati Makori for their help throughout the study.

Last but not least, I would like to express special appreciation and gratitude to my family: my wife Lilian Kerubo for all her love, care and unfailing support and encouragement, without which this thesis would not have been accomplished; and my Parents –My father Zebedeo Mong'are and my Mother Mary Kwamboka for their constant help and encouragement, even during the tough days. Without them my work and life would not have the meaning it has now or in the future.

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LIST OF ABBREVIATIONS AND ACRONYMS

BLS	America Bureau of Labor Statistics
dB (A)	decibels A network weighting
DOSHS	Directorate of Occupational Safety and Health Services
FITC	Forest Industrial Training Centre
HAV	Hand-arm vibration syndrome
HAV	Hand-arm vibrations
IFC	International Finance Corporation
ILO	International Labour Organization
KEFRI	Kenya Forest Research Institute
KFC	Kenya Forestry College
KFS	Kenya Forest Service
MENR	Ministry of Environment and Natural Resources
MF&W	Ministry of Forestry and Wildlife
MFA	Ministry for Foreign Affairs of Finland
NIHL	Noise induced hearing loss
NIOSH	National Institution of Safety and Health
NSSA	National Social Security Authority
OSHA	Occupational Safety and Health Act, 2007 Kenya

PPE	Personal Protective Equipment
SAZ	Standards Association of Zimbabwe
SHE	Safety, Health and Environment
SPSS	Statistical Package for Social Sciences
TLV	Threshold Limit Values
TMA	Kenya Timber Manufactures Association
WHO	World Health Organization

ABSTRACT

Working in sawmills has been identified as one of the most dangerous occupations even in countries with high levels of compliance with occupational health and safety regulations. The main objective of the study was to assess occupational safety and health status of workers in selected saw milling industry in Nakuru County. The study employed a cross sectional analytical design which included a walk-through survey. The study targeted 9 sawmills with a population of 11029 employees, from which a sample of 386 respondents was drawn via a two-stage sampling technique. The first stage involved sampling the number of saw mills in the four town centres (Njoro, Elburgon, Molo and Nakuru). The second stage stratified sampling involved taking a simple random sample from each stratum represented by different categories of workers. Stratification and random sampling procedure was used to select workers from sawmilling industries in Njoro, Elburgon, Molo and Nakuru towns of Nakuru County. The researcher collected primary data using a questionnaire while secondary data was collected through existing literature relevant to the current research topic under study. Quantitative data was analyzed using descriptive statistical tools namely frequencies, percentages and mean while inferential statistical tools such as correlation was used to determine and explain variable relationship; through SPSS Version 22 computer program. Semi-structured questionnaires were used to assess the workers' understanding on occupational safety and health, training needs, accidents and safety controls at work place. Management commitment to safety and health and legal compliance was determined through observation of records kept and use of the checklist. From the findings, Most sawmill workers are usually males and in the active age group due to the demands of the work; a study carried out in Kenya had more than sixty percent of his respondents to be males. Wood dust (81%) and noise (82%) were reported as a major hazards by almost all of the sawmill workers in this study. Workers were not adequately provided with protective face shields (16%), nose masks/respirators (46%), earplugs or muffs (21%) and helmets(44%). Further, majority of the respondents encountered accidents at the sawmill workshops and production areas at 45.1%. Those who encountered accidents, the majority 31.4% had laceration injuries followed by the bruises at 10.8%. 45% agreed that both worker and Sawmill owners were responsible for safety at work. 72% indicated they use sawdust for agricultural uses and animal bedding while 85% burns waste paper. 93.8% of the workers were exposed to noise levels of 90 dB (A) and above for more than 8 hrs daily. 90.6% of the workers are aware that noise can cause deafness and 88.8 % of the workers were aware that it can be prevented. The causes of accidents in the places of work were lack of training at 43%, carelessness and ignorance at 23%, lack of personal protective equipment at 19% and Spillages at 15%. This study concluded that sawmill workers exposure to wood dust and machine as hazards was high but usage of personal protective equipment was however very low. Sawmill sites visited in this study were observed to carelessly heap wood dust/shavings in open spaces. Accumulated wood dust particles are easily combustible and can cause fire explosion. The most common injuries and illnesses in sawmills were bruises and lacerations which result from improper usage of machines, obsolete and faulty machines with most of the safety guards removed or non-functional, lack of safety and health trainings, carelessness and nonuse of Personal Protective Equipment. The safety control measures and safety management systems are not adequately in place. Adequate measures should therefore be put in place to mitigate against these hazards in sawmills, especially by the employers.

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Over the years the forestry and wood products sectors have contributed immensely to the socioeconomic development of many developed and developing countries. While hundreds of thousands of people are directly employed in sawmills where raw logs are processed and converted to wood timber in countries endowed with forest resources, almost equal numbers are indirectly employed in other sectors that either further process the wood into other products, or make use of processed woods worldwide Dhubhain *et al.* (2008). Kenya has a total of 633 pre-qualified saw millers spread all over the country. This includes 30 large sawmills, 65 medium sawmills and 538 small saw millers (KFS, 2010/2011). Most sawmills are located in the Rift Valley, Central, Eastern and Western regions of Kenya and they are mostly privately owned (MF&W & MFA, 2008). In the Rift Valley, majority of the saw mill industries are in the wood producing Mau forest areas in Nakuru County. The largest concentration of sawmills is found in Njoro, Elburgon, Molo and Nakuru town. The guaranteed log supply is a major factor in the location of sawmilling industries in the mentioned areas in the County. According to KFS (2008), prequalification inspection report, there were 276 registered sawmills in Kenya. Out of these 276 registered sawmills, 37 are operational (large 8, medium 7 and 22 small) licensed saw mills found in Nakuru County.

Mbaabu *et al.* (2008) have explained the sawmill sizing and classification criteria in their prequalification inspection report of the Kenyan sawmills. They indicated that Kenyan sawmills have been categorized into three different size categories as follows:

- i. Large-Scale sawmill is a sawmill that has over 20m³ of daily production.
- ii. Medium scale sawmill has a daily production of between 10-20 m³ per day.
- iii. Small-scale sawmill is a saw mill with less than 10m³ of daily production.

Sawmill business is a thriving business in Nakuru County because of the availability of timber as well as the current high demand for the product in the local market that has recently developed in the country. Many of the firms belong either to the small or informal sector. The informal small sawmills are characterized by one to five casual employees on a good day while the registered bigger sawmills have five to ten employees Forestry Statistics (2003). The bigger saw miller employers sometimes subcontract the informal ones. The most important wood products, produced, consumed and traded in the county are sawn-wood, plywood, wood panels printing and writing paper and paper boards Forestry Statistics (2003).

In Nakuru County the tree species mostly used for timber and pole production include; *Conferees. Lusitanica* (Cypress), *Eucalyptus grandis* and *Pinuspatula*. Technology used in the industry varies from old and obsolete methods to the “state of the art” technology (for example as used in plywood manufacturing and sawmills). Majority of small-scale saw mills however have old and inefficient machinery, where tractor engines, electric motors and saws are mostly used, and where labour intensive methods are used in logging and loading timber(Kenya Forest Service, 2009).. After logging, the timber is graded and seasoned before being sold.

The nature of the work done by workers in these occupations and the types of equipment and materials they handle present many on-the-job hazards. These hazards and injuries result from such incidences as: being caught-in or struck by machinery, falling from height, heavy lifting or repetitive movements, twisting or reaching, and inhaling noxious or toxic chemicals (James, 2001). Besides the hazards inherent in this occupation, there are the un-favourable weather conditions and noise pollution that is injurious to human health. (Judd *et al*, 2004). Human factors, which acts upon the working capacity and the daily production efficiency, include the individual characteristics such as sex, age, body-size, physical fitness, nutritional and state of health (Aiyelari *et al*, 1998; Jekayinfa, 2007).

It has also been observed that psychological, cultural, economic, technological and organizational factors also act upon man's working capacity and production (Lehman, 2009). There is need to have precise knowledge on the subject and the various exposure levels need to be measured and monitored. As noted by Comlan *et al.* (2007) in their study of wood processing enterprises in Gabon, the lack of a prevention policy for the wood sector and occupational risks constitute an acute actual public health problem. They suggested that registration and research, being the main source of information on work accidents and occupational diseases should be improved.

1.2 Statement of the problem

Timber sawing is one of the occupations that provide raw materials to the building construction, furniture, paper and wood making industries. This very essential industry has offered employment opportunities to many people. It has also improved their economic status and projects the works of other sectors of the economy that depend on the timber raw materials. This industry is however being threatened by occupational hazards causing discomforts in the operations, tampering with efficiency and continuity in the business. From available literature on occupational safety and health in sawmills, majority of sawmills are privately owned (Ludeki, 2007). Like other enterprises, privately owned sawmills are driven by profit making at the expense of incurring costs on training and improved work environment for viable production operations (Kiuru, 2009). Additionally, a number of sawmills have no updated data bases for their workers, basic and vocational training and experience levels. As a result, lack or absence of training and competence on improved sawing has led to increased exposure to hazards and health issues. Similarly, most sawmills have no capacity to continually train their workers to adopt to changing techniques in sawmilling at individual levels (Otalala, 2008). Moreover, the ILO (2008) posited that sawmill workers suffer 270 million accidents and at least 335, 000 fatal injuries annually. As well, there is inadequate implementation of institutional and legal governance frameworks on occupational health and safety in developing countries leading to little or minimal impact (Cotton *et al.*, 2005). This has led to millions of employees dying due to injuries

and falling ill every year because of workplace hazards. Further, high noise levels in sawmill industries have resulted to hearing losses (European Agency for Safety and Health at work, 2012). Further, lack of training procedures and occupational exposure to ergonomic hazards in the wood processing industries result from lifting weights and uncomfortable posture during working hours (Adei & Kunfaa, 2007). It is in view of the aforesaid issues in the saw milling industry that this study is embarked upon to assess the status of occupational safety and health in sawmilling industries in Nakuru County.

1.3 Objectives

1.3.1 Main Objective

The main objective of the study was to assess occupational safety and health status of workers in selected saw milling industry in Nakuru County.

1.3.2 Specific Objectives

- i. To analyze safety and health hazards and resulting injuries or ill health that employees are exposed to in saw milling work places in Nakuru County.
- ii. To assess the employers' and workers' knowledge and awareness in recognizing safety and health hazards and unsafe work practices in sawmilling work places in Nakuru County.
- iii. To evaluate the control measures and safety practices put in place in managing safety and health hazards and workplace risks in sawmilling workplaces in Nakuru County.

1.4 Research Questions

The study seeks to answer the following questions:

- i. What are the safety and health hazards employee and others are exposed to in the in sawmilling workplaces in Nakuru County?

- ii. How is the level of awareness of personnel involved in timber sawmilling in recognizing hazards and unsafe working practices in sawmilling workplaces in Nakuru County?
- iii. What measures have been put in place by employers and employees to manage safety and health hazards and workplace risks in sawmilling workplaces in Nakuru County?

1.5 Significance of the Study

The findings of this study will be vital to the government agencies and other stakeholders in occupational safety to prioritize safety in the wood processing industries in Kenya. This is because they provide large numbers of jobs and have the potential to significantly improve livelihoods in rural areas, where the opportunities for work are known to be less than in urban areas. Therefore, the findings of this study will also be beneficial to the saw mill employees, their families, communities and the saw mill industries because enhanced safety and health will reduce injuries and costs incurred. It is expected that this study will assist in ensuring compliance to legal requirements by the sawmill industries in guaranteeing safe and healthy working conditions for the workers including an adequate regime for their rest. Researchers in occupational safety will also use the findings as a reference material for further studies.

1.6 Study Scope

In Kenya, sawmills size is distributed between large: medium: small scale in the proportion (30, 65 and 538 respectively (KFS Conservancy Map Annual report, 2010/2011, 19).As a result of these very high variations, the scope of this study cover the following categories: Chain saw operators (loggers), Log transporter drivers, Mechanics, Sawmill machine operators and Employer's managers in small sawmill industries in Nakuru County.

1.7 Limitations of the Study

The study experienced limitations mainly on time. This was mitigated through the engagement of research assistants who assisted in data collection hence saving time. Accessibility to some of the saw mill managers posed a challenge since majority of the representatives accessible were a bit reluctant. The researcher used the research introduction letter to convince them that the information was meant for academic purposes only and that it was confidential.

1.8 Conceptual framework

The most basic of ethical principles deals with avoiding doing harm to others. It has been an unfortunate but common occurrence however, for these moral codes to be kept in the realm of personal codes, and not always applied to business dealings. Clearly, creating a healthy workplace that does no harm to the mental or physical health, safety or well-being of workers is a moral imperative (WHO, 1999).

All organizations and institutions are in business to be successful at achieving their missions. All these workplaces require workers in order to achieve their goals, and there is a strong business case to be made for ensuring that workers are mentally and physically healthy through health protection and promotion. Sawmill jobs are hazardous and take place in settings which are both unhealthy and unsafe. Such work environments can expose the workers who work in them to environmental diseases, manual, tools and equipment hazards, traffic accidents, fire hazards, crime and assault and weather-related discomfort. The framework in Figure 1.1 represents the necessity of Health and Safety Interventions.

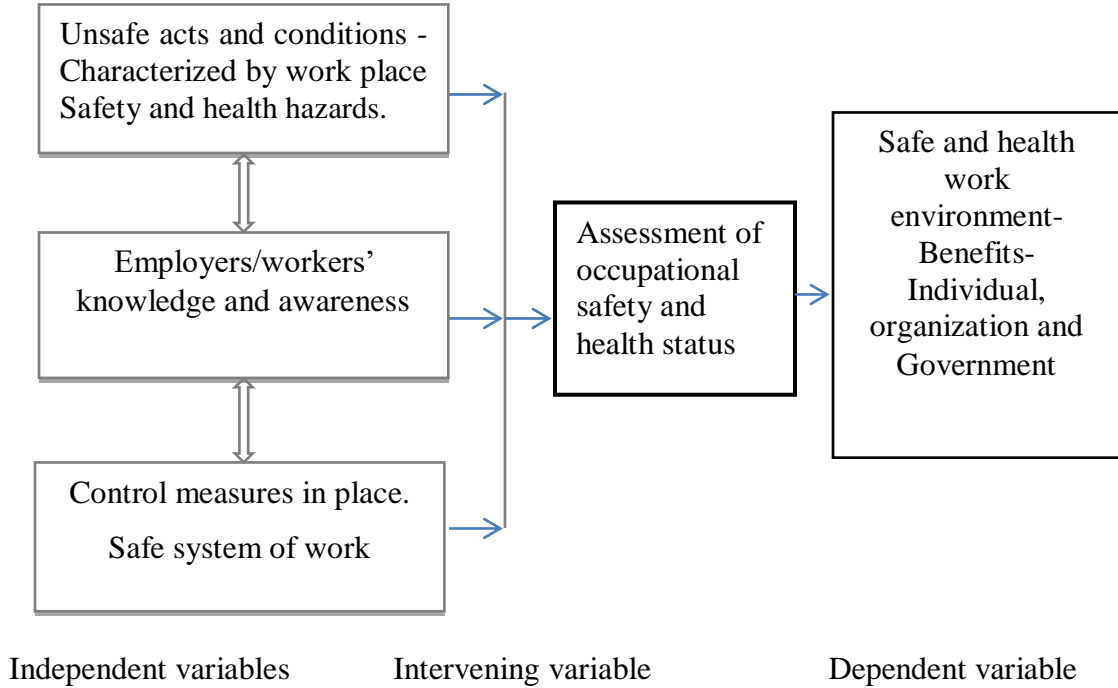


Figure 1.1: Conceptual framework

From figure 1.1 above whenever people are carrying out work, they will have accidents because they can be working in an unsafe manner and not realise. Training them improves their own hazard awareness and promotes a safe system of work. A safety and health intervention create a conducive environment for workers and helps them to relate freely. This reduces hazards and risks to individuals and the resulting effects on their families and the society at large. A central belief in most of the occupational safety and health promotion literature is that people perform better when they are physically and emotionally able to work and want to work, which in turn leads to higher productivity, which can lead to higher profits.

The effectiveness of human resource depends on the organizational climate and relationships as well as strategies put in place to ensure their wellbeing. The productivity of individuals and organizations plays a vital role in determining the Gross Domestic Product of countries. This is because the individuals and organizations will be in the position to pay taxes to support government development projects. This research study on the assessment of occupational Safety and health status of registered and informal saw mill industry will help reducing accidents, incidents and government expenditure on health and consequently reducing rates of mortality.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Though industries have been established to meet various human needs since the dawn of civilization, some if not all pose detrimental effects on the health of man. Efforts on awareness and international concern of the problem of occupational diseases and accidents remain modest globally as 160 million people are affected by avoidable occupational diseases annually (Ochire *et al.*, 2014). It is estimated that more than 2 million workers die each year from work related accidents and diseases (Bello, 2010). Also, the International Labour Organisation (ILO) estimates that workers suffer 270 million accidents and at least 335, 000 fatal injuries annually International Labour Organization (2008). The wood and timber related industries are however not exempted in terms of the degree of health hazards they pose to workers. Industry-related accidents and environmental hazards can cause death, disease, and injury. Work-related accidents induce enormous emotional and financial costs to families and to society. Since the human and economic costs of occupational accidents and diseases remain high, it requires concerted efforts to handle them.

In 1992, the United States of America Bureau of Labor Statistics reported that logging in Columbia Parkway had a workplace injury rate of more than 14,000 injuries per 100,000 full-time workers compared with 8,000 per 100,000 for the total private sector (BLS, 1994). Workers' compensation data showed that injury events causing lost workdays were very similar to those that caused fatal logging injuries (Myers & Fosbroke, 1994); the four occupational groups that accounted for the most logging fatalities also accounted for the most workers' compensation claims - 79% (NIOSH, 1995).

In Italy, the wood processing industry in general rates as one of the most hazardous occupations Colman *et al.* (2007). Rotating devices, cutting or shearing blades, in

running nip points, and meshing gears are examples of workplace injuries, while crushed hands, severed fingers, amputations and blindness are typical wood working accidents (Boy 2002). Colman *et al.* (2007) added to the hazardous wood working, high noise levels from operating machinery, dust conditions and work related musculo-skeletal disorders from repetitive movements that are likely to affect health of employees.

2.2 Theoretical review

2.2.1 Legislation and Enforcement of Health and Safety Regulations

Cotton *et al.* (2005) noted that the institutional and legal governance frameworks on occupational health and safety in developing countries have little impact. Most of the organizations are small and medium enterprises operating within their domestic markets where enforcement of health and safety standards and labour standards is very lax. Enforcement of health and safety regulations remains a problem due to lack of adequate resources available to government institutions responsible for occupational health and safety administration. Also, there remains an acute need for contract provisions to support the enforcement of labour laws in developing countries SE (2008).

According to the preamble to the ILO constitution of 2007, the protection of the worker against sickness, diseases, and injury arising out of his employment is a precondition to universal and lasting peace (ILO, 2007). As a result, millions of employees die, are injured and fall ill every year because of workplace hazards. It has been reported that 250 million work related accidents occur every year worldwide. With these tragedies, the means of action used by ILO to promote occupational health and safety include International Labour Standards, Conventions, and Codes of practice, provision of technical advice and the dissemination of information (ILO, 2009). The ILO has adopted more than 40 standards and over 40 codes of practice specifically dealing with occupational safety and health. Occupational Health and Safety Convention 1981 (No 155) and Occupational Health Services Convention 1985 (No 161) that covers the concept of occupational safety and health are the other conventions that are concerned

with the protection of employees against risks and hazards as well as convection on safety and health branches of economic activities.

Others include the convention on 2006 Promotional Framework for Occupational Safety and Health (No 187), (Alphonse, 2008). The protection of employees against hazards and risks at work remain a fundamental human right and as such the right to safety and health at work is enshrined in the United Nations Universal Declaration of Human Rights 1948, which states that, 'Everyone has the right to work, to free choice of employment, to just and favourable conditions of work.' The United Nations International Covenant on Economic, Social and Cultural Rights of 1976 reaffirms this right in the following terms.

The state parties to the present covenant recognize the right of everyone to the engagement of just and favourable conditions of work which ensure safe and health working condition' (NSSA, 2008). The Seoul declaration, approved with a strong unanimous endorsement, was signed at the World Summit by a total of 46 leaders. The Seoul declaration state that a safe and health, working environment should be considered as a fundamental human right and it encourages government to consider ratification of the ILO Promotional Framework for Safety and Health Convention, 2006 (no 187) as a priority, (Hope, 2009). Safety and health are basic human rights to be enjoyed by all employees throughout the world.

These can be enjoyed through formulation and implementation of national health and safety legislation and the adoption of international safety and health standards. Zimbabwe has adopted the following conventions: (C155) Occupational Health and Safety, (C161) Occupational Health Services, (C162) Safe use of asbestos and (C176) Safety in mines (Occupational Health Services Convention, 1985). Zimbabwe national laws that cover occupational health and safety include NSSA Statutory instrument 68/90 accident prevention and workers compensation with particular emphasis on the duties of the employers and workers in accident prevention; the Pneumoconiosis Act which clearly stipulates the need for medical examination for all workers in dusty occupations

and the Factory and Works Act with its supporting regulations and in particular regulation 263 on general safety and health issues Maruta (2005). Zimbabwe national laws basically provide for safe and health workplaces, safe work systems and workers compensation and rehabilitation. Maruta (2005) asserted that through ILO standards and national OHS laws decent work for all workers can be achieved through building and maintenance of a preventative health and safety culture.

The Standards Association of Zimbabwe (SAZ) plays a very important role in reducing impact of environmental hazards through periodically auditing implementation of ISO 14001/2004 Environmental Management Systems as well as OSHAS 18001 Maruta (2005). Such audits are made not only for certification of industry but also as an assessment tool for measuring performance with special regard to reducing Environmental and health disasters. The situation has been improving gradually and Zimbabwe has been commended for developments in management of Occupational Health and Safety. WHO (2005) noted that the number of diseases and deaths have declined in the past decade in Zimbabwe.

Critics in Zimbabwe were, however, quick to say that such a decline is attributed not to developments in management of OHS, but to the fact that the industry is and for the past decade has been operating far beyond capacity. In case of the timber industry, the metamorphosis from manual system of sawing to the use of electrically driven rotary tools technically introduced around 1930s, grinding and polishing, followed by chainsaws in the 1950s for felling, disbranch and sawing of timbers have caused disturbance to the health of the users (Gardner, 1982). Chainsaw used by timber workers have the potential to cause terrible injuries. One of the biggest hazards is kickback, which happens when the chainsaw carries into contact with objects such as logs or branches. Tyner and Lee (1985) reported that vibration of the range of 40 -1.25Hz associated with the use of vibrating tools, lead to white “fingers” or dead hand” which constitute 56% of problems among forestry and wood sawyers in Brazil.

Occupational Health and Safety in Europe's forestry industry (2012) maintained that carrying out heavy physical work and being exposed to noise, vibration, biological and chemical hazards put forestry workers at risk of harm. Furthermore, European Agency for Safety and Health at work (2007) added that wood working tools may expose workers to vibration that could result in hand-arm and vibration induced "white finger" syndrome. Noise or unwanted sound, is one of the most pervasive occupational health problems. It is a by-product of many industrial processes. European Agency for Safety and Health at work (2012) asserted that "high noise level can cause permanent hearing loss". Common source of noise in the wood industry include all-terrain vehicles, stump grinders, wood chippers, chainsaw and free drilling machines. National Institution of Safety and Health (NIOSH, 2012) reported that approximately 22 million U.S. workers are exposed to hazardous noise level at work.

Similarly, HSE (2007) asserts that people, who are exposed to high noise levels even for a short time, may experience temporary hearing loss. This loss is gradual, and sufferers do not realize that their hearing is being damaged (Rao, 2008). According to European Agency for Safety and Health at work (2012), dangerous substances that may affect the health of forestry workers include fertilizers, colorants for marking trees and timber and exhaust gasses from chainsaws. Discussing health risk of machine fumes, Occupational Safety and Health Administration (OSHA, 2012) asserts that the main components of chainsaw exhaust emission are hydrocarbons, and that breathing in these fumes can cause adverse health effects. These hazards have short and long-term effects as follows.

Short term effects are irritation of eyes, nose and throat, dizziness (light headedness), nausea wheezing, headache and drowsiness (feeling sleepy).

Long-terms effects are increased susceptibility to bacteria or viral respiratory infection, Asthma persistent cough, lack of coordination and Blood disorder.

In Zimbabwe wood and wood products are ranked among the major accident, injuries and diseases industries, and in Manical and Province they are at the fore front (Mutetwa,

2005). The Timber Producers Federation of Zimbabwe is using various methods to reduce occupational hazards in the wood sector, but with limited success (NSSA, 2007). Parastatals such as NSSA are assisting in the management of occupational hazards in the wood industry. NSSA is assisting with inspections, laws and regulations. In Zimbabwe, laws have been developed to supplement international standards and these laws cover hazards in the mining, industrial and agricultural sectors Chingofa (2010).

According to the World Health Organization, a substantial part of the general morbidity of the population is related to work (WHO, 2006). This assertion, though frightening, is not surprising as workers represent half of the global population and contribute greatly to the economic and social value of contemporary society (WHO, 2006). Indeed, people spend a significant portion of their lives at work with their jobs often bringing meaning and structure to their lives (Jahoda, 1982). Because work is a central part of many people's lives, it generally is recognized that individuals should have a safe and healthy working environment (Warr, 1987). According to the WHO Health for All principles and ILO (1981) Conventions on Occupational Safety and Health (No. 155) and on Occupational Health Services (No. 161) every worker has the right of access to occupational health and safety services, irrespective of the sector of the economy, size of the company, or type of assignment and occupation. The Rio Declaration on environment and development (1992) also states that "human beings are at the Centre of concerns for sustainable development UNCED (1992). Workers are entitled to a healthy and productive life in harmony with nature". Clearly the ability to enjoy a safe and healthy working environment is an important part of a sustainable future.

In Kenya Occupational Safety and Health Act (OSHA) which was enacted in 2007 provide for the safety, health and welfare of workers and all persons lawfully present at workplaces. The purpose of this Act is to secure the safety, health and welfare of persons at work; and to protect persons other than persons at work against risks to safety and health arising out of, or in connection with, the activities of persons at work.

This Act applies to all workplaces where any person is at work, whether temporarily or permanently. Therefore, the act and its provisions apply to the timber industry since the timber industry site is regarded as a factory. The Act provides for duties of both employer/occupier and the employees in ensuring the safety, health and welfare at work (OSHA, 2007). The Act requires every occupier to establish a safety and health committee at the workplace in accordance with regulations prescribed by the Minister if there are twenty or more persons employed at the workplace; or the Director directs the establishment of such a committee at any other workplace. Section 11 of Occupational Safety and Health Act, 2007 requires the occupier of a workplace to cause a thorough safety and health audit of his workplace to be carried out at least once in every period of twelve months by a safety and health advisor, and a copy thereof sent to the Director of directorate of Director of Occupational Safety and Health Services (DOSHS).

2.2.2 Enforcement Mechanisms of Safety and Health Regulations

Enforcement mechanisms are part of safety and health management. An organizational framework must be set up to facilitate the implementation of the policy. A structure that clearly defines the duties and responsibilities of the various levels as far as safety is concerned must be designed. It should ensure that safety is integrated rather than separated from production thereby facilitating total commitment to safety. Safety and health organization on a site includes the following: Safety officer, supervisor, worker, safety Committee, safety Representatives and Government representative (**HSA, 2016**).

In Kenya the safety, health and welfare of workers is the Occupational Safety and Health Act (OSHA) which was enacted in 2007. This Act was enacted to provide for the safety, health and welfare of workers and all persons lawfully present at workplaces, and to provide for the establishment of the National Council for Occupational Safety and Health and for connected purposes. The purpose of this Act is to secure the safety, health and welfare of persons at work; and to protect persons other than persons at work against risks to safety and health arising out of, or in connection with, the activities of persons at work.

This Act applies to all workplaces where any person is at work, whether temporarily or permanently. Therefore, the act and its provisions apply to the sawmilling industry since the sawmill site is regarded as a factory. The Act provides for duties of both employer/occupier and the employees in ensuring the safety, health and welfare at work. OSHA (2007) requires the use of personal protective equipment (PPE) to reduce employee exposure to hazards when engineering and administrative controls are not feasible or effective in reducing these exposures to acceptable levels. If PPE is to be used, a PPE program should be implemented. This program should address the hazards present; the selection, maintenance, and use of PPE; the training of employees; and monitoring of the program to ensure its ongoing effectiveness OSHA (2007). The PPE required in the sites include; eye protection and face protection, hearing protection, respiratory protection, hand and arm protection, foot and leg protection, head protection and body and fall protection mechanisms

Adetokunbo (2004) asserts that employer have legal duties to maintain woodworking machines to reduce noise and to maintain noise control equipment in good condition. Furthermore, the same source added that, faulty machines contributed tremendously to most accidents and injuries in the woodworking environment. These sawyers splitting the wood into different categories of plank and shapes are exposed to cut by blade of faulty machine or out of their careless attitude at work. In addition, European Agency for Safety and Health at work (2012) maintains that, “Risk increases when proper damping techniques are not applied, machines are not maintained, tools are not alternated, and workers use a vibrating tool for a long period without break. HSE (2007) posited that the first concern of any management in industry is to do business profitably, without understanding that safety, health programme and care for the environment embrace profitable ways of operating effectiveness to achieve comparative goals.

2.3 Previous studies relevant to the study

Research has shown that injuries and illness in the wood working sector of Mutare in Ghana are caused by exposure to occupational hazards (Adei & Kunfaa, 2007). Hazards

include any aspect of technology, or activity that poses risks. The level of risk is primarily the combination of two factors: the level of toxicity or amount of energy present and the degree of exposure NSSA (2007). Health and safety in the wood working sector can only be pursued comprehensively, integrating all spheres of work, Steenkamp (2002). The nature of work in wood processing industries, type of equipment and material handled present on the job all influence the nature of hazard Judd (2004). Occupational injuries in the timber sector represent significant public concern. Timber related accidents induce emotional and financial costs to both families and society.

In 1998, Europe's wood and wood products industry suffered around 90 000 work accidents involving more than three days absent from work. In Italy, the timber processing industry rates as one of most hazardous occupations. Accidents and injuries are because of conveyor systems, rapid moving parts of machines (blades, saws), falls and slips, kickbacks, wood handling, and vehicle accidents (Boy, 2002). Colman *et al.* (2007) noted that rotating devices, cutting or shearing blades, in running nip points and meshing gears are typical examples of potential sources of workplace injuries while crushed hands, severed fingers, amputations and partial blindness are typical wood working accidents. In Gabon's timber processing industry, in 2007 and 2008 data collected on work related accidents through the National Social Security Bureau indicated that the largest percentage of work related accidents were in public utility industries (30.1%), timber processing (21.5%) and commerce (16.5%).

Wood processing in Gabon is a dangerous occupation which involves more than 30% of the active population. In 2007-2008 accidents involving contact with objects and equipment exceeded all other events accounting for 64.1% of traumatic occupational accidents. Approximately a quarter (24.6%) of these occurred among the timber processing workers in Gabon. Further out of a total of 825 injuries the proportion linked to wood processing was 21.5%. In this group 24.2% of woodworkers were injured in 2007 and 19.3% in 2008. With regard to nature of work related injuries and disorders; open wounds 48.6%, traumatic injuries 29.9%, borne and spine injuries 17.5% and multiple traumatic injuries 7%. Hence National Social Security Bureau programme

gathers epidemiological information that helps to understand more about accidents linked to timber processing.

In Nigeria, Oyo and Osun in wood processing industries, a total of 140 injury cases were recorded among 640 workers. Results indicated that mill operators suffer highest rates of 83% while moving planks of wood into milling machines such as moulder machine, timber stacking accidents accounted for 36% while transport accidents is 22%. Furthermore, injuries occurring to body parts include upper limb 68%, back and lower injuries 58% and less prominent lower injuries at 13%. In the case of Nigeria wood processing industries, a major risk factor noticeable in the factory was age factor of machines and equipment in use. Most of the machines were obsolete with most of the safety guards removed and non-functional.

It was also noted that from the study, the respondents' notion about the concept of health and safety rules for operations in timber processing do not give preference to basic safety training in hazardous operations. None of the workers had attended safety training in the previous years. In most cases most of the workers entered the timber industry not as trained wood industry workers with a requisite professional knowledge. This had exposed most of the workers to some untold level of hazards (Bello 2010). Findings in the wood working industries in Zimbabwe relate well with those in countries such as Italy and Tanzania. According to these studies many workers in the wood processing industries worked under extremely hazardous conditions without the appropriate protective clothing (Boy 2002; Rongo *et al.*, 2004). Boy (2002) noted that the wood working industry in Italy ranks among the most hazardous industries in that country.

The potential sources of workplace injuries include rotating devices, cutting or shearing blades, in-running nip points and meshing gears while crushed hands, severed fingers, amputations and blindness are the typical accidents. The records from the medical sectors of the wood-working enterprises revealed that the common types of health complaints that included respiratory, pulmonary, dermatological, ophthalmic, musculoskeletal (especially backache). As observed by Adei and Kunfaa (2007) in their

study of wood processing industries in Ghana, occupational exposure to ergonomic hazards in the wood processing industries of Mutare were mainly due to lifting weights and uncomfortable posture during working hours.

Workers could stand up to as long as seven hours of an eight-hour shift. Matoone (1997) observed that back pain was the main complaint that resulted from awkward work postures such as prolonged standing, bending or kneeling. Workers are also exposed to chemical hazards such as gas toxin, glue, sodium chloride, aerolites, casmite, oxygen, acetylene and gas oil as also observed by Adei and Kunfaa (1997).

There is need to have material data sheets as a way of raising the workers awareness on safe ways of handling the chemicals. According to McCann and Babin (2007) there is need for good dilution ventilation and additional protective gear such as goggles and NIOSH-approved toxic dust masks for workers in the chemical industry. In a study carried out in New Zealand Wallart (2002) noted that noise exposure is a well-known hazard in wood processing industries, with a higher proportion of employees exposed to noise. A survey in Alberta wood processing industry revealed that on average wood processing machines produced 90 to 100dB thus employees were at risk from noise induced hearing loss. Wallart (2002) argues that, noise abatement at source might be considered an unattainable goal, but simple solutions such as properly positioned barriers, machine isolation and double wall enclosures have been recognized for some time in most wood processing countries in developed countries.

For instance, in New Zealand in Hawkes Bay, wood processing industry has drastically reduced noise emissions from an average of 98 dB to 86dB. In South Africa Noise Induced Hearing Loss (NIHL) was a leading compensable condition between 2000 and 2002. In Zimbabwe there are no collated NIHL statistics (Mazibuko, 2005). The problem of noise in developing countries has not been well researched and documented, though exposure limits have been set by most national governments and international organizations. These limits generally vary between a limit of 85 or 90dB for an 8-hour shift, (NSSA, 2009). In Zimbabwe, in terms of the Factories and Works (General)

regulations Section 6, the limit for exposure to noise is 90dB(A) for an 8-hour shift and internationally an administrative level of 85dB.

These controls are essential to control noise from machinery in processing and manufacturing industries to safeguard workers health. The target for industry is to therefore ensure that noise levels are kept to or below the recommended limit of either 90 or 85dB (A). Several possibilities to control noise are available such as administrative and engineering, NSSA (2009). Stackers comprised the largest occupational group among the 20 workplaces. In addition to the usual wood processing risks such as wood dust, noise and heat, workers reported exposure to night shift, sharp metals and objects, heavy lifting and pulling movements, flying and falling objects, awkward positions, slips and trips, meeting production quotas and stress. Workers were also exposed to precariousness, improper amenities, poor health, safety and hygiene conditions and inadequate medical services.

In a study carried out in Zimbabwe (Jerie, 2011) has shown that the use of personal protective equipment was poor and inappropriate in the wood processing industries. All workers apart from management and medical staff acknowledged receiving a pair of security shoes/ boots and two overalls every year. The workers could be seen wearing their nose masks, but some had the nose masks on their foreheads as they found them uncomfortable. Workers also perceived the sawdust extractors to be inefficient because some of the sawdust was left in the air thus exposing workers to wood dust inhalation and body exposure. Similar findings were made by Matoone (1997) in his study of wood working enterprises in Lesotho. Table 3 shows that less than 50% of the required protective equipment was provided.

In the wood-working industries of Zimbabwe, occupational safety, health and hygiene are not perceived as an urgent priority. The management or company owners do not provide adequate finance for maintenance as well as the purchase of protective clothing. There is no much attention given to the safety of processing machines, equipment, tools as well as their link to health requirements. There is no guarantee of safe and healthy

working conditions from employers or an adequate regime for their rest and nutrition. Employees are also only provided the barest of protective clothing they need and without any instructions of how to use it. Workers also indicated that exposure to dust and noise was due to the lack of control at source. Despite being aware of several occupational and environmental health hazards, there are no clear policies for the woodworking sector. Some of the measures used in the sector are outdated and do not comply with occupational safety and health standards. These tended to discourage employees from adhering or applying them.

Wood dust is classified by the Occupational Safety and Health Administration OSHA (1985), as a hazardous substance and is subject to the Hazard Communication Standard. Until 1985 wood dust was regulated by OSHA under the Nuisance Dust Standard. Research has shown that wood dust is not just ordinary dust. Hardwoods and soft woods in timber processing industries have different airborne levels of permissible exposure limits. Among the hardwoods, beech and oak used in furniture manufacturing have severe health hazards associated with them than softwoods. However, the extent of these hazards and the associated wood types has not been clearly established.

Wood-dust becomes a potential health problem when wood particles from processes such as sanding, smoothing and moulding become airborne. Breathing these particles may cause allergic respiratory symptoms, mucosal and non-allergic respiratory symptoms. Woodworkers are vulnerable to health hazards posed by their working environment. In Australia all wood dust is classified as carcinogenic. Exposure to sawdust is liable to cause dermatitis and allergic respiratory infections. The majority of machine operators in Australia are reported to have been diagnosed of respiratory infectious diseases due wood dust. When a worker is sensitized to wood dust, he/she is prone to suffer from an allergy reaction after repeated exposure.

Other effects of wood dust are eye irritation, nasal dryness, irritation to eyes and the nose and frequent dryness. However, dust extractors have been put in place to minimize wood dust at their source of production, (IFC 2007). According to OSHA (2003), dust

exposure should be controlled through the adoption and maintenance of effective extraction and filtration systems which are supplemented by use of personal protective equipment such masks and respirators. In a study carried out in American, Graham (2004) indicates that level of education influences worker health and safety in the workplace. Graham (2004) writes that education helps to provide the appropriate skills needed to achieve social status and make healthy lifestyle choices. She writes that studies exploring adverse health effects of the psychosocial work environment show that individuals in positions that are characterized by routinized work with little supervision have low self-esteem and higher stress levels. This leaves them prone to workplace hazards and leads to adverse effects on production by way of absenteeism.

Workplaces, argues Graham (2004) can exert either a positive or negative influence on worker behaviour. She argued that the risk of death before reaching retirement age was two and a half times higher for men and women in unskilled occupations than for those in professional positions. Her findings from an extensive Finnish study using education as a measure of socioeconomic status are that both men and women the most highly educated tend to live longer and have more disability-free years than their less educated counterparts. She also found a number of American studies to show that those with less education run greater risks. Parboteeah and Kapp (2007) in their study of ethical climates and workplace safety behaviour found that egoistic behaviour relates positively to injuries and negatively to safety in the workplace. They also discovered that benevolence and principled attributes relate negatively to injuries but positively to safety enhancing behaviour in the workplace.

This suggests that the life style of an individual significantly affects safety and health in the workplace. Traumatic occupational accidents and diseases in the wood sector represent a significant public health concern. Work-related accidents induce enormous emotional and financial costs to families and to society (Balsari *et al.*, 1999). Unfortunately, work related accidents and diseases continue to be serious in the world. The human and economic costs of occupational accidents and diseases remain high and call for concerted efforts to handle them (Abongomera, 2008). The ILO (2008) estimates

that more than 2 million workers die each year from work related accidents and diseases and this is probably an underestimation. The International Labour Organisation (ILO) estimates that workers suffer 270million accidents and at least 335 000 fatal injuries annually. Avoidable occupational diseases affect 160 million people every year. International concern and awareness of the problem of occupational diseases and accidents remains modest.

Muchemedzi (2007) observed that the global work force stands at 2.8 billion with approximately 300,000 employed in the wood and wood products industry and globally, 2.2 million work related fatalities and 270 million occupational injuries occur annually. The largest number of fatalities is associated with the timber industry with 92.4 deaths per 100 000 workers in 2006, a decrease from 118 in 2002. In 2008 the number of fatalities increased to 116 deaths per 100 000 workers. Tiedemann (1998) asserted that the largest number of accidents related to wood processing occurred around 10:45am. Longer work duration increases the risk of errors and near errors and decrease the workers vigilance. In 1998 Europe's wood and wood products industry suffered around 90 000 work accidents involving more than three days off-duty from work. Timber processing accidents and illnesses rose by 5.0% in the period 1996 to 1998.

In Italy, the wood processing industry in general rates as one of the most hazardous occupations. Rotating devices, cutting or shearing blades, in running nip points, and meshing gears are examples of workplace injuries, while crushed hands, severed fingers, amputations and blindness are typical wood working accidents (Boy, 2002). Colman *et al.* (2007) added to the hazardous wood working, high noise levels from operating machinery, dust conditions and work related musculo-skeletal disorders from repetitive movements that are likely to affect health of employees. In Libreville, Gabon, most formal employees are in the wood processing in which logs of wood are transformed into various finished products. Wood processing in Gabon is a dangerous occupation and it involves more than 30% of the active population.

Out of 825 injuries, wood processing constituted 24.2% of wood workers injured in 2007 and 19.3% in 2008. During the 2007 and 2008 period accidents involving contacts with equipment exceeded all other events accounting for 64.1% of traumatic occupational accidents in wood processing (Colman *et al.*, 2007). The need to prevent occupational hazards leading to occupational injuries has been of growing interest and a great challenge to the governments and industries in the wood processing sector (Mutetwa, 2005). Unfortunately, little research has focused on the field of occupational health especially relating to occupational hazards (WHO, 2005). NSSA (2009) indicated that an annual occupational mortality rate of 1 249 per 100 000 workers was witnessed in Zimbabwe in the past decade.

2.4 Critique of the existing literature relevant to the study.

A critical analysis of available literature on occupational safety and health in sawmills has highlighted the challenges workers undergo. Some research studies revealed that many sawmills are privately owned and therefore exploit their workers to make profits at expense of improved working conditions. While this is true to some extent, the findings fail to provide solutions on how occupational safety should be enhanced in such set up. This implies that more research solutions should be crafted from the point of policy formulation, implementation, oversight and evaluation at all levels. As well, literature has pointed out that lack of training for competence development of the workers is an obstacle which has led to increased occupational hazards and injuries. However, these findings falls short of pin-pointing challenges instead of providing concrete and measurable ways in which training of workers can be done to improve working conditions. There is need to provide a continuous improvement training program for all workers to sensitize them on hazards, injuries, fires and lifting techniques including use of safety gears. Nevertheless, most of the literature has focused on highlighting the inadequacies at sawmills. This study proposes to examine the existing gaps in occupational safety and health at sawmills and at the same time provide recommendations on how to improve the conditions in the sawmills.

2.5 Summary

Sawmills have contributed greatly to the economic growth and wellbeing of many countries across the world. This therefore means that the sawmilling sector is critical to both the economy, the workers and the environment in which logging and processing of timber and timber products is done. It is upon this premise that occupational safety and health status in sawmills is very important. To begin with, the nature of the work done by workers and the types of equipment and materials they handle present many on-the-job hazards. These hazards and injuries result from such incidences as: being caught-in or struck by machinery, falling from height, heavy lifting or repetitive movements, twisting or reaching, and inhaling noxious or toxic chemicals. Besides the hazards inherent in this occupation, there are the unfavourable weather conditions and noise pollution that is injurious to human health. The enactment and implementation of occupational safety and health acts and measures have greatly improved the productivity of the sawmills. However, injuries and hazards continue to harm workers leading to deaths, illnesses and disabilities. Thus, occupational safety and health efforts must be continuous and focused on improving productivity, safety, health and wellbeing of workers.

2.6 Research gaps

A critical analysis of available literature on occupational safety and health in sawmills has highlighted the challenges workers undergo. Some research studies revealed that many sawmills are privately owned and therefore exploit their workers to make profits at expense of improved working conditions. While this is true to some extent, the findings fail to provide solutions on how occupational safety should be enhanced in such set up. This implies that more research solutions should be crafted from the point of policy formulation, implementation, oversight and evaluation at all levels. As well, literature has pointed out that lack of training for competence development of the workers is an obstacle which has led to increased occupational hazards and injuries. However, these findings fall short of pin-pointing challenges instead of providing concrete and

measurable ways in which training of workers can be done to improve working conditions. There is need to provide a continuous improvement training program for all workers to sensitize them on hazards, injuries, fires and lifting techniques including use of safety gears. Nevertheless, most of the literature has focused on highlighting the inadequacies at sawmills. This study proposes to examine the existing gaps in occupational safety and health at sawmills and at the same time provide recommendations on how to improve the conditions in the sawmills.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter covers the research methodology which was adopted for the study. The chapter covers study design, data sources, population sampling, sample determination, data analysis and presentation. It also describes the research instruments, their application and reliability of the research instruments.

3.2 Research Design

The study employed a descriptive survey design. A survey design is also used to facilitate the collection of a considerable amount of data quickly, efficiently and accurately (Oso&Onen, 2005). Mugenda and Mugenda (2003) defined survey research as an attempt to collect data from members of a population in order to determine the current status of the population with respect to one or more variables. This research strategy was preferred because it permits the collection of data through questionnaires administered to a sample. The data collected by this design used to suggest reasons for particular relationships between independent and dependent variables (Saunders & Thornhil, 2007).

3.3 Study area

The research was carried out in Nakuru County in the central rift valley region of Kenya. The study area lies between Latitude 0° 15 South and longitudes 36° and 04° East. Geographically, the study was limited to Njoro, Elburgon, Molo and Nakuru town. Nakuru county is one of the most active areas with relatively large number of small scale sawmills and timber commercial centers.

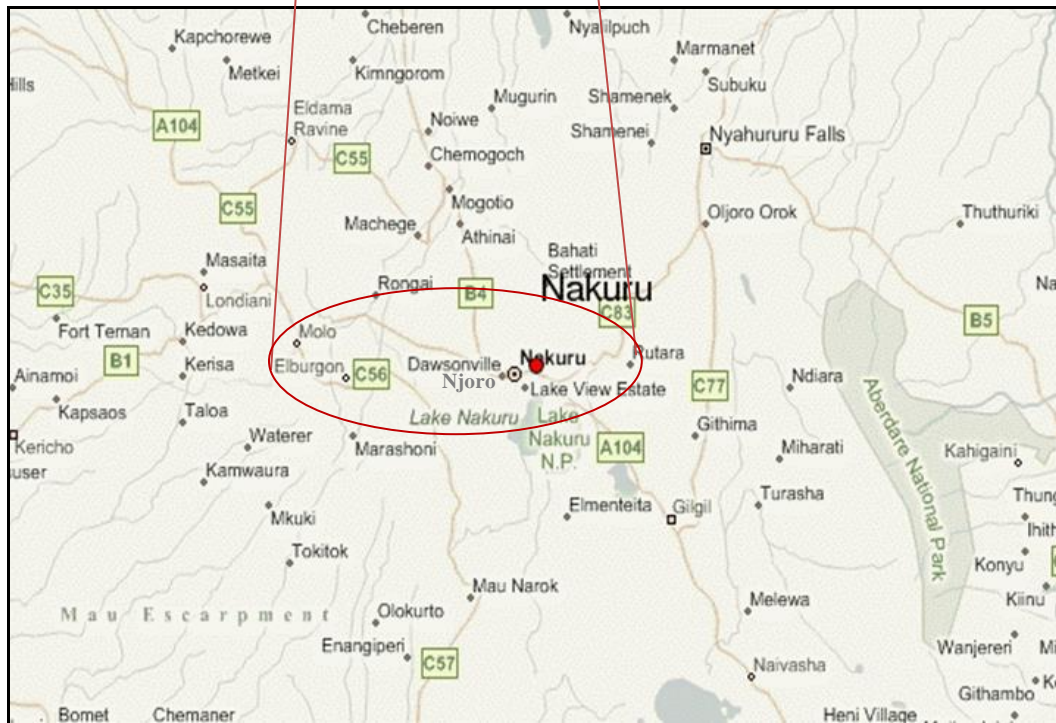
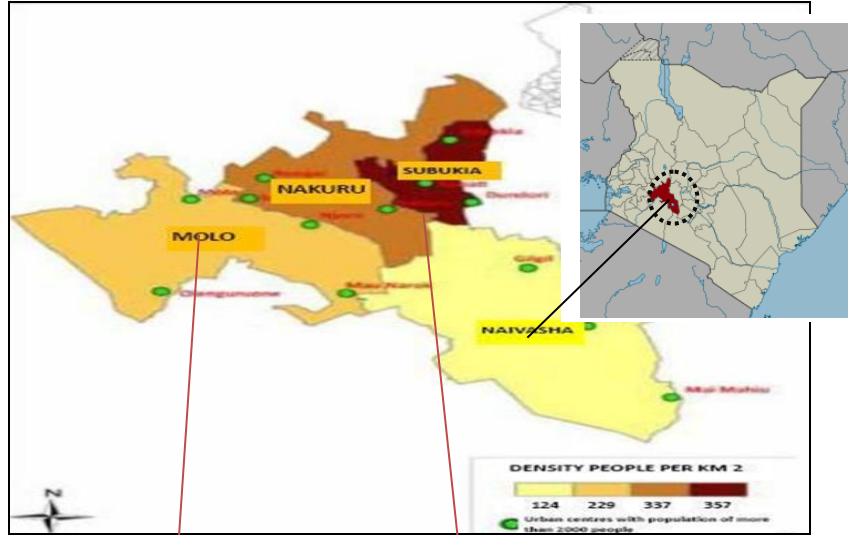


Figure 3.1: Map of the study area, Source: Google satellite 2016

3.4 Target Population

According to Castillo (2009), a research population is generally a large collection of individuals or objects that is the focus of a scientific query. Nakuru County has 37 registered and operational saw mills. Out of the 37 sawmills, 8 are large saw mills, 7 medium while 22 are small saw mills. The study targeted all the 11029 registered workers comprising of chain saw operators, log transporter drivers, mechanics; sawmill machine operators and employer's managers from the 37 sawmills. Further, the study concentrated on the medium and large-scale sawmills because they are more operational than the small ones. This criterion was purposely chosen because it is known that the medium and large-scale sawmills have comparatively more workers than the small ones and their operations relevantly describe the average sawmilling enterprises in Kenya today (KFS, 2008). The target population consisted of men and women workers above eighteen (18) years of age.

3.5 Sampling

The study adopted stratified random sampling method to draw respondents from the target population. Bryman and Bell (2007) have pointed out that stratified sampling "ensures that the resulting sample was distributed in the same way as the population in terms of the stratifying criterion". Stratified sampling is a good approach method when there is a good statistical database available. It gives flexibility to decide on identification and allocation of the units for the strata. It also gives possibilities to use and make more than just one stratifying criterion (Bryman & Bell, 2007).

When selecting the sampling frame and the sample size, the local conditions formed a significant basis in the decision making for this study. The most important selection criterion was the location of the forest plantations in Nakuru County and the saw mills. Another aspect in the strata selection focused on work categories (chain saw operators, log transporter drivers, mechanics; sawmill machine operators and employer's managers). This was important to have an even distribution of the units within the

sampling frame and the sample. A selection of a simple random sample from each of the resulting strata was made. This minimized the sampling errors or biasness of the sample.

3.6 Sample Size Determination

A sampling frame is a list of all the items where a representative sample is drawn for the purpose of research. Sampling must be so large that it allows a researcher to feel confident about the sample representativeness and it allows the researcher to make inferences of the sampling frame and the entire population (Silverman, 2005). In this research, a two-stage sampling strategy was adopted. The first stage involved sampling the number of saw mills in the four town centres (Njoro, Elburgon, Molo and Nakuru). The second stage stratified sampling involved taking a simple random sample from each stratum represented by different categories of workers. The sample size **386** for the five strata (chain saw operators, log transporter drivers, mechanics, sawmill machine operators and employer's managers) was determined using the mathematical approach by (Brewer & Miller, 2003).

3.6.1 Sampling Sawmills

If there is no estimate available of the proportion in the target population assumed to have the characteristics of interest, 50% should be used as recommended by Fisher *et al.*(1994) as quoted by (Mugenda & Mugenda, 2003). Therefore, 9 saw mills were targeted (5 large and 4 medium) with **11029** employees located in Njoro, Elburgon, Molo and Nakuru town respectively as shown in Table 3.1

Table 3.1: Number of Sawmills Per Town

Type of Saw Mill	Njoro	Elburgon	Molo	Nakuru	Total
a) Large sawmills	3	2	2	1	8
b) Medium Sawmills	2	2	1	2	7
Total	5	4	3	3	15
50% (Large Sawmills)	2	1	1	1	4
50% (Medium Sawmills)	1	1	1	1	5
N= 50%(a+b),	3	2	2	2	9
Approximately					

N=Number of sawmills per town.

3.6.2 Sampling the Strata (Category of Work)

Using Miller and Brewer (2003) formula for sample determination, a simple random sample was drawn from each stratum to obtain a sample size which was totaled up to get the study sample size.

Table 3.2: Number of workers Per Stratum and Town

Category of work	Number of Sawmills and Workers Per Category				
	Njoro (3)	Elburgon (2)	Molo (2)	Nakuru (2)	Total
Chain saw operators (loggers)	735	476	476	476	2163
Log transporter drivers	433	292	292	281	1298
Mechanics	1005	681	670	671	3027
Sawmill machine operators	1438	962	963	962	4325
Employer's Managers	76	54	43	43	216
Total	3687	2465	2444	2433	11029

$n = \frac{N}{1+N(\alpha)^2}$ Where, n is the Sample size, N is the Sampling frame, α is the Error margin

(0.05) and 1 is the Constant.

If $n=386$, $n = \frac{N}{1+N(0.05)^2}$

$$n = \frac{11029}{1 + 11029 (0.05)^2}$$

$$n = \frac{11029}{28.5725}$$

$n= 386$

Table 3.3: Sample Size Distribution per Strata

Category of work	Logging/sawmill workers	Sample size
Chain saw operators (loggers)	2163	76
Log transporter drivers	1298	45
Mechanics	3027	106
Sawmill machine operators	4325	151
Employer's Managers	216	8
Total	11029	386

Table 3.4: Sample size distribution among the sawmills

Category of work	Njoro(3)	Elburgon(2)	Molo(2)	Nakuru(2)	Sample Size
Chain saw operators (loggers)	25	17	17	17	76
Log transporter drivers	16	12	12	5	45
Mechanics	35	27	22	22	106
Sawmill machine operators	50	33	34	34	151
Employer's Managers	3	2	2	1	8
Total	129	91	87	79	386

3.7 Data Management

3.7.1 Data Collection

Data was collected using semi-structured questionnaires, interviews, observations and measurements.

3.7.1.1 Questionnaire and checklist

The study employed a semi-structured questionnaire (appendix I) and a checklist (appendix II) was used in identifying the occupational hazards and risks associated with sawmill industries and describe the awareness of employees on Occupational Safety and Health in the working areas. Apart from the employees, questionnaires were administered to work-place managers who, as part of their general duty of care, are required to ensure the effective application of OSH policy and practice in their work environment. The questionnaires assessed the occupational safety and health status of the saw milling industry.

The aim of the questionnaire and checklist was to generate reliable and valid data from a high proportion of population within a reasonable time period at a minimum cost. The use of a questionnaire is relatively cheap and a quick way of obtaining information. The

questionnaires had both closed ended and open ended. The closed ended questionnaires aided the coding and analysis of responses whilst the open ended facilitated richness and intensity of responses. Questionnaires were personally administered by the researcher and one research assistant. The respondents were thoroughly trained on the subject and essence of the study. The language used in the questionnaire was therefore interpreted to ensure clarity of understanding by respondents.

3.7.1.2 Interviews

According to Kvale (1996), research interviews try to understand something from the subjects' 'point of view' and to uncover the meaning of their experiences. Interviews allow people to convey to others a situation from their own perspective and in their own words. The interview was conducted with the institutions involved in Occupational safety and Health. These institutions include: Directorate of Occupational Safety and Health, National Environment Management Authority and Kenya Bureau of Standards.

3.7.1.3 Direct observation

Guided work site visits to sawmilling sites were performed to directly observe and document the identified hazards, tasks, job site organization, work practices, equipment and tools being used. Noise level measurements were taken at selected locations within the saw mill when the operations were on during day time using a sound level meter type D-1422C.

3.8 Data processing and analysis

The data collected was edited, collated to eliminate errors and coded for analysis using the Statistical Package for Social Sciences (SPSS version 19) tool. The coded data was analyzed both quantitatively and qualitatively. Quantitative data was analyzed using descriptive (percentages and frequencies) and inferential (chi-square and correlation) analyzes to draw inferences between independent variables and the dependent variable. Cross tabulation was used to determine the proportion of workers who use a facility

against their age, sex or educational background. Chi-square test for qualitative data was used to assess the workers awareness regarding the type of hazards they are exposed to and health facilities. Noise levels collected were analyzed and compared with the standards [Threshold Limit Values (TLV),] adopted by International Labour Organization (ILO), World Health Organization (WHO), DOSHS standards and National Environmental Management Authority standard and DOSHS standards.

3.9 Ethical Considerations

Ethical approval was obtained from the Institute of Energy and Environmental Technology in Jomo Kenyatta University of agriculture and Technology. Permission was also obtained from the Kenya Forest Service before the commencement of the study. The purpose of the surveys was explained to the management and informed consent was given. Participation of the study population was voluntary and all participants were above 18 years. Participants were assured of confidentiality of the information provided. Also, the data collected was confidential and was used for research only.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Demographic Characteristics of the Respondents

This section gives background information about the respondents and the saw mills. The variables measured included the respondents' age, basic education, professional education, occupation and professional experiences in sawmilling.

4.1.1 Response Rate

The study targeted a sample size of 386 respondents out of which 370 filled and returned the questionnaires giving a response rate of 95.9%. This response was very good and representative of the target population and conforms to Mugenda and Mugenda (2003) stipulation that a response rate of 50% is adequate for analysis and reporting but a response rate of 70% and above is excellent. Findings in Figure 4.1, the study found that sawmills in Njoro had 34%, Elburgon 23%, Molo 22% and Nakuru 21% of the respondents. The study further established that sawmills in Njoro employed more workers than sawmills in Elburgon, Molo and Nakuru respectively. The more the number of workers the more likely a hazard may harm a worker in the saw mills. This imply that lack of hazard awareness in sawmills in Njoro would mean a significant number of workers being exposed to occupational health hazards while working.

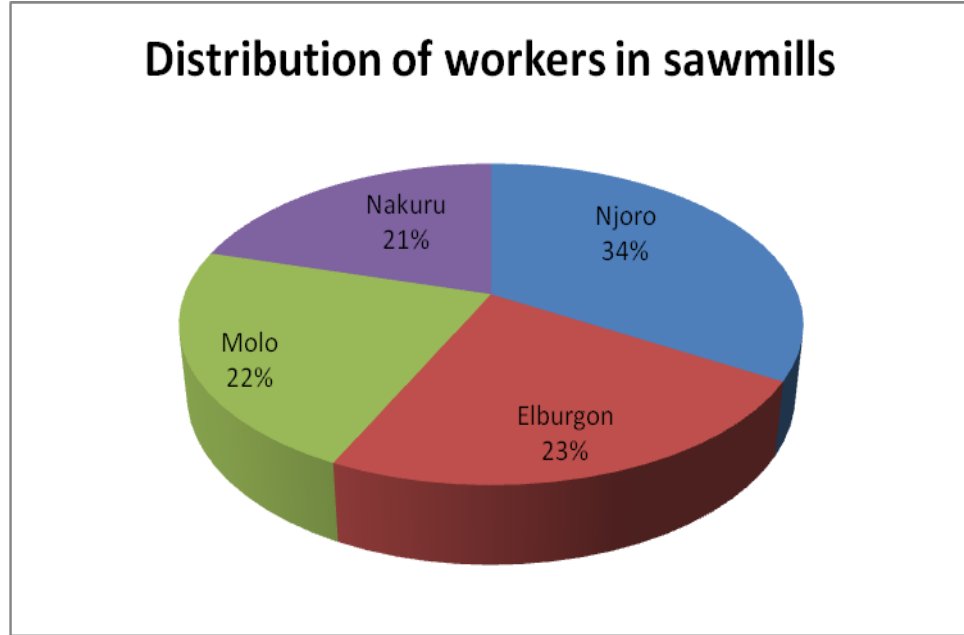


Figure 4.1: Distribution of Respondents in Sawmills

4.1.2 Gender Distribution of the Respondents

Males formed most of the respondents at 60.0% and the females at 40.0% as shown in Table 4.1. These data suggests that more males (60%) were engaged in sawmilling activities thus confirming the FAO report of the female tendency towards rural farming and trading activities (Forestry Statistics, 2003). This may be attributed to the high level of physical manual labor required in operating heavy machines, moving timbers and dust nature of the job. The works specifications at sawmill often include machine operators, timber wheeler, plank lifters, plank carriers, waste collector, timber yard cleaners and timber vendors. The female population in this study was largely waste collector, timber yard cleaners and timber vendors.

Table 4.1: Gender Distribution of the Respondents

Gender	Frequency	Percent (%)
Male	222	60.0
Female	148	40.0
Total	370	100.0

4.1.3 Age Category of the Respondents

The respondents were asked about their age category in order to find out the age structure of the respondents of sawmilling industries in Nakuru County. The age groups were divided into five age categories. The results of age distribution are shown in Table 4.2.

Table 4.2: Age Category of the Respondents

Age Categories	Frequency	Percent (%)
18-24 years	56	15.1
25-34 years	102	27.6
35-44 years	93	25.1
45-54 years	82	22.2
55-65 years	37	10.0
Total	370	100.0

The results indicated that the labor force of sawmills industry in Nakuru County is young. This was based on the fact that majority 27.6% of the respondents are aged 25-34 years followed by 25.1% aged between 35-44 years of age. 15.1% of the respondents were below 25 years, more than half of the workers were 25- 45 years and only 32.2 % of them were more than 45 years.

The relatively young age of the respondents in this study with majority of them (52.7%) being in the 25 to 44 years age group, and most of them (60%) being males could be related to the strenuous nature of their job which involves carrying heavy woods and operating delicate machines in noisy and hot work environment (as elderly people and females are less likely to be able to cope with such conditions). Also, operators of sawmills usually prefer to recruit young people as compared to older ones because of the lower cost of employing them, and being more flexible in terms of the work hours. Studies conducted in Nigeria by Agu *et al.* (2016) also reported relatively young cohorts of sawmill workers with a male majority.

4.1.4 Level of Education of the Respondents

Majority (48.6%) of the respondents had attained secondary school education, 28.9% Upper primary level, 8.6% diploma level, and 9.0% lower primary while 4.1% had attained university degree level and only 0.8 % of the workers had masters' degree level of education and above (Figure 4.2). Since most of the workers had attained secondary level education, they could understand and appreciate basic safety measures including safety procedures. Therefore, they were less likely to get injured as compared to those who had attained lower primary and upper primary education levels. This is not surprising because educational attainment facilitates easy assimilation of instruction. This finding corroborates a study that shows that level of education influences worker health and safety in the workplace (Gyekye & Salminen, 2005). The level of education is important especially during hazard awareness creation through training and following of safe work and safety procedures. With most of the workers having secondary education, implies that education could facilitate understanding and appreciation of basic safety measures.

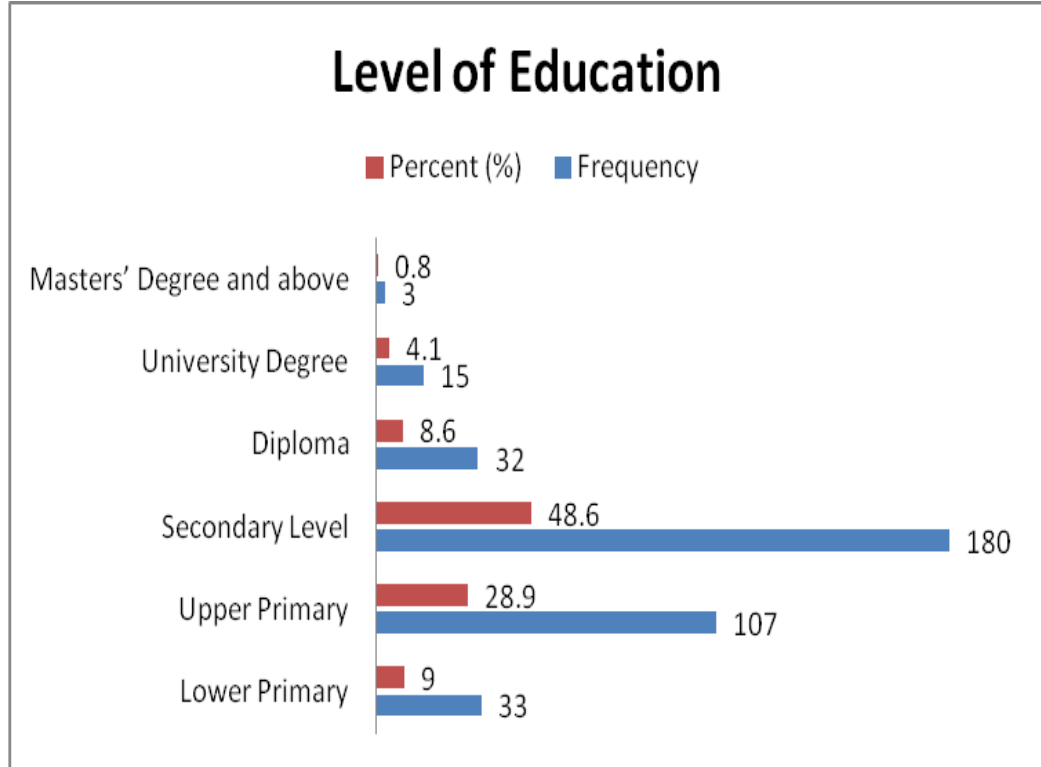


Figure 4.2: Level of Education of the Respondents

4.1.4 Respondents' Sector in the Sawmill Industry

Majority (50.2%) of the respondents was in wood packing and stacking followed by sawmills machine operators at 25.7 %. Log transport drivers formed 10.6%, mechanics 9.7% while supervisors and managers formed 3.8% (Table 4.3).

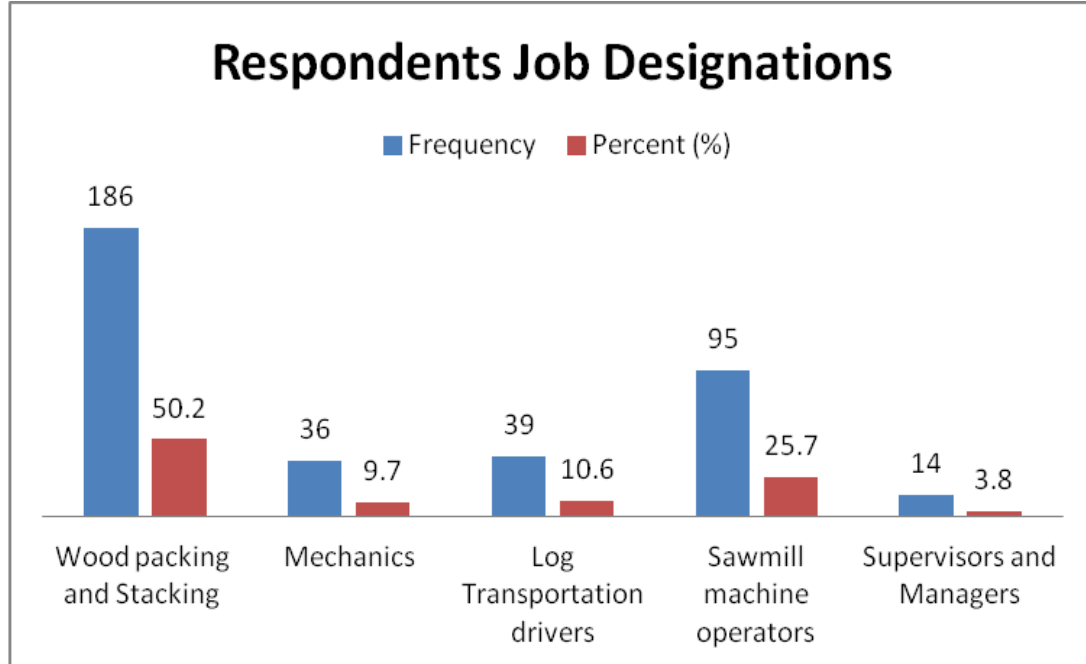


Figure 4.3: Job Designation of the Respondents

The job designation structure showed that wood packing and stacking had the highest number of the respondents (50.2%) while Supervisors and Managers had the least number of the respondents (3.8). This implies that many of the workers who are less education are involved in jobs that required manual handling and are very ignorant of safety measures (Adeyemi, 2013).

4.1.5 Working Experience in the Current Job

Majority (38.1%) of the respondents had worked with the sawmill industry for 2-5 years followed by those between 6-10 years (25.4%) whereas and (8.2%) had worked between 21-30 years (Table 4.3). The workers had been employed for an average of 7.4 years (range 6-10 years). From the results, it can be concluded that the workers experiences and competences in sawmilling activities vary a lot and so is the competences of the workers at different levels. Those who had worked for longer periods had more experience in the sawmilling sector than the majority who had worked for 2 to 5 years.

Table 4.3: Length of Service (Yrs) in the Current Job

No. of Years	Frequency	Percent (%)
0-1 years	53	14.3
2-5 years	141	38.1
6-10 years	94	25.4
11-20 years	50	13.5
21-30 years	30	8.2
31-40 years	2	0.5
Total	370	100.0

4.1.6 Cross Tabulation between Demographic Characteristics of Respondents and Safety and Health in Sawmills

Cross tabulation and Chi-square test of the association level of the occupational safety and healthy with the demographic characteristics of the respondents. The cross tabulation and chi-square test results are illustrated in Table 4.4.

Table 4.4: Cross Tabulation between Demographic Characteristics of Respondents and Occupational Safety and Health in Sawmills

Variables and Values		Occupational Health and Safety			
		Yes	No	Total	Chi-Square Test
Gender	Male	65.0%	35.0%	100.0%	X ² = 1.026, df = 1 P = 0.312
	Female	55.5%	45.5%	100.0%	
Age	Below 34 years	60.5%	39.5%	100.0%	X ² = 0.257, df = 1 P = 0.693
	Above 35 years	65.6%	34.4%	100.0%	
Education	Pri. and Secondary	80.8%	19.2%	100.0%	X ² = 5.37, df = 3 P = 0.068
	College and University	87.1%	12.9%	100.0%	
Length of Service(Yrs)	Below 10 yrs	85.4%	14.6%	100.0%	X ² = 2.924 df = 1 P = 0.093
	Above 11 yrs	69.4%	30.6%	100.0%	

4.1.7.1 Cross Tabulation between Gender and Occupational Health and Safety

The Chi square test results ($\chi^2 = 1.026$, $df=1$, $P = .312$) in Table 4.4 revealed that there was no statistically significant association between gender and occupational health and safety. Thus, this shows that both male and female equally experience occupational health and safety challenges in the timber saw mills.

4.1.6.2 Cross Tabulation between Age and Occupational Health and Safety

The test results ($\chi^2 = 0.257$, $df=1$, $P = 0.693$) revealed that there was no statistically significant relationship between age and occupational health and safety. The age of the respondents is not directly related to the preference of occupational health and safety in the timber saw mills. This means that at any age, occupational health and safety in timber saw mills is very critical.

4.1.6.3 Cross Tabulation between level of education and Occupational Safety and Health

The results of the chi-square test ($\chi^2 = 5.37$, $df=3$, $P = 0.068$) in Table 4.4 reveals that there is no statistically significant relationship between the level of education and the preference of occupational health and safety issues in the timber saw mills. This implies that any person at whatever level of education can experience occupational health and safety challenges in the timber saw mills.

4.1.6.4 Cross Tabulation between Length of service and Occupational Health and Safety

The cross tabulation and chi-square test results ($\chi^2 = 2.924$, $df=1$, $P = .093$) in Table 4.4 disclosed that there was no statistically significant relationship between length of service and occupational health and safety in the sawmills. Hence, the Length of service has no preference for occupational health and safety hazards in the timber saw mills.

4.2 Safety and Health Hazards Employees are exposed to in Sawmills

4.2.1 Workplace Safety and health hazards

The hazards at the sawmills work place identified and reported by the respondents included exposure to wood dust (81%), noise(78%) and fires (82%), exposure to heavy lifting and pulling movements (41%), flying and falling objects (33%), sharp metals objects and running machines (57%), slips and trips (13%), meeting production targets (17%) awkward positions (19%), improper conveniences with poor health hygiene conditions 10% and (76%) for lack of safety equipment like helmets, aprons and gloves (Table 4.5).

Table 4.5: Types of safety and health hazards experienced by respondents in sawmills

Hazards Exposed	Frequency	Percent (%)
wood dust from sawing and hand Sanders	300	81%
Noise	303	82%
Fire and explosion hazards	118	32%
sharp metals objects and running machines	192	52%
Heavy lifting and pulling movements	152	41%
Flying and falling objects	122	33%
Slips and trips	58	13%
Meeting production targets stresses	63	17%
Awkward positions	70	19%
Poor health hygiene conditions	37	10%
Lack of safety equipment and PPEs	281	76%

Other hazards observed through use of checklist were contact with the moving parts or the hot exhaust system of the chainsaw; exposure to exhaust gases and fumes; hazards arising from manual handling operations; exposure to noise from blade contact with the

log and vibration from the handles; falls from a height; In-running nip points ; reciprocating movement; chemical hazards from exposure to coatings, finishing, adhesives, solvent vapors; handling lubricating oils and petrol and coming into contact with sap from the log which might lead to dermatitis; flying particles such as tree bark and sawdust; uneven ground or wet grass which could lead to slips and falls; falling objects such as branches or the tree itself; contact with overhead services; hazards arising from adverse weather conditions such as wind, rain and UV radiation from the sun and stings or bites from insects or reptiles. High number of the responds (81%) observed sawdust that was left in air by inefficient extractors as a hazard because it exposes them to wood dust inhalation and body exposure (Table 4.5). Similar findings were made by Matoone (1997) in his study of wood working enterprises in Lesotho.

4.2.2 Areas Prone to Accidents in Sawmills

The Study established that the majority (45.1%) of the respondents encountered accidents at the sawmill workshops and production areas. In addition, 40.8% indicated that they encountered accidents at the sawmill yards and surroundings. 14.1% encountered accidents on the road way while transporting logs to the saw mills (Fig 4.4). A good safety and health management system would focus on creating hazard awareness to the groups in the sawmill yards, workshops and production areas because most of the workers experience injuries in these areas. These findings are congruent to those of Steenkamp (2002)who posited that Health and safety in the wood working sector can only be pursued comprehensively, integrating all spheres of work. The nature of work in wood processing industries, type of equipment and material handled present on the job all influence the nature of hazards (Judd, 2004).

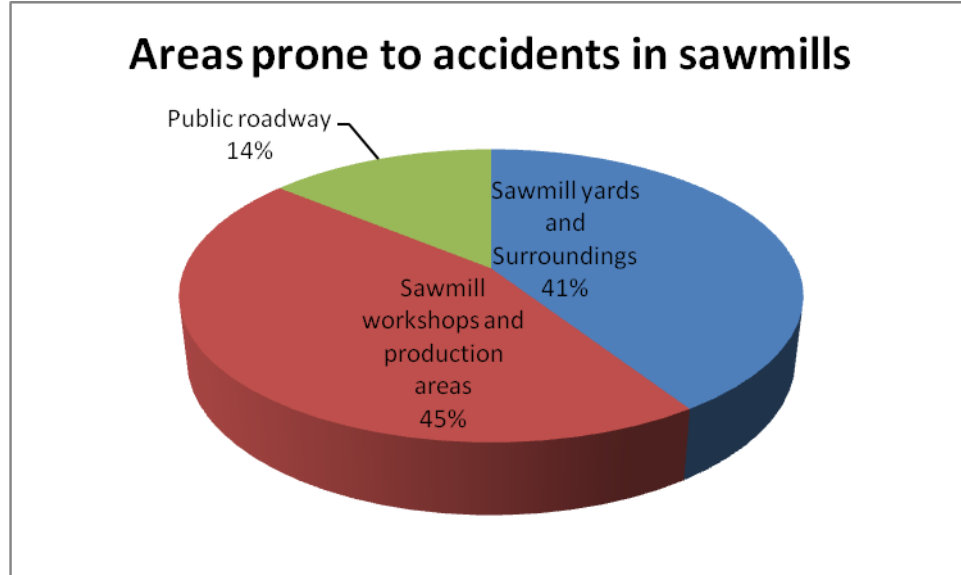


Figure 4.4: Areas Prone to Accidents in the sawmills

4.2.3 Exposure to occupational hazards by workers

All the workers are highly exposed to at least one hazard (Table 4.5). More than half of the workers were exposed to wood dust, noise and heat other hazards which made them complain of more than one health problem. According to NSSA (2007), accidents and injuries in the sawmilling industry are caused by exposure to occupational hazards. Hazards include any aspect of technology, or activity that poses risks. The level of risk is primarily the combination of two factors: the level of toxicity or amount of energy present and the degree of exposure. The findings indicated that majority of the workers have not had major accidents at the work place. The high significance 0.000 which is less than 0.05, suggests that there is a big difference between those who have been involved in accidents and those who have not. The chi square value asymptotic significance indicates the awareness on accidents at work is highly significant in exposing workers to hazards as indicated in Table 4.6.

Table 4.6: Accidents at the Work Place

Category	Observed	Expected	Residual
Yes	154	1	153
No	216	369	-153
Total	370		

Chi square = 23472.44 degree of freedom = 1

Asymptotic significance = 0.000

4.2.3.1 Correlation between Accidents or injuries and exposure to occupational hazards

The correlation analysis indicates that there was a very strong, positive and significant relationship between accidents at work place and occupational safety and health (Pearson Correlation $r = 0.857$ and $p\text{-value} = 0.003$).

4.2.4 Activities Involved in During Accidents

The study found that the workers being injured were involved in different activities at the sawmill industries. (Table 4.8) 18.1% were involved in moving logs, 20.0% while doing maintenance and 35.9% during saw milling activities using circular saws and other machines. 12% experienced injuries while moving timber to stacks and 13.2% during log transport. The study revealed that majority 35.9% of the workers experienced injuries at the point of operation where work is performed on the material while using circular saws and other machines in the saw mills. At the point of operation, the stock is cut, shaped, bored, or formed. Most woodworking machines use a cutting and/or shearing action. The findings support those of Boy (2002) who carried a study in the Italian sawmill industries and established that the timber processing industry rates as one of most hazardous occupations. Accidents and injuries occur because of conveyor

systems, rapid moving parts of machines (blades, saws), falls and slips, kickbacks, wood handling, and vehicle accidents.

Table 4.7: Activities Involved in During Accidents

Activity	Frequency	Percent (%)
Moving Logs	67	18.1
Maintenance	77	20.8
Milling using circular saws and other machines	133	35.9
Log Transport	49	13.2
Moving Timber to stack	44	12.0
Total	370	100.0

4.2.5 Nature of Injuries Experienced

Majority 31.4% of the sawmill workers suffered from lacerations or cuts while a few (0.6%) experienced heart attacks (Table 4.9). 5.7% experienced fractures, 30.3% had bruises, 10.3% had sprains and 10.8% reported having had strains. Therefore, on the nature of injuries experienced in the sawmill industry; the workers were exposed to a wide range of injuries with varying extents. The injuries imply that although majority of the workers have been trained on safety, they should continually hold refresher trainings and empowerments to reduce the injuries experienced. Workers that have been trained on safe procedures are less likely to suffer injuries or ill health. Workers not trained on safe work procedures to use when undertaking various activities at work learn how to work through other methods such as observation or relying on informal methods from colleagues.

Table 4.8: Nature of Injuries

Activity	Frequency	Percent (%)
Fracture	21	5.7
Bruises	112	30.3
Laceration	116	31.4
Sprain	38	10.3
Strain	40	10.8
Heart attack	2	0.6
Burn	32	8.7
Others	9	2.2
Total	370	100.0

Regarding body parts in which the workers experienced injuries, the study findings revealed that the majority 31.4% had laceration injuries followed by the bruises at 10.8% while the least experienced injuries were heart attacks at 0.6% as shown in Table 4.10. The study established that majority of the respondents suggested that to reduce the rate of accidents, the sawmills should provide safety precaution measures, train and educate workers on occupational safety, observance of machine layouts, provision of protective gear and use right tools at the right time. The findings support the study by Colman *et al.* (2007) which posited that rotating devices, cutting or shearing blades, in running nip points and meshing gears are typical examples of potential sources of workplace injuries while crushed hands, severed fingers, amputations and partial blindness are typical wood working accidents. Bello (2010) established that in Nigeria, more injuries occurring to body parts include upper limb 68%, back and lower injuries 58% and less prominent lower injuries at 13%.

The body injuries recorded in tables 4.9 and 4.10 were largely due to not using personal protective equipment (Safety glasses, helmet, hand gloves and steel toed boots) when manually handling of heavy logs by several workers rather than using the conventional conveyors. Such injuries are also attributable to movement of sawn products such as log

transport, loading and offloading, lumber stacking and transport of timber to market, during equipment maintenance including restoration, repair and routine maintenance of mill and saw filling. During log loading, a few workers often constitute themselves to conveyor pushing and rolling heavy logs into the saw table. This often leads to accumulated stress which causes lower back injuries and other health hazards.

Table 4.9: Part of Body Involved in the Injuries

Part of Body Injured	Frequency	Percent (%)
Ankle	37	10.0
Arm	39	10.5
Back	24	6.5
Body/multiple	27	7.3
Chest	24	6.5
Eye	32	8.7
Foot	40	10.8
Hand	50	13.5
Head	30	8.1
Leg	35	9.5
Shoulder	26	7.0
Other	6	1.6
Total	370	100.0

4.2.6 Facilities in Sawmills

According to the results in Figure 4.5, 59.1% of the respondents indicated that there were no spare parts for some sawing machines; 10.0% indicated that there was no timber drying and sanitation facilities, 20.0% indicated there were no new machinery while 10.9% cited lack of training centers for technological advancement skills. From the findings, it can be inferred that most of the sawmills should buy new machines and spare parts for their machinery, invest in timber driers to avoid losses because of timber developing defects and also embrace the idea of technology training centers to improve their efficiency and capabilities to produce quality timber and timber products. According to Bello (2010), Nigeria wood processing industries, a major risk factor noticeable in the factory was age factor of the machines and equipment in use. Most of the machines were obsolete with most of the safety guards removed and non-functional. It was also noted that from the study, the respondents' notion about the concept of health and safety rules for operations in timber processing do not give preference to basic safety training in hazardous operations. One of the manager interviewed noted that management is committed to doing everything possible to prevent injuries and to maintain a safe and healthy environment. All supervisors are responsible for ensuring that their employees are trained in approved work procedures and to ensure that employees follow safe work methods and all related regulations. The right tools and equipment with safety features have been provided but sometimes workers remove the safety guards.

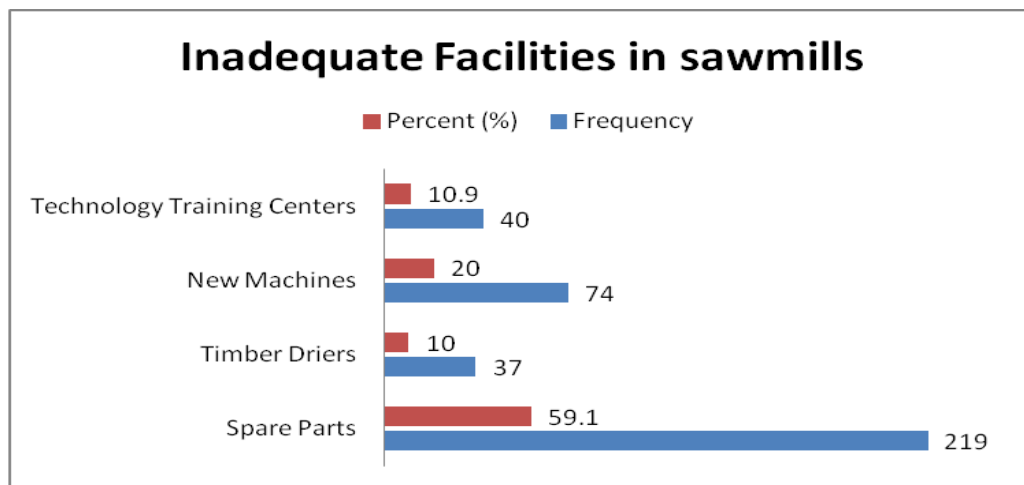


Figure 4.5: Facilities in the Sawmills

4.2.7 Noise Level Measurements

From the findings, the overall measured noise levels in the study area ranged from 58.7 dB (A) to 107.4 dB (A) and 93.6 % of the workers were exposed to noise levels of 90 dB (A) and above for more than 8 hours daily.

Table 4.10: Noise level in Nakuru Saw Mills

Ref	Representative Source	Noise Level dB(A)	TVL	Comments
1	Security area (Main Gate)	58.7	60 dB(A)	Acceptable
2	Wood planer area	88.5	90 dB(A)	Acceptable
3	Circular saw	99.8	90 dB(A)	Nuisance
4	Chain saw	105.6	90 dB(A)	Nuisance
5	Jackhammer	107.4	90 dB(A)	Nuisance
6	Drill press	83.1	90 dB(A)	Acceptable
7	Timber work(Machines were not operation)	62.2	90 dB(A)	Acceptable
8	Drum Sander	77.8	90 dB(A)	Acceptable

The study results (Table 4.10) has shown that sawmill machines such as Circular saw , Chain sawthe majority, and Jackhammer areas operation areas, exposes the workers to daily personal noise exposures in excess of 85 dB (the upper exposure action value). Sawmills are noisy environments in which to work. Damage to personal hearing, resulting in hearing loss and sometimes the discomfort of ringing in the ears (tinnitus) is likely, if suitable precautions are not taken (NSSA 2009). According to NSSA (2009), noise is any sound pressure variation in the air or other or other medium that can be detected by the human ear. Noise induced hearing loss is the most serious adverse health effect of noise and a compensable occupational disease.

Wallart (2002) noted that noise exposure is a well-known hazard in wood processing industries, with a higher proportion of employees exposed to noise. A survey in Alberta wood processing industry revealed that on average wood processing machines produced 90 to 100dB thus employees were at risk from noise induced hearing loss. Wallart (2002) argues that, noise abatement at source might be considered an unattainable goal, but simple solutions such as properly positioned barriers, machine isolation and double wall enclosures have been recognised for some time in most wood processing countries in developed countries. For instance in New Zealand in Hawkes Bay, wood processing industry has drastically reduced noise emissions from an average of 98dB to 86dB.

4.3 Employers' and Workers' knowledge and awareness on Safety and Health Hazards

Majority (96.6 %) of the workers were aware that noise can cause deafness and (86.5 %) of the workers were aware that it can be prevented, but only (3.8 %) of the workers used hearing protectors of which only (1.3%) uses them regularly. (33.8 %) of workers had noise related health problems but only (10.7%) had sought medical assistance. (37.3 %) of the workers had impaired hearing and (83%) of those with impaired hearing had worked for more than 6 years (Table 4.12). This means that the saw mill workers were exposed to hazardous noise level and they recognized noise as a hazard, but initiatives are required to increase use of effective preventive measure. The findings were similar

to Wallart (2002) survey conducted in Alberta wood processing industry which revealed that on average wood processing machines produced 90 to 100dB thus employees were at risk from noise induced hearing loss. Wallart (2002) further argued that, noise abatement at source might be considered an unattainable goal, but simple solutions such as properly positioned barriers, machine isolation and double wall enclosures have been recognized for some time in most wood processing countries in developing countries.

Table 4.11: Noise Hazard Levels and Impacts on Sawmill Workers in Nakuru County

Response	Frequency	Percent (%)
Exposed to 90 dB(A) Noise levels and above	339	93.6
Aware that noise causes deafness	357	96.6
Aware that deafness can be prevented	329	86.5
Using ear protection equipment	14	3.8
Noise related health problems	125	33.8
Impaired hearing	138	37.3

Respondents indicated that a risky working environment is one which exposes a worker to danger, has no instructions on how to use tools and has no control mechanisms. On safe working environment, the respondents indicated that it has detailed and documented working instructions and has protective equipment for work.

4.3.1 Workers' Knowledge on Safety Responsibility at Work Places

Occupational health and safety workers' knowledge and awareness is regarded as being aware of safety issues and the potential hazards to one-self and others in the workplace. According to the results, 45% of the respondents fully agreed that both worker and Sawmill owners were responsible for safety at work, 30% said it is the safety officers while 25% indicated everyone is responsible but employer has more responsibility for safety (Table 4.13). According to the preamble to the ILO constitution, the protection of

the worker against sickness, diseases, and injury arising out of his employment is a precondition to universal and lasting peace. As a result, millions of employees die, are injured and fall ill every year because of workplace hazards (ILO, 2010). The XVIII World Congress on safety and health at work was held in Seoul, Republic of Korea from 29 June to 2 July 2008. The Seoul declaration state that a safe and health, working environment should be considered as a fundamental human right and it encourages government to consider ratification of the ILO Promotional Framework for Safety and Health Convention, 2006 (no 187) as a priority, (Hope, 2009). Safety and health are basic human rights to be enjoyed by all employees throughout the world.

Table 4.12: Responsibility for Safety at the Work Place

Category	Frequency	Percent (%)
Both Worker and Sawmill owners	167	45.0
safety officers' duty	111	30.0
Everyone and employer has more responsibility	92	25.0
Total	370	100.0

4.3.2 Causes of Accidents at Work Place

Majority (43%) said lack of training, (23%) carelessness and ignorance, (19%) lack of personal protective equipment PPEs and (15%) said oil spillages on work place floors (Table 4.14). It was noticeable in most of the mills visited that a major risk factor was the age factor of the machine and equipment in use. Most of the machines were obsolete with most of the safety guards removed or non-functional. On site observation also revealed that environmental safety, work place organization and safe work procedures have not been taken as seriously because there were heaps of wood shavings from planning machine and saw dust accumulation around circular saw and band saw.

Little attention was paid to the use of individual protection devices such as wearing of earmuff or plug when operating machine, wearing of hand gloves when moving and stacking logs or sawn lumbers, neither is any preventive measure paid to hazards due to chemical emission from some species of log handled by putting on overall. Accident investigations and documentation are non-existent as evident by the non-availability of accident/injury records in nearly all the sites visited.

The high percentage of body injuries recorded in tables 2 was largely due to manual hauling of heavy log by a number of workers rather than the conventional conveyors or lift crane. Such occurrences are also attributable to movement of sawn products such as log transport, loading and offloading, lumber stacking and transport to the lumber market, during equipment maintenance including restoration, repair and routine maintenance of mill and saw filling.

Table 4.13: Causes of Accidents at the Work Place

Response	Frequency	Percent (%)
Lack of training	159	43.0
Carelessness and Ignorance	85	23.0
Lack of PPE	70	19.0
Spillages of liquid substances including oil	56	15.0
Total	370	100.0

In addition, all the respondents agreed that accidents at the work place can be avoided by training and educating the works on occupational safety and health to increase awareness, provision and use of appropriate PPE, holding tool box talks more often and regularly and sensitizing the workers and employers on safety issues and their implementation.

4.3.2.1 Causes of Accidents at Work Place and Training on Safety

Table 4.14: Cross Tabulation between Causes of Accidents at Work Place and Training on Safety

Variables and Values			Training		Total	Chi-Square Test
			Yes	No		
Lack of training	Yes		95.2%	4.8%	100.0%	X ² =51.649, df = 1 P=.000
	No		33.3%	66.7%	100.0%	
Carelessness and Ignorance	Yes		100.0%	.0%	100.0%	X ² = 7.245, df = 1 P=.023
	No		88.2%	11.8%	100.0%	
Lack of PPE	Yes		100.0%	.0%	100.0%	X ² = .055, df = 1 P=.815
	No		97.3%	2.7%	100.0%	

The chi-square test results ($\chi^2 = 51.649$, $P = .000$) showed that there was a statistically significance interaction between lack of training and training on safety (table 4.15). Similarly, carelessness and ignorance and training on safety ($\chi^2 = 7.245$, $P = .023$) revealed that there was a statistically significant relationship between carelessness and ignorance and training on safety. The cross-tabulation analysis between lack of PPE and whether one was trained on safety revealed that there was no statistically significant relationship ($\chi^2 = .055$, $P = .815$).

4.3.3 Aims of avoiding Shortcuts at Workplace

Majority (42%) respondents pointed out that it was to avoid carelessness, ensure proper handling of tools, avoid unnecessary and dangerous accidents and enable one to find breakdown issues within the shortest time (Table 4.16). The answers given by the respondents indicate that the workers were aware that avoiding short cuts at work can prevent or reduce the risk of getting involved in accidents.

Table 4.15: Consequences of Shortcuts at the Work Place

Response	Frequency	Percent (%)
Avoid Carelessness	52	14.0
Proper Handling of Tools	130	35.0
Reduce the risk of getting involved in accidents	155	42.0
Fixing Breakdowns	33	9.0
Total	370	100.0

Majority (65%) of the respondents indicated that protective gear helped them to avoid accidents, avoid contact with chemicals and also ensured safety and protection of the workers. On housing keeping, the respondents pointed out that it was all about ensuring everything was at the right place and time. They also indicated that good housekeeping was about making or keeping the work place clean, safe and allow smooth running of the work processes. All the workers, (100%) were in agreement that good housekeeping was the responsibility of everyone.

4.3.4 Refuse Management at Work Place

Regarding how the sawmills dealt with refuse when the correct refuse bins were not in sight, (40%) of the respondents indicated they collected the refuse in one place, 20% put the refuse in the available bins though not the correct bins while 40% indicated that they threw away the refuse (Figure 4.6). The findings shows there are gaps in refuse management which should be addressed by the saw mills' management.



Figure 4.6: Handling of Refuse at work place

Regarding the uses of various wastes generated by the sawmills, Majority (72%) indicated that they use sawdust for agricultural uses and animal bedding, (85%) burns waste paper, (76.0%) use used engine oil as a lubricant and wood preservative while (10%) general waste is taken to designated dump sites for burning. On site observation revealed that environmental safety, work place organization and safe work procedures have not been taken seriously because there were heaps of wood shavings from planing machine and saw dust accumulation around circular and band saws. These refuse management practices lead to increased pollution in the environment which is detrimental to the lives of the sawmill workers. Available information from Australia indicates that all wood sawdust is classified as carcinogenic (Woods & Calnan, 2010). The health effects of occupational exposure to wood dust can cause dermatitis and allergic respiratory infections to the sawmill workers. Most machine operators in Australia are reported to have been diagnosed of respiratory infectious diseases due wood dust. When a worker is exposed to wood dust, he/she is prone to suffer from an

allergy reaction after repeated exposures. Sawdust also causes eye irritation, nasal dryness, irritation to eyes and the nose and frequent dryness (Haygreen & Bowyer, 2012).

To manage sawdust effectively, sawdust extractors should be put in place to minimize wood dust at their source of production (IFC, 2007). This study established that a few sawmills had put sawdust extractors in place. This has consequently exposed sawmill workers to hazards which have a negative impact to their health. According to OSHA (2003), dust exposure should be controlled through the adoption and maintenance of effective extraction and filtration systems which are supplemented by use of personal protective equipment such masks and respirators.

Table 4.16: Waste Management at Work Place

Type of Waste	Management of the waste	Frequency	Percentage
Sawdust Waste	Disposal for agricultural uses and animal bedding	266	72.0
Paper waste	Burnt, Used at locomotive boiler	316	85.0
Liquid (used engine oil)	Used as lubricating oil and wood preservative	281	76.0
General waste	Burnt daily at designated dump site	37	10.0

4.3.5 Handling of oil Spillage at Work

Results indicate that (30%) of the respondents wiped the spillage using sawdust, (22%) collected in one place for re-use while (48%) left it for the cleaners to do their job. The results indicate that there is greater likelihood for workers to suffer from accidents as a result of spillages at work especially for those which were left unattended. This is because procedures to be followed in case of oil spillage such as containing the spill not to continue spreading, demarcating the area for safety reasons and alerting others working in the area and if the spill is from a known substance being of a minimal or a

controllable quantity to clean it up immediately were not in place. Numerous published studies have focused on oil spills and their effects on workers and populations living in areas surrounding environment. The workers and populations living in areas surrounding environment are greatly affected by oil spills. The fishing industry, recreational areas, and public water supplies all suffer following a spill. Inadequate cleanup causes long-lasting health effects for populations living in areas surrounding oil spills. Onwurah *et al.* (2007) explained that spills that are not cleaned up sufficiently could cause accidents to workers and can seep into the soil and contaminate strata surrounding potential drinking water supplies. The responses to oil spill depends on the quantity and floor gradient. They recommended development of company policy on controlling oil spillages and procedures to be followed in case of oil spillage emergencies. Onwurah *et al.* (2007) explained that oil spillage control kits should be kept near areas suspected to have oil spillages. The research conducted in Nakuru sawmills found that this was lacking as only saw dust was being used as a spill measure. If a work process results in a liquid accumulating on the floor or grade surface in a work area and the liquid creates a slipping or other hazard, floor drains or other suitable means should be used to control the hazard.

Table 4.17: Handling of Spillage at Work

Response	Frequency	Percent (%)
Wipe out the spillage using sawdust	111	30.0
Collect in one place for re-use	81	22.0
Leave it for cleaners	178	48.0
Total	370	100.0

4.3.6 Fire Drill at Work Place

The study established that (68.2%) of the sawmill workers had experienced fire or explosions at the work place at one time or another due to over drying of timber materials to very high temperatures. Regarding reaction of the respondents during a fire drill, (42%) of the respondents indicated they will use the fire exit, (20%) indicated they will fight off the fire using fire extinguisher while (38%) pointed out they will run away from the fire to report to the fire disaster management department(fig 4.7). A fire drill is a simulated emergency procedure which aims to emulate the processes which would be undertaken in the event of a fire or other similar emergency. It involves creating a situation which replicates what would happen if a real fire were to occur, usually with the inclusion of fire alarms, and requires employees, and anyone else who may be within company at the time, to evacuate. The responses show that procedures for fire disaster management are not adequately in place. Relevant information is not provided on the risks and precautions to be taken in case of fire. Fire drill is also intended to make sure relevant fire warden or fire safety supervisor know exactly what they are doing and can act as incredibly beneficial practice if their expertise is ever really needed. The responses show that there are no trained and equipped competent persons to implement fire-fighting measures. Most of sawmills premises are also not provided with appropriate fire detectors, alarms and fighting equipment. The firefighting equipment defective and their servicing was long overdue.

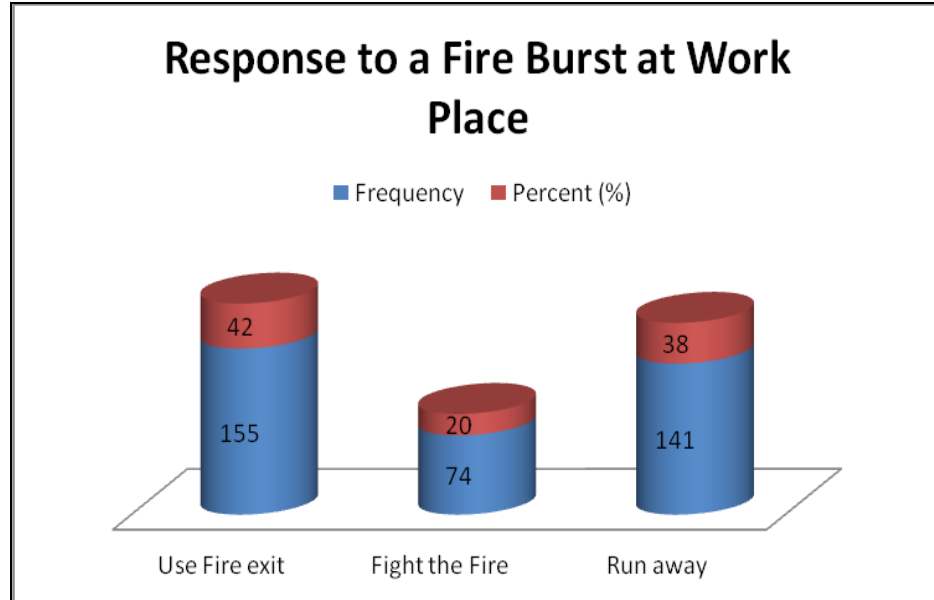


Figure 4.7: Response to Fire drill at Work Place in Nakuru Sawmills

4.4 Control Measures and safety practices

4.4.1 Safety Rules in Sawmills

Regarding the safety rules which states take care, be observant of what can go wrong, what can cause it and what you can do to prevent it, Majority (88%) of the respondents answered that one needs to be sure technically on what they are doing and know the exact procedures leading to the final results of a task. The respondents were also asked about the conditions or signs of emergency workers should always guard against. Majority of the respondents (36%) indicated smoke (Table 4.18).

Table 4.18: Conditions or Signs of Emergency to Guard at work place in sawmills

Response	Frequency	Percent (%)
Smoke	133	36.0
Unusual noise	104	28.0
Electrical fault	93	11.0
Spillage or leakage of oil	40	25.0
Total	370	100.0

On issues of safe systems of work at sawmill work place, all the workers were fully in agreement they were there except that they stressed the need for regular trainings. This they said will go a long way in reducing unnecessary accidents and injuries at the work place.

On the use of Permit to Work as a management systems to ensure that work is done safely and efficiently, majority (60%) of the respondents indicated that it was just a routine, others indicated that it was meant to address issues with attendance and follow up (22%) and while the rest (18%) were not sure about signing the Permit to Work (Figure 4.8). Instructions or procedures are often adequate for most work activities, but some require extra care. A permit to work system is a formal system stating exactly what work is to be done, where, and when. It requires a responsible person to assess the work and check safety at each stage. The people doing the job sign the permit to show that they understand the risks and precautions necessary. Permits are effectively a means of communication between site management, plant supervisors and operators, and those who carry out the work. Examples of high-risk jobs where a written permit to work procedure may need to be used include hot work such as welding, vessel entry, cutting into pipes carrying hazardous substances, and work that requires electrical or mechanical isolation. It is also a means of coordinating different work activities to avoid conflicts.

The results indicate that the respondents have not fully distinguished Permit to Work from an access pass or work authorization often issued to visitors. The saw mills had no

written safety program, or safe work procedures and safety systems of work. The implementation and enforcement of a comprehensive safety program should include task-specific safety procedures and employee training. Training is a critical element in an integrated safety program and should include the communication of task-specific safety procedures and training in the avoidance and abatement of work place hazards. Employees should have the knowledge, training and experience to perform the job that he/she is designated. Knowledge and competency are normally achieved through training or experience or a combination of both.

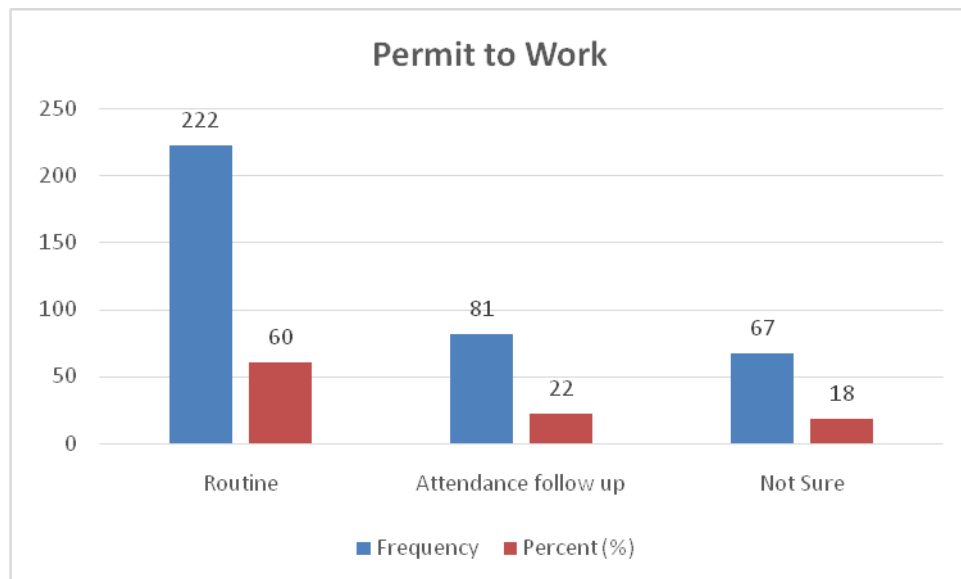


Figure 4.8: Permit to Work in saw mill work places in Nakuru County

4.4.2 Sawmill workers' occupational Safety and Health training

The main sawmill machine operators such as the circular breakdown saw machine operator, the circular re-saw machine operator, the band saw breakdown machine

operator and the band re-saw machine operator are the key workers in the sawmilling operations. According to results in (Table4.19),30.3% of respondents were Saw machine operators, 7.1% Circular re-saw machine operator, 48.0% Band saw breakdown operator while 14.6% were Band re-saw machine operator 14.6% of the sawmill machine operators trained on occupational safety and health education or specific job safety training. In fact, this was a clear indication of low safety training levels and therefore obviously too low competence and professional safety skills at the sawmilling industries studied. This is also an answer to various production constraints, injuries experienced and difficulties in the production of timber and other products. Training of the saw mill operators on how to operate and maintain the machines safely and efficiently will ensure effectiveness and productivity of the saw mills.

Table 4.19: Training of Sawmill Machine Operators

Machine Operators	Frequency	Percent (%)
Saw machine operators	46	30.3
Circular re-saw machine operator	11	7.1
Band saw breakdown operator	72	48.0
Band re-saw machine operator	22	14.6
Total	151	100.0

4.4.3 Safety training preferred for supervisors and managers at the Sawmills

According to study results, Majority (80.0%) of the respondents either preferred short course training by registered DOSH firms or preferably in-house training at the sawmills while 20% preferred Professional /vocational education. The results indicated without doubt that the sawmill owners do not like to invest in formal vocational education on safety. The managers said that most important is to get quick on the spot training at sawmill on mill and production management, saw doctoring and machine maintenance and they prefer short courses training that they can afford.

The most preferred training for supervisors, foremen and managers was the short course training that is either arranged at the sawmill or at FITC in Nakuru. Majority (77%) of respondents did not have any professional education or occupational safety and health training at all while 23% had short course professional training which was mainly received from the FITC in Nakuru, when the institute was still operational and from training institutions and either a college or university which offered short course certificates in occupational safety and health. These findings indicate that majority of the respondents across the various sawmills were not aware of their occupational safety requirements and needs. According to the ILO management guidelines of 2001 the employer being part of management is responsible for the safety and health of the workers. The ILO safety and health management guidelines of 2001 state that under accountability and responsibility element, safety and health should be considered as a line management responsibility.

Table 4.20: Training on Job Safety

Category	Observed	Expected	Residual
Yes	74	1	73
No	296	369	-73
Total	370		

Chi square = 5343.44 degree of freedom = 1

Asymptotic significance = 0.000

Though there are many workers who have not been trained on job safety, the low significance 0.000 which is less than 0.05, suggests that there is a big difference between those who have been trained on job safety and those who have not been trained. The chi square value asymptotic significance indicates lack of job safety awareness training is significant in exposing workers to hazards. There is therefore need for the saw mills to

conduct more trainings to reduce the difference between observed and expected values. The respondents who had been trained further indicated that they were trained on machine handling, keeping the workplace clean, first aid in case of emergency and on fire safety. Workers at sawmill need to be introduced to the health and safety systems at induction where they are indicated on the saw mill's safety and health rules, procedures and the site-specific safety measures.

A follow up by a safety and health officer or manager should be made as soon as possible or in a month later where he checks whether the workers understood and are following safe work practices. The workers and safety manager should sign a form attesting to this.

The correlation analysis results indicated that there was a very strong positive and significant relationship ($r = .836^{**}$ and $p\text{-value} = .000$). This implies that training has a significant influence on occupational safety in sawmills hence training programs on workplace safety are required as a way to promote the adoption of safe behaviours by workers. Workers need to be trained on professional risks, on prevention-related modalities and behaviours, on the relevant norms and on the rights and duties of workers in terms of safety. In addition, newly hired workers should receive training, as should on currently employed workers each time their tasks and/or responsibilities change and each time the risks involved in their work change. Employees holding positions of responsibility need also to undergo specific training. Jacobs. and Jaseem Bu-Rahmah, (2012), indicate that training opportunities increase the level of individual performance and organizational commitment among workers in their career advancement, influences the workers behaviors and attitudes such as motivation and organizational commitment, particularly in the case of stable employment. In upholding the views of Jacobs and Jaseem Bu-Rahmah (2012), Pigors and Myers (2008), submitted that training should encourage those employees who make a successful effort to increase their knowledge or skill. Training is a component of staff development and if carried out effectively, it can lead to improvement in the performance of employees.

4.4.4 Tool Box Talk and Job Safety Analysis as a Control Measure

According to the findings, 40% of the respondents held tool box talk (TBT) before starting work while 60% did not conduct any tool box talk (TBT). Moreover, those who held tool box talk before starting work further indicated that sometimes it was not regularly conducted, and it is tedious and time consuming. Moreover, majority (80%) of the respondents confirmed that they were taught to use the right tool for the right work and never to use any tool if one didn't know how it worked. Additionally, the respondents pointed out that the tool box talk was very important in fostering more understanding on machine operations, minimizing accidents and kept on reminding the workers on safety precautions at the work place.

On Job Safety Analysis (JSA), only 2 (22.2%) of the 9 sawmills visited conducted JSA and hazard identifications for each work procedure for the purpose of establishing proper task procedures to minimize or eliminate the occupational hazards. Leigh JP (2010) study showed utilizing JSA for improving task procedures in sawmills reduced costs and related unnecessary expenses resulting from lower occupational injury rates, employee absenteeism and workers' compensation, and also lead to increased performance and productivity.

A job safety analysis (JSA) is a procedure which helps integrate accepted safety and health principles and practices into a particular task or job operation. The task can be broken down to a sequence of steps or actions, which are used to identify hazards connected to the task or produced by the environment. Once the hazards are known, the proper solutions can be developed to eliminate or control hazards. Employees are encouraged to participate in job safety analysis.

The Chi-square correlation analysis further established that majority of the workers did not have tool box talk at the work place. The low significance 0.000 which is less than 0.05 (Table 4.21) suggests that there is a big difference between those who held tool box talk and those who did not. The chi square value asymptotic significance indicates that

awareness on tool box talks should be enhanced to ensure sawmill workers are aware of hazards and accidents at the work place.

Table 4.21: Tool Box talk as a Control Measure

Category	Observed	Expected	Residual
Yes	148	1	147
No	222	369	-147
Total	370		

Chi square = 21667.56

degree of freedom = 1

Asymptotic significance = 0.00






As well, the study conducted a correlation analysis between tool box talk as a control measure and occupational safety and health. From the findings of the correlation analysis the study established that there was a strong, positive and significant relationship ($r = .812^*$ and $p\text{-value} = 0.010$). The $p\text{-value}$ of 0.016 is less than the conventional 0.05 implying that the relationship is strong, positive and significant.

Tool box talk on its own, is not enough to keep your workers in the sawmill work areas safe. A job safety analysis (JSA), sometimes called a job hazard analysis (JHA), is an organized analysis of a specific job in a specific location. By completing a JSA, it helps to ensure that you have properly planned the work and that workers can do it safely while the Toolbox talks are particularly useful when discussing safety to review “good catches” or incidents that have happened within a company or they can be lessons learned that have been shared in sawmills work places.

4.4.5 Safety Signs in Sawmills

Majority (92%) of the respondents indicated that red signified emergency or danger. The research results (Table 4.22) further show that there were mixed responses on the other color codes where (76%) of the respondents were not sure about the meaning of yellow color followed by blue color (66%) and red (prohibition) color (52%). Almost all the workers understood what the red color implied probably from experience. The respondents also noted that there was no training on color signs or placement of colors at specific points at the work place to indicate a specific action to be undertaken.

Table 4.22: Understanding of safety signs and Color Codes at Work Place

Color Signs	Meaning	Sure (%)	Not Sure (%)
Green 	No Danger (Safe condition), First aid	55.0	45.0
Blue 	Mandatory, Where protective gear	34.0	66.0
Red 	Fire (fire equipment)	92.0	8.0
Red 	Prohibition	48.0	52.0
Yellow 	Warning, emergency, Hazard, Danger,	24.0	76.0

Regarding action to be taken when an alarm rings, majority (81%) reported that they will seek to know what is causing the alarm before running towards it or acting accordingly. The respondents also indicated that alarms often ring when there is an accident or emergency at the work place.

However, most (68%) of the respondents opinioned that most of the sawmills did not give them a specific way of reacting like running to a central point for head count except for a few which had trained their workers on alarm response. Majority (53%) of the workers (53%) did not know what to do with the machine alarms while at work, (32%)

pointed out that they will stop the machine and report the matter to their supervisors for action to be taken and 15% did not give their responses (Table 4.26).

Table 4.23: Alarm Response at Work

Response	Frequency	Percent (%)
Not know what to do	196	53.0
Stop Machine	118	32.0
No response	56	15.0
Total	370	100.0

On hazard prevention in sawmills, all respondents said being cautious is the major way of preventing the hazard. Some (18%) of the respondents believed that use of personal protective equipment (PPE) can help to prevent the hazards. They want their employers to provide them with durable PPE. Personal Protective Equipment (PPE) usage was very low (10%) with the highest users being those using coveralls. Osagbemi *et al.* (2010) study also revealed very low usages of PPE among sawmill workers. Reasons given by respondents during the In-depth interview were non-availability because the employers rarely provided them and when provided, they are not durable. This is in agreement with Osagbemi *et al.* (2010) previous studies that have reported similar findings. Provision of right and durable PPE is the responsibility of employers

Safety signs including PPE symbols like helmet, face masks, nose masks, boots and other safety wears were not displayed at strategic locations in most of the sawmills. This is to ensure compliance with the safety measures. Machines which are to be controlled manually or remotely some had no warning signs and symbols pasted on them. Fire exit pathways were also not marked and those marked doors were either closed or obstructed by wood materials.

On site observation also revealed that environmental sanitation was not taken seriously, only (22.2%) of the mills had marked and well maintained toilets and washing facility. Only 3 (33.3%) of the 9 sawmills had designated waste dump sites for burning, others heaped their wood wastes for local food vendors and livestock farmers to come and pack for their own use, and in cases where the wood waste exceeded what was needed by these packers, the sawmill workers packed it together and burnt it within the open spaces in the sawmill. Only 3 (33.3%) of the nine sawmills had serviced and correctly placed fire extinguishers and first aid boxes. None of the nine sawmills visited had any recreation or games facilities. Oluwatosin *et al.* (2015) study also revealed very poor sanitation with no label for gender usages and waste management zones which were not marked among sawmill workers.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Occupational health and safety is one of the issues which if neglected could significantly affect the operational efficiencies of sawmills. An injury and health related problems associated with wood processing could seriously affect the socio-economic condition of the worker, his dependants and the company. The study assessed the knowledge of workplace hazards; safety practices and control measures among selected sawmills in Nakuru county. The result of this study suggests that the respondents were able to observe noise, dust, fire and explosion, Sharp metals objects and running machines, heavy lifting and pulling movements, flying and falling objects, slips and trips, stress by managers to meet production targets, awkward positions and poor health hygiene conditions. However, the majority could not identify others hazards apart from noise and saw dust this was due to low percentages of the respondents. The categories of workers in sawmill industries acquired their skills and expertise on the job and years of experience put into the job. However, they lack the professional safety approach to their work.

Their knowledge and awareness of occupational hazards, safe systems of work, policies and control measures was very low. Personal Protection Equipment such as earmuff or plug, hand gloves, dust masks and eye defenders are not used adequately during wood processing and are often considered as disturbing by the respondents. The respondents suffered from lacerations or cuts, and burns injuries during wood processing.

Attentions to safe work environment and organization are not adequate. Also the equipment and the right tools are not available to carry out effective routine maintenance safely.

Dust and wood wastes are not properly disposed; this was evident from heaps of wood shavings and saw dust accumulation around sawmill machines.

The saw mills had put in place tool box talks which were adhered to by some employees. Signing of work permits was also implemented though some employees found it tedious and time consuming. Additionally, the employees were taught to use the right tool for the right work and never to use any tool if they did not know how it worked. Response alarms and safety signs and color codes were also in place though employees had divergent views on the meaning of the colors. Some employees were trained on how to response to fire drills. Safety rules were also put in place to be followed by employees in the saw mills. Appropriate fire detectors, alarms and firefighting equipment were observed missing in most sawmills work places. Challenges as observed inadequate welfare facilities, unawareness of health and safety matters among the workers and lack of equipped first aid kits on the sawmill work places. Welfare facilities were also noted as a big challenge since they are not adequately provided as well as personal protective equipment. There is need for government to closely monitor the sawmill operators' practices and ensure full compliance with occupational health and safety regulations.

5.2 Recommendations

Based on the findings of the study, the following recommendations are made with the hope that if implemented there will be improvement on safety and health of sawmill workers and subsequently boost their productivity in Nakuru county.

The Government (Nakuru County) through the Directorate of Occupational Safety and Health (DOSHS) in partnership with relevant agencies such as (Kenya Forestry Service (KFS), Kenya Timber Manufacturers Association (TMA), Kenya Forestry College (KFC) and the Forest Industrial Training Centre (FITC) need to develop safety and health guidelines to regulate operations of sawmill industries in Nakuru County, as information on safety and health status of the sawmill workers would be revealed. The safety and health guidelines should cover the following areas; employment standards, safety policy

statement for the sawmill: general statement of company policy, employee awareness and participation of general management, disciplinary policy, operations management , general procedures, safety guidelines on use of tools and equipment, machines and vehicles, fire prevention, medical program, personal protective equipment use, maintenance of sawmill machines, equipments and tools, site safety rules (procedures & precautions) and clearing the work area, material handling ,inspections – record keeping , audits, training, communication, incident analysis (incident reporting, incident investigation and incident follow up), cell phone ban in operation areas, electricity, proper lifting techniques/procedures, fire and chemical safety, drug and alcohol policy and testing, vehicle operations, employee acknowledgement of health and safety rules and prohibitions. The regulators should also organize periodic workshops and training programmes on safety and health to cover proper education on workplace hazards, types and proper use of different protective devices to safeguard their health. There is a need to re-emphasise formal training of sawmill workers by the technical colleges to increase awareness and knowledge of work-related hazards.

Management and the sawmill owners being part of the management should develop, implement, and enforce a written safety program. They should improve on funding of safety programmes, re-training of staff to improve the present level of occupational safety and health knowledge and the facilities used. The policy of the sawmill company should include regular and broad-based safety training to all staff and a reward system for compliant staffs of the saw mill industry. They should provide appropriate and modern PPEs for staff members in the saw mill industry working areas to improve compliance. There should be supportive supervision of all staff ofthe sawmill industry to comply with hazards control methods. There should be regular conduct of safety audit of the saw mills and follow up of the audit outcome by the management team.

The saw mills should develop safe work methods statements and a comprehensive training programme to create awareness on safety and health management system with great emphasis on the sawmill yards, workshops, timber stacking, log transport and production areas. The saw mills should continually hold refresher trainings and

empowerments to reduce the injuries experienced. The saw mills should invest in buying new machines, spare parts and build training centers for technological advancement skills. The saw mill owners and management should relook at the consequences of uncontrolled noise is having on their workforce and formulate strategies to train them on noise hazards and provide them with adequate protection equipment.

The saw mills should invest on training the employees on occupational safety and health training, sawmill technology and production management skills. The sawmill owners should focus on training all employees and reduce biasness to machine operators. The saw mills should emphasize on the importance of tool box talks to their employees to avoid unnecessary injuries and accidents at the work place. The management should form a Safety and health committee to advice on safety and health matters. The composition of such a committee should include representatives of employers and workers. Safety systems of work such as risk assessments or job safety analysis and permit to work should be developed and implemented. Training on the meaning of safety signs and color codes, response to fire drills and provision of the appropriate personal protective equipment, fire detectors, alarms, fighting equipment and improvement on engineering controls should be urgently addressed.

Employees should report all accidents, near misses and all safety problems to the management. Staff members should be proactive and professional in the Timber yard, Public roads and workshop areas, Staff members should endeavor to comply with safety precautions in the company. Cooperate/non-interference/misuse anything provided for safety purposes. They should use machines and Personal protective equipment (PPEs) safely, properly and for intended purpose.

5.3 Suggestion for Further Research

It is suggested that further studies should on the effectiveness of training professionals involved in occupational safety and health contributions towards preventing worker exposure hazards in saw mills.

REFERENCES

- Abongomera, G. (2008). Impact of decentralisation on antiretroviral therapy services at population level in Agago district in rural northern Uganda: results from the Lablite population surveys. *Int Health*, 9, 91–9.
- Adei, D. & Kunfaa, E.Y. (2007). Occupational health and safety policy in the wood processing industry in Kumasi, Ghana. *Journal of Science and Technology*, 27(2), 151-171.
- Adeoye, O. A., Adeomi, A. A., Abodunrin, O. L., Olugbenga-Bello, A. I., & Abdulsalam, S. T. (2015). Awareness of occupational hazards and health problems among sawmill workers in Osun state, Nigeria. *International Journal of Research and Review*, 2(1), 1-14.
- Agu, A. P., Umeokonkwo, C. D., Nnabu, R. C., & Odusanya, O. O. (2016). Health problems among sawmill workers in Abakaliki and workplace risk assessment. *Journal of Community Medicine and Primary Health Care*, 28(2), 1-10.
- Aiyelari, E.A., Cole, A.H. & Alabadan, B.A. (1997). *An evaluation of human energy*, Washington, DC: Pretice hall.
- Aiyelari, E.A., Ndaeyo, N.U. & Hyuma, I. (1998). Ergonomic evaluation of fuel power requirement in gari frying. *Journal of Topical Forest Researches*, 14(1), 92 – 101.
- Alphonse, T. (2008). Decent work and global strategy on occupational safety and health. *On Guard Sustainable Safety and Health Practice*. 15(1), 7- 13.

- Balsari, P., Ceilo, P. & Zanuttini, R. (1999). Risks for the workers in plywood manufacturing: A case study in Italy. *Journal of Forest Engineering*, 10(2), 12-15.
- Bean, L.T. & Butcher, T.N. (2006). Wood dust exposure hazards. Retrieved from: www.healthfully.org/eolvidl.htm
- Bello, R. (2010). *Assessment of injuries in small scale sawmilling industry of south western Nigeria*. Nigeria: University of Ibadan.
- Berman, D. M. (1978). *Death on the job: occupational health and safety struggles in the United States* (pp. 111-116). New York: Monthly Review Press.
- BLS (1994). *Survey of occupational injuries and illnesses*, Washington, DC: BLS.
- Bora (2009). *Support to Forest Sector Reform in Kenya Programme*. Nairobi: Kenya Forest Service.
- Boy, S. (2002). Safety of woodworking machinery: benefitting from workers' experience. *TUTB Newsletter*, 28, 20-23.
- Brewer, J.D. & Miller, R.L. (eds) (2003). *The A-Z of Social Research*. London: Sage.
- Bryman, A. & Bell, E. (2007). *Business research methods*. (2nd ed.). New York: Cambridge University Press.
- Castillo, J.J. (2009). Non-Probability Sampling. Retrieved, from <http://www.experiment-resources.com>.
- Comlan, P., Ezinah, F., Nambo Wezet, G., Anyunzoghe, E.S., & Obiang Ossoubita, B. (2007). Occupational Health and Safety Problems among Workers in Wood Processing Enterprises of Libreville, Gabon. *African Newsletter on Occupational Health and Safety*, 17(2), 44-46.

- Cotton, A. P., Sohail, M., & Scott, R. E. (2005). Towards improved labour standards for construction of minor works in low income countries. *Engineering, Construction and Architectural Management*, 12(6), 617-632.
- Dhubhain, AN, Flechard, MC, Moloney, R, O'Connor, D, & Crowley, T. (2008). *The economic impact of the forestry and wood products sector in Ireland*. Dublin, Ireland: Coford.
- European Agency for Safety and Health at Work (EU-OSHA), (2012). Bilbao, December 2012 The role of labour inspectorates in tackling the psychosocial risks at work in Europe: problems and perspectives. *Safety and Health at work*, 6(4), 263-267
- European Agency for Safety and Health, (2008). *European Agency for Safety and Health at Work Annual report 2007* Luxembourg: Office for Official Publications of the European Communities.
- Fischer, G., K. Frohberg, M.L. Parry, M.L. & Rosenzweig, C. (1994). Climate change and world food supply, demand and trade: Who benefits, who loses? *Glob. Environ. Change*, 4, 7-23.
- Forestry Statistics (2003). Policy Information Group, Ministry of Agriculture and Forestry, Wellington.
- Forestry Statistics (2003). *Policy Information Group*, Wellington: Ministry of Agriculture and Forestry.
- Gardner, A. W. (1982). *Current approach to occupational health 2*. London: John Wright & sons.
- Graham, H. (2004). Social determinants and their unequal distribution: clarifying policy understandings. *Millbank Quarterly* 82, 101-24.

- Gyekye, S. & Salminen, S. (2005). *Responsibility Assignment at the workplace: A Finnish and Ghanaian Perspective*. Blackwell Synergy.
- Gyekye, S. A., & Salminen, S. (2005). Responsibility assignment at the workplace: A Finnish and Ghanaian perspective. *Scandinavian Journal of Psychology*, 46(1), 43-48.
- Haygreen, J.G, & Bowyer, J.L. (2012). *Forest products and wood science: an introduction*. Ames, IA: The Iowa State University Press.
- Hirsjärvi, S., Remes, P. & Sajavaara, P. (2005). *Tutki ja Kirjoita*. 11 painos: Jyväskylä:
- Hope, K. M. (2009). An insight into the identification of hazards, assessment of risks and risk control. *Health and safety in South Africa*, 2(3), 12.
- HSE (2007). Occupational Diseases and ill Health in the forestry Industry Retrieved from: <http://www.hse.orgfwork/place hazard/ppe 2007>.
- I.F.C. (2007). *Environmental Health and Safety guidelines for sawmilling and manufactured wood products*. New York: International Finance Corporation.
- ILO, (1981). *Occupational safety and health convention (No.155)*. Geneva: International Labour Organisation.
- ILO, (1985). *Occupational safety and health convention (No.161)*. Geneva: International Labour Organisation, Switzerland
- ILO. (2009). Occupational health and Safety Conventions. Retrieved from:www.ilo.org/conventions

- ILO. (2010). Occupational health and Safety Conventions. Retrieved from: www.ilo.org/conventions *Inspection report*. Nairobi: Kenya Forest Service.
- International Labour Organization, (2008). *Fundamental principles of occupational health and safety*. Geneva: ILO.
- Jacobs, R. L & Jaseem Bu-Rahmah, M. (2012). *Developing employee expertise through*
- Jahoda, M. (1982). *Employment and unemployment*. London: ILO.
- Jacobs, R. L., & Jaseem Bu-Rahmah, M. (2012). Developing employee expertise through structured on-the-job training (S-OJT): an introduction to this training approach and the KNPC experience. *Industrial and Commercial Training*, 44(2), 75-84.
- Jain, R. K. & Rao, S.S. (2008). *Industrial Safety Health and Environment Management System*. New Delhi: Khana.
- James H., (2001). Sawmill Chemicals and Carcinogenesis. *Environmental Health Perspectives*. 109(3).1
- Jekayinfa, S. O. (2006). Energy consumption pattern of selected mechanized farms in Southwestern Nigeria. *Agricultural Engineering International: CIGR Journal*.
- Jekayinfa, S.O. (2007). *Ergonomic Evaluation and Energy Requirements of Bread-baking Operations in South Western Nigeria*. South Western Nigeria: Agricultural Engineering International.
- Judd, D. (2004). Safety in the wood products industry. *Forest Products Journal* 54(10): 13.

- Judd, H. M. & Janice, K. W. (2004). Safety in the wood products industry. *Forest Products Journal*, 54(10).
- Kenya Forest Service, (2008). Forest Cover Map, Retrieved from: <http://www.kfs.go.ke/html/kenya%20forest%20college>.
- Kenya Forest Service, (2009). Forest Cover Map, Retrieved from: <http://www.kfs.go.ke/html/kenya%20forest%20college>.
- KFS Conservancy Map Annual report 2010/2011, 19.
- Kiuru, J. (2009). *Competence Development and Capacity Building of Sawmill Enterprises in Kenya*, Unpublished MSc. Thesis, Finland: Lappeenranta University of Technology.
- Kunfaa, E.Y. (2007). Occupational health and safety policy in the wood processing industry in Kumasi, Ghana. *Journal of Science and Technology*, 27(2), 151-171.
- Kvale, S. (1996). *Inter Views: An Introduction to Qualitative Research Interviewing*, London: Sage.
- Kwame, O. B., Kusi, E., & Lawer, E. A. (2014). Occupational hazards and safety practices: a concern among small scale sawmilling industries in Tamale Metropolis, Ghana. *International Journal of Scientific & Technology Research*, 3(10), 234-236.
- Laws of Kenya. (2007). *Occupational Safety and Health Act*. Nairobi: Government Printer.
- Lehman, G. (2009). Physiological measurements as a basis of work organization in industry. *Ergonomics* 1, 328.

- Leigh, J.P. (2011). Economic burden of occupational injury and illness in the United States. *Milbank* 89, 728-772.
- Maruta, T. T. (2005). Occupational health services legislation and standards Zimbabwe. On Guard Best Practices in Occupational Health and Safety. *Aiming Zero Tolerance*. 11(4), 10.
- Matoone, B.M. (1997). The wood processing industry in Lesotho. *African Newsletter on Occupational Health and Safety*, 7(2), 46-47
- Mazibuko. D. (2005). Hearing conservation. On Guard Best Practices in Occupational Health and Safety, *Aiming Zero Tolerance*. 11(4), 11.
- Mbaabu, J., Otieno, D.O., Muriithi, S.K. & Ihure, S.G. (2008). *Brief on Prequalification*
- McCann, M. And Babin, A. (2007). Woodworking hazards. Retrieved from: www.woodworkersclub.com/
- Miller, R. L. & Brewer, J. D. (2003). *A-Z of Social Research*. London: SAGE Publication Ltd.
- Ministry for Foreign Affairs of Finland (MFA). (2008). *Miti Mingi Maisha Bora – Support to Forest Sector Reform in Kenya, Implementation Phase (2009 – 2014), Programme Document, Final Draft*. September 2008.
- Ministry of Forestry and Wildlife of Kenya (MF&W) & Ministry for Foreign Affairs of Finland Ministry of Forestry and Wildlife of Kenya (MF&W) & Ministry for Foreign Affairs of Finland (MFA). (2008). Miti Mingi Maisha Bora – Support to Forest Sector Reform in Nakuru County, Kenya. *International Journal of Health Sciences*, 5(4), 75-102.
- Muchemedzi, S. (2006, 2007). Violations of OHS responsibilities and legal liabilities. *On Guard an Aid to Occupational Safety and Health*. 1(1), 13.

- Mugenda, M. O. (2003). *Research methods: Quantitative and Qualitative approaches*. Nairobi: African Centre For Technology Statics (ACTs).
- Mugenda, O.M, & Mugenda, A.G. (2003). *Research Methods: Quantitative and Qualitative Approaches* (Revised Ed). Nairobi: African Centre for Technology Studies (ACTS) Press.
- Mutetwa. B. (2005). Our national five year occupational safety and healthy strategy 2006-2010. On Guard Best Practices in Occupational Health and Safety: *Aiming Zero tolerance, 11(4), 12-22*.
- Muthike, G.M. (2006). *The Status of Timber Sawing Industry in Kenya, Are We Saving or Wasting Trees*. Nairobi: Forest Products Resource Centre.
- Myers, J.R. & Fosbroke, D.E. (1994). Logging fatalities in the United States by region, cause of death, and other factors--1980 through 1988. *JSR 25(2), 97-105*.
- NIOSH (2012). Noise and Hearing Loss Prevention. Retrieved from <http://www.cdc.gov/niosh/topics/noise>
- NSSA. (2008). National report on occupational diseases. Retrieved from: <http://www.nssa.org.zw>.
- NSSA. (2009). National report on occupational diseases. Retrieved from: <http://www.nssa.org.zw>.
- NSSA. (2009). National report on occupational diseases. Retrieved from: <http://www.nssa.org.zw>.
- Occupational Safety and Health Act, (2007). *Laws of Kenya*. Nairobi: Government.
- Onwurah, I.N, Ogugua, V.N., Onyike, N.B., Ochonogor, A.E., & Otitoju, O.F. (2007). Crude oil spills in the environment, effects and some innovative clean-up

biotechnologies. *International Journal of Environmental Research*, 1(4), 307-320.

Operations in South Western Nigeria. *Agricultural Engineering International: the CIGR Ejournal. Manuscript EE 07 002. Vol. IX. June, 2007*

Osagbemi, GK, La-Kadri, RT, & Aderibigbe, SA. (2010). Awareness of Occupational Hazards, Health Problems and Safety Measures among Sawmill Workers in North Central Nigeria. *TAF Prev Med Bull*, 9(4), 325–328.

OSHA (1985). Formaldehyde: Method 52. In: OSHA Analytical Methods Manual, Salt Lake City, UT: U.S. Department of Labor, Occupational Safety and Health Administration, OSHA Analytical Laboratory

OSHA (2012) Sawmills Tool: Diesel engine Exhaust Retrieved from: <http://www.osha.gov/SLTC/eTools/sawmills/Diesel.html>

OSHA. (2003). Ventilation controls for various machines. Http Accessed 20 March 2015.

Oso, W.Y, & Onen, D. (2005). *A General Guide to Writing Research Proposal and Report: A Handbook for Beginning Researchers*. Kisumu: Option Press and Publishers.

Otala, L. (2008). *Osaamispääoman johtamisesta kilpailuetu*. WSOY: Porvoo. Oxford University Press Inc.

Parboteeah, K. P., & Kapp, E. A. (2008). Ethical climates and workplace safety behaviors: An empirical investigation. *Journal of Business Ethics*, 80(3), 515-529.

Pigors, P., & Myers, A. C. (2010). *Personnel administration: a point of view and method*, (9th ed.), New York: McGraw Hill Book Company Printer.

- Reason, J. (1998). Achieving a safe culture: theory and practice. *Work & Stress*, 12(3), 293-306.
- Rongo, L.M.B., Barten, F. Msamanga, G.I., Heederik, D. & Dolmas M.V. (2004). Occupational health problems affecting small scale industry workers in Dar-Es-Salaam, Tanzania. *Occupational Medicine*, 54, 42-46.
- Saunders, M., Lewis, P. & Thornhill, A. (2007). *Research Methods for Business Students* (4th ed.). Harlow: FT Prentice Hall.
- Saunders, M., Lewis, P. & Thornhill, A. (2009). *Research methods for business students* (5th ed.). Harlow: FT Prentice Hall.
- SE. (2008). *Successful health and safety management. HSG65, Health and Safety Executive*, London: SE.
- Silverman, D. (2005). *Doing Qualitative Research: a Practical Handbook*. Second edition. *Small and Medium Enterprises Development in Sawmilling*. London: Sage Publications.
- Tiedemann, S. (1998). Accident risk as a function of hour at work and time of the day as determined from accident data and exposure models for the Germany working population. *Work Environ Health*, 24(3), 43-8.
- Tyner, F. H. & Kee, K. (1985). *A synopsis of Occupational Medicine* (2nd ed). Great Britain: John Wright.
- United States Department of Labor's Occupational Safety & Health Administration. (2007). *OSHA Guidelines for Personal Protective Equipment: Are Your Employees Wearing The Right Stuff? Saf Heal Top*. New York: John Wiley and sons.

- Wamukoya, G. & Ludeki, J. (2007). *Analysis of Policy: Regulatory and Fiscal Framework. International Journal of Health Sciences*, 5(4), 75-102.
- Wamukoya, G. & Ludeki, J. (2007). *Analysis of Policy: Regulatory and Fiscal Framework for Small and Medium Enterprises Development in Sawmilling. The Miti Mingi Maisha*
- Warr, P.B. (1987). *Work employment and mental health*. Oxford: Oxford University Press.
- WHO (1999). *Healthy Workplace Framework: Background and Supporting. Literature and Practices*. Geneva: WHO.
- WHO, (2005). *Declaration of workers health*. Stresa, Italy: WHO Collaborating Centres of Occupational Health.
- WHO, (2006). *Declaration of workers health*. Stresa, Italy: WHO Collaborating Centres of Occupational Health.
- Woods, B, & Calnan, C.D. (2010). *Toxic Woods*. Retrieved from: wwodhazards.htm
- World Health Organization. (2014). *Annual technical report: 2013: department of reproductive health and research, including UNDP/UNFPA/WHO/World Bank Special Programme of Research Training in Human Reproduction (HRP)* (No. WHO/RHR/14.01). World Health Organization.

APPENDICES

Appendix I: Letters of Introduction

RICHARD OGOTI MONG'ARE

JKUAT MAIN CAMPUS,

P.O. BOX 62000-00200,

NAIROBI.

Dear Sir/Madam,

RE: INTRODUCTION LETTER FOR ACADEMIC RESEARCH

I am a Master of Science Occupational Safety and Health student in at Jomo Kenyatta University of Agriculture and Technology (JKUAT) conducting a research study entitled “**Assessment of Occupational Safety and Health Status of Sawmilling Industries in Nakuru County**”. The purpose of this letter is to request you to kindly fill in the questionnaire with precision and accuracy. The questionnaire is supposed to assist in answering specific objectives of the research which is being undertaken as part of the University requirement. Any information given herein will be treated with utmost confidentiality and only be used for the purpose of research.

Thanking you in advance for your contribution.

Yours faithfully,

Richard OgotiMong'are

JKUAT –Msc. Occupational Health and Safety



**JOMO KENYATTA UNIVERSITY
OF
AGRICULTURE AND TECHNOLOGY
INSTITUTE OF ENERGY AND ENVIRONMENTAL TECHNOLOGY**

P.O. BOX 62000, Nairobi, Kenya. Tel: (067) 52251/52711/52181-4. Fax: (067) 52164 Thika. Email: director@ieet.jkuat.ac.ke

DATE: 24th May, 2016

The Director,
Kenya Forest Service,
P.O. Box 30513, 00100,
NAIROBI

Dear Sir/ Madam,

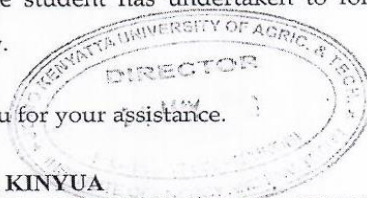
SUBJECT: EET32-3003/2013 –MONG'ARE RICHARD OGOTI

The above named person is a postgraduate student at the Institute of Energy and Environmental Technology (IEET) in Jomo Kenyatta University of Agriculture and Technology. He is pursuing the Master of Science degree in Occupational Safety and Health and he is currently undertaking his research on "*Assessment of occupational safety and health status of sawmilling industries in Nakuru County*".

Any assistance given to him will be highly appreciated and the information given thereof shall be treated professionally and shall only be used for the purpose of producing the thesis. The student has undertaken to follow the research ethics as stipulated by the university.

Thank you for your assistance.


PROF. R. KINYUA
DIRECTOR, INSTITUTE OF ENERGY AND ENVIRONMENTAL TECHNOLOGY



JKUAT is ISO 9001:2008 and 14001:2004 CERTIFIED
Setting trends in Higher Education, Research and Innovation



Kenya Forest Service Hqs
Karura, Off Kiambu Rd
P.O. Box 30513 - 00100,
Nairobi, Kenya.

CONF/SAW/1/KFS/VOL.VI (115)

14th June, 2016

Ref: No.

Date:.....

Prof. R. Kinyua,
The Director,
Institute of Energy & Environmental Technology,
Jomo Kenyatta University of Agriculture & Technology
P.O. Box 62000,
NAIROBI.

RE: EE T32-3003/2013 - MONG'ARE RICHARD OGOTI

Kenya Forest Service is in receipt of your request for assistance in connection with Richard's research on "Assessment of occupational safety and health status of sawmilling industry in Nakuru County".

Any relevant information will come from the sawmills which the student will be able to visit. Kenya Forest Service has no objection in the study even though the sawmills are privately owned. Therefore, the student is expected to seek permission of entry to any sawmill he visits from the manager or owner. I have no doubt he will get the necessary assistance.

**JOHN N. KIHARA,
FOR: DIRECTOR.**

Copy: Ecosystem Conservator- Nakuru County

JNK/la

Trees for better lives

Tel: (254) 020-3754904/5/6, (254) 020-2014663, (254) 020-2020285, Fax: (254) 020-2385374
Email: info@kenyaforestservice.org, Website: www.kenyaforestservice.org

Appendix II: Research Questionnaire

(A) Closed Questionnaire

Preliminary information to be supplied

Date.....

1. Name of Sawmill.....Business Unit.....Number of workers.....

2. Employment status- permanent casual mark with a (✓ tick)

3. Occupation.....
.....

4. To which gender do you belong?

Male

Female

5. Which age group do you belong to, mark with a (✓ tick) here below?

18 - 24	<input type="checkbox"/>	25 - 34	<input type="checkbox"/>	25 - 34	<input type="checkbox"/>	35 - 54	<input type="checkbox"/>	55 - 65	<input type="checkbox"/>
---------	--------------------------	---------	--------------------------	---------	--------------------------	---------	--------------------------	---------	--------------------------

6. What highest level of education you have attained, mark with a (✓ tick) here below?

None	lower primary	Upper primary	Secondary level	Diploma	university degree	Master's degree and above

5. In which sector /designation/position of the sawmill Industry do you work in, mark with a? (✓ tick)

a) Wood packing & stacking loader Mechanic/maintenance

d) Log transportation e) sawmill machine operator. f) hers. (Specify)

7. How long have you been engaged in your present job?

0 - 1		2 - 5		6 - 10		11 - 20		21 - 30		31 - 40
-------	--	-------	--	--------	--	---------	--	---------	--	---------

8. Have you ever attended any training on safety about the job you do? (✓ tick in box)

Yes

9. State the training if (6) is yes:

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

10. Specify the safety equipment/facilities provided in your job sector

- a)
- b)
- c)
- d)
- e) None

11. Have you ever been involved in any accident while doing your job? (✓ tick in box)

Yes No

12. Where did this accident/injury happen?

- a) Sawmill yards and surrounds
- b) Sawmill workshops and production areas
- Public roadway

13. What activities were you involved in at the time of the incident?

- a) Moving logs to mill b) maintenance milling using circular saws
d) Log transport e) moving timber to stack

14. Nature of Injury?

- a) Fracture, bruises, laceration, sprain,
e) strain, f) Heart attack, g) burn, h) others

15. State any other facilities that are not available in your place of work.

- a)
b)
c)
d)

(B) Open - ended Questions

Category A Questions

1. Who is responsible for ensuring safety at the workplace?
2. Do you conduct toolbox talk before you start working?

- 3. What are you taught or warned against during the tool box talk at your site?

- 4. Why are short cuts not allowed at the workplace?

- 5. How helpful is the tool box talk to you?

- 6. Why is it necessary to wear the proper personal protective equipment in your type of work?

- 7. Do you think it is always necessary to wear it?

- 8. What is good housekeeping?
.....
.....
.....
.....

- 9. Who do you think should be responsible for good housekeeping after every work shift?

- 10. What do you do with refuse when correct refuse bins are not in sight?

11. How do you manage the following wastes?

(a) Sawdust

waste.....
.....
.....

(b) Paper

waste.....
.....
.....

(c) Liquid (used engine oil waste)

.....
.....

12. What do you do with refuse when correct refuse bins are not in sight?

13. What do the safety signs on the attached sheet signify with colour codes the green, blue, red, and yellow.

14. What are you expected to do when you hear an alarm ringing?.....

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

15. How often do you hear an alarm ring at work?

a. What do you do when it rings?

b. Why do you do so?

16. Have you ever experienced a fire burst or explosion at the workplace?

17. What did you do when it happened (if not what would you do)?

18. How often do you use or come across a defective tool?

a) What do you do with it?

b) What is a hazard and name various types of hazards in your company

19. Can you tell the difference between a risky and a safe working condition?

How do you differentiate between the two?

Category B Questions

1. The safety rules say take care, be observant of what can go wrong, what can cause it, and what can you do to prevent it.

What conditions or signs of emergency are you always to guard against at your worksite?

2. What conditions or signs of emergency workers are to report at any time at the workplace?

3. Do you have safe systems of work?

4. What is the importance of signing a permit to work at work?

5. What is the importance of logging in and out/time in and out register at work?

6. What do you think could be the cause behind incidents in the workplaces?

7. Do you think workplace incidents can be avoided?

8. Explain why do you think so?

Appendix III: Occupational Safety and Health Workplace/Office Safety Checklist

Institute:		Facility:		Survey Date:		
Building/Rooms covered on this checklist:						
During the survey of the designated area, complete the checklist below . Check N/A if the item does not apply.						
BASIC LIFE SAFETY	YES	NO	N/A	COMMENTS	CORRECTIVE ACTION TAKEN	CORRECTION COMPLETED
1. Are exit signs illuminated and visible?						
2. Are corridors and exits free from obstructions and unlocked?						
3. Access to exit doesn't require travel through high hazard area?						
4. Stairways are in good repair with handrails						

and non-slip tread?

5. Stairways are not being used for storage?

6. Stairway steps are uniform in size?

7. Is the Emergency Evacuation Route & Action Plan posted?

8. Are exit doors closed and not propped open?

9. Is there no obvious damage to sprinklers?

10. Are fire extinguishers easily accessible, checked monthly, and operational?

11. Are fire extinguishers mounted so that the travel distance from employees to any extinguisher is 75 feet or less?						
GENERAL OFFICE SAFETY	YES	NO	N/A	COMMENTS	CORRECTIVE ACTION TAKEN	CORRECTION COMPLETED
1. Are aisles, doorways and corners free of obstructions to permit visibility and movement?						
2. Lighting in work areas and walkways adequate?						
3. Are chairs in safe condition and are caster, rungs and legs sturdy?						
4. Are all equipment and supplies in their proper places?						

5. Is there adequate walking and egress clearance? a. 44" for corridors and stairways. b. 36" for aisles. c. 32" for doors.					
6. Are carts, dollies, etc. available for use in transporting heavy objects and boxes?					
7. Is housekeeping being adequately maintained?					
8. Are MSDS available for office and housekeeping chemicals?					
9. Are OSHA posters prominently displayed?					

TRIP/FALL HAZARDS	YES	NO	N/A	COMMENTS	CORRECTIVE ACTION TAKEN	CORRECTION COMPLETED
1. Is the floor surface level and undamaged?						
2. The floor is not wet or slippery? <ul style="list-style-type: none"> a. A warning sign is available in case of spills? b. Cleanup supplies are readily available? c. Non-slip mats are in entryways if needed? 						

TRIP/FALL HAZARDS (continued)	YES	NO	N/A	COMMENTS	CORRECTIVE ACTION TAKEN	CORRECTION COMPLETED
3. Are carpeted areas clean, carpets secured to floor and free of worn or frayed seams?						
4. Is any equipment or supplies protruding into walkways?						
5. Are there cords or cables causing a trip hazard?						
6. Are permanent use cords covered by runners when crossing walkways?						
7. Is a step stool or ladder available to minimize the use of chairs for reaching high objects?						

ELECTRICAL	YES	NO	N/A	COMMENTS	CORRECTIVE ACTION TAKEN	CORRECTION COMPLETED
1. Are GFCI outlets within 6 feet of a water source?						
2. Is access to electrical panels or electrical room unobstruction (at least 36")?						
3. Are outlets overloaded?						
4. Extension cords are not used in lieu of fixed wiring?						
5. A maximum of one power strip per electrical receptacle is used? (no daisy chains)						
6. Electrical cords and plugs are in good condition? (i.e., not frayed, taped, spliced, or missing ground prongs)						
7. Electrical receptacles are in good working						

condition?						
8. All electrical equipment in good working condition?						
9. Are electrical closets free of storage?						
ELECTRICAL (continued)	YES	NO	N/A	COMMENTS	CORRECTIVE ACTION TAKEN	CORRECTION COMPLETED
10. Are personal appliances such as space heaters or coffee makers compliant with the buildings electrical circuit system?						
11. Are space heaters equipped with a multi-directional tip-over switch?						
12. Are space heaters equipped with an overheat sensor?						

MAINTENANCE (outside and inside)	YES	NO	N/A	COMMENTS	CORRECTIVE ACTION TAKEN	CORRECTION COMPLETED
1. Are doors and locks in good working order?						
2. Are ceiling tiles intact, undamaged and in place?						
3. Are there no signs of weather damage or mold growth in the facility?						
4. Are all windows unbroken and free from any type of damage?						
5. Do air conditioning vents and ducts appear to be clean upon visual inspection?						

6. Are outside lights in good working order?					
7. Does the exterior of the building present no safety concern?					
8. Is the parking lot area free of any safety concern? (i.e. overgrown landscaping, uneven pavement, traffic hazards)					

Additional comments:

Appendix IV: Sound Level Meter

