OCCUPATIONAL SAFETY AND HEALTH STATUS IN THE KENYA AGRICULTURAL AND LIVESTOCK RESEARCH ORGANISATIONS, WESTERN KENYA REGION

CHARLES WAFULA BUYELA

JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY

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Occupational Safety and Health Status in the Kenya Agricultural and Livestock Research Organisations, Western Kenya Region

Charles Wafula Buyela

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DECLARATION

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

Signature_____ **Date**_____

Buyela, Charles Wafula

This thesis has been submitted for examination with our approval as University supervisors

Signature_____ **Date**_____

Mr. Charles Mburu

JKUAT, Kenya

Signature_____ **Date**_____

Dr. Paul Njogu, Ph.D

JKUAT, Kenya

DEDICATION

This research work is dedicated to my wife Jescah N.W., My children Paul, Mercy and Yvonne.

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ACRONYMS AND ABBREVIATIONS

ACGIH	American Council of Government Industrial Hygienists
ACIH	American Conference of Industrial Hygienists
AS/NZS	Australian/ New Zealand Standards
COP	Code of Practice
Db (A)	Decibels (A)
DOSHS	Directorate of Occupational Safety and Health Services
G M O	Genetically modified organism
GOK	Government Of Kenya
HAV	Hand-arm vibrations
HAVS	Hand-arm vibrations syndrome
IEET	Institute of Energy and Environmental Technology
ILO	International Labour Organization
ISO	International Organization for Standardization
JISHA	Japan Industrial Safety and Health Association
JKUAT	Jomo Kenyatta University of Agriculture and Technology
KALRO	Kenya Agricultural and Livestock Research Organization
MORTA	The Management Oversight and Risk Tree Analysis

MSDS	Musculoskeletal Disorders
NIOSH	National Institute for Occupational Safety and Health
OSH	Occupational Safety and Health
OSHA	Occupational Safety and Health Act, 2007 Kenya
OSHMS	Occupational Safety and Health Management System
SOPs	Standard operating procedures
PPE	Personal protective equipment
USA	United States of America
USDA	United states department of agriculture
WHO	World Health Organization

ABSTRACT

Kenya Agricultural and Livestock Research Organisation, Western Kenya region comprises of Non-ruminant Research Institute at Kakamega and Food Crop Research Institute at Kitale. The two research institutes are mandated to innovate and improve technological activities that touch on the environment and the livelihood of people. Such practices should comply with occupational safety and health standards in order to avoid risks from exposed hazards. The aim of this study was to assess occupational safety and health practices in Kenya agricultural and livestock research organisations, western Kenya region. The study assessed hazards, determined safety and health awareness of workers and explored effectiveness of control measures present at the two workplaces. Structured questionnaires, camera and checklists were used for data collection including personal observation. Data was analyzed using the Statistical Package for Social Sciences. The study revealed that common classes and sources of hazards were chemical hazards from exposures to pesticides, dust / mist in field trials, cleaning detergents/disinfectants in research laboratories; biological hazards arising from working with animals and plants; ergonomic hazards arising from planting, weeding, sitting, walking or standing; physical hazards from exposures to heat in green houses and in open field as supported by workplace inspection. It was established that both institutes had a safety and health policy with 75% and 79% of respondents from Kakamega and Kitale centres respectively being aware of the existence of policy. However, 55% and 63% of respondents from Kakamega and Kitale respectively reported to have access to safety and health policy (χ^2=.813, df=1, p=.367), indicating the need for more sensitization to enhance access. Seventy percent (70%) from Kakamega and 67% from Kitale comply with safe work procedures in their daily operations. However, 60% from Kakamega and 53% of respondents from Kitale reported that they are not trained on identification of hazards as a control measure and therefore are at risk of exposure to harmful chemicals. All respondents from Kakamega and 84% of the respondents from Kitale reported to have used chemicals (χ^2=3.887, df=1, p=.049). . Sixty two percent (62%) from Kakamega and 63% of respondents from Kitale confirmed presence of safety and health committees at the two centres for hazard controls (χ^2=.010, df=1, p=.922). Seventy seven percent (77%) from Kakamega and all respondents from Kitale indicated that they are provided with personal protective equipment for control of hazards (χ^2=3.887, df=1, p=.049). Presence of safety and health committees, complying to safe work procedure practices, personal protective equipment provision and its usage, minimises worker's suffering from accident at the two work places. The study findings concluded that although there was exposure to occupational hazards, there were adequate control measures put in place to prevent risks of exposure among the respondents from both institutions. The management needs to intensify campaign for safety and health policy document accessibility, training and quantifying hazards at the two research institutes in order to raise safety and health awareness and effective control of hazards.

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

The KALRO Western Kenya Research Institutes were created under the Kenya Agricultural and Livestock Research Act of 2013. The Institutes' main focus is to develop improved technologies that support the upgrading and commercialization both the non-ruminant and food crops value chains. Upgrading these value chains will lead to wealth creation, food and nutritional security for all the players.

The Institutes conduct focused research on non-ruminants (pigs, poultry, and rabbits) and food crops (cereals, grain legumes, and root and tuber crops) with a potential for commercial farming. In the past, non ruminants and food crops did not receive adequate attention in research and development. These have proved to be highly prolific with high returns and have great potential to contribute to food security, income generation and poverty alleviation. The Non Ruminant and Food Crops Research Institutes have the mandate of generating and catalyzing knowledge, innovative technologies dissemination and services for sustainable livelihoods.

The Institutes have a national mandate with the following objectives;

i. Generate knowledge, information and technologies that will enhance the productivity of animal and food value chains,
ii. Develop and promote markets and marketing strategies for animal and food products value chains,
iii. Facilitate and advocate policy option for enhancing demand-driven non-ruminant and food crop product value chains,
iv. Strengthen the capacity for implementing non-ruminant and food crop product value chains Research

v. Catalyze the dissemination of knowledge, information, and technologies on non-ruminant and food crop product value chains.

The non-ruminant research and food crop research institutes have common programmes for conducting research in both livestock and crops. These programmes carry out research in the previous western province which covers Kakamega, Bungoma, Busia and Vihiga Counties. KALRO-western Kenya region also covers neighbouring counties such as Trans Nzoia, Nandi, Siaya, Kisumu and others as need may arise.

The common research programmes at KALRO-Western Kenya are as follows: Maize; Grain legumes – mostly beans (bush beans and climbing beans); Root and tuber crops (cassava and sweet potato); Sorghum and finger millets; Horticulture (bananas, African leafy vegetables (ALVs), assorted fruit tree seedlings such as guava, avocado, pawpaw and mangoes); Oil crops (oil palm, soya beans, groundnuts, bambara nuts and simsim); Seed unit (works with other programmes such as root and tuber crops, cereals and legumes); Natural resource management (deals with soils and related issues); Animal production (dairy cows, dairy goats, pigs, poultry and animal nutrition); Post harvest (cuts across various programmes; e.g. post harvest handling and value addition); Biotechnology (mostly tissue culture bananas but has potential for cassava, sweet potato and oil palm); Socio-economic (cuts across in most of the programmes); Outreach and partnerships (technology dissemination and relationships with clients).

The agricultural production activities carried out in KALRO-Western Kenya;(crops, livestock and machinery usage) results into interaction relationship between human health and work, which may bring about occupational safety and health issues; hence there was a need to establish the extent of implementation of OSH standards at the two research institutions as a case study for its incorporation in KALRO- Mandate. KALRO-Western, like any other production system in Kenya, is expected to create a safe work environment and ensure workers are not affected by workplace hazards in

their operations, for efficient and effective unit achievement of their mandate (GOK, 2007c)

Other Kenya Agricultural Livestock Research Organization are shown in Table1.1

Table 1.1: Agricultural and Livestock Research Organization institutes in Kenya

Research institute	Head quarter/County	Location/coordinates
Agricultural mechanization research institute	Machakos	$1^0 35^1$S and $37^0 14^1$E
Horticulture Research Institute	Muranga	$0^0 59^1$S and $37^0 0.4^1$E
Industrial Crops Research Institute	Kilifi	
Sheep & Goat Research Institute	Marsabit	
Sugar Research Institute	Kisumu	
Tea Research Institute	Kericho	
Veterinary Research Institute	Kiambu	$1^0 13^1$S and $36^0 38^1$E
Apiculture Research Institute	Baringo	
Arid & Range Lands Research Institute	Makueni	$2^0 10^1$S and $37^0 55^1$E
Beef Research Institute	Garissa	$0^0 27^1 0.9^{11}$S and $39^0 38^1 45^{11}$E
Biotechnology Research Institute	Kiambu	
Coffee Research Institute	Kiambu	
Dairy Research Institute	Nakuru	
Genetic Resources Research Institute	Kiambu	

(Source: www.kalro.org)

An occupational health anticipates and prevents health problems or hazards that are caused by the work which people do or innovate to promote health and safety of workers which is part of the battle against major scourges of poverty, ignorance and diseases that is still handicap to many Kenyans. The owners or occupiers of any agricultural production institute in Kenya are required by the Occupational Safety and Health Act of 2007 to carry out initial risk assessments in order to manage their risks at the source. Risk management is the systematic application of management policies, procedures and practices to tasks by identifying, analyzing, evaluating, treating and monitoring associated risks. Process whereby decisions are made to accept a known or assessed risk and/or the implementation of actions to reduce the consequences of probability of occurrence is referred as risk management (Jeremy, 2006). Risk management covers a wide range of hazards and these can be conveniently categorized under the general headings of environment, technical/economic and social/people hazards. Thus risk management is a system of managing risks at work (GOK, 2004).

1.2 Problem Statement

KALRO-western Kenya has a large number of employees who contribute immensely to the economy through research and development of new innovative agricultural products. The research institute utilises many chemicals that may be potentially irritating, toxic, mutagenic, teratogenic and/or carcinogenic in their laboratories (Tonui, 2007). Virtually all chemicals are hazardous, if a person is exposed to a sufficient degree. Moreover, the hazard of working with biocides, dust, soot, ash, machines, animals and plants is compounded by the likelihood of multiple exposures to one or more hazards over time. Exposure to more than one hazard may result in synergistic effect of damage greater than the additive damage of the individual exposure. In the absence of hygiene, safety and security controls at workplace, exposures to such like hazards may result into frequent ill health conditions to workers. According to ILO (2013), workers in agriculture run at least twice the risk of dying on the job as workers in other sectors and at least 170,000 agricultural

workers die each year and more of the world's 1.3 billion agricultural workers are seriously injured in workplace accidents involving machinery, or poisoned by pesticides and other agro-chemicals.

This study sought to assess the extent of the implementation of OSH-standards and safe work procedures by Kenya agricultural and livestock research organisation for protection of workers from accidents and ill health effects arising from activities of person at work.

1.3 Objectives

1.3.1 Main Objective

Assess status of occupational safety and health practices in the Kenya agricultural and livestock research organisations in Western Kenya region

1.3.2 Specific objective

i. To assess hazards present in KALRO-Kakamega and Kitale stations
ii. To determine occupational safety and health awareness among workers and management in Kakamega and Kitale stations
iii. To explore the effectiveness of control measures for hazards present in Kakamega and Kitale stations

1.4 Research Questions

i. Which are hazards present in Kakamega and Kitale station?
ii. How is occupational safety and health awareness among workers and management in Kakamega and Kitale stations?
iii. Which are control measures for hazards explored in Kakamega and Kitale stations?

1.5 Hypothesis

Null (H_0): there is no implementation of OSH standards in KALRO-western Kenya region

1.6 Justification

The study findings will assist research institutes to put in place adequate OSH standards for compliance to good safety agricultural practices and promotion of safe work procedures for protection of workers from accidents and ill health effects arising from activities of person at work. This is important since often research organizations overlook such issues on assessing the operation of occupational safety and health systems of agricultural based institutions yet have implications on quality and standards of expected research outputs as they affect personnel and actions within the work environment. In addition to the obvious and significant benefits from preventing serious illness, there could be indirect benefits, such as a reduction in the costs associated with occupational illness for employers, employees and society. These costs include medical, insurance and legal expenses; time lost from work and disability or unemployment. The research findings may be used to promote embedding continual improvement through auditing and implementation of guidelines for environmental management systems (EMS) such as International Organization for Standardization (14001; 2004), by both workers and managers in KALRO production systems. This will enhance OSH continuous improvement in KALRO thereby promoting a safety culture at workplace, given that there were limited studies carried out.

1.7 Scope of the Study

The research was conducted at Non-ruminant and Food crop Research Institutes which are the headquarter centres for KALRO Western Kenya region. The study assessed the operation of occupational safety and health systems of agricultural based institutions during the months of April to June 2016.

1.8 Limitation of the Study

This included lack of technical knowhow among participants in terms of their interpretation responses to research instruments such as check- lists and questionnaires used to collect data.

1.9 The Conceptual Framework

The conceptual framework below gives an outline of possible causes of action or presents a preferred approach to occupational safety and health management system to safeguard workers from work related hazards basing on operational variables.

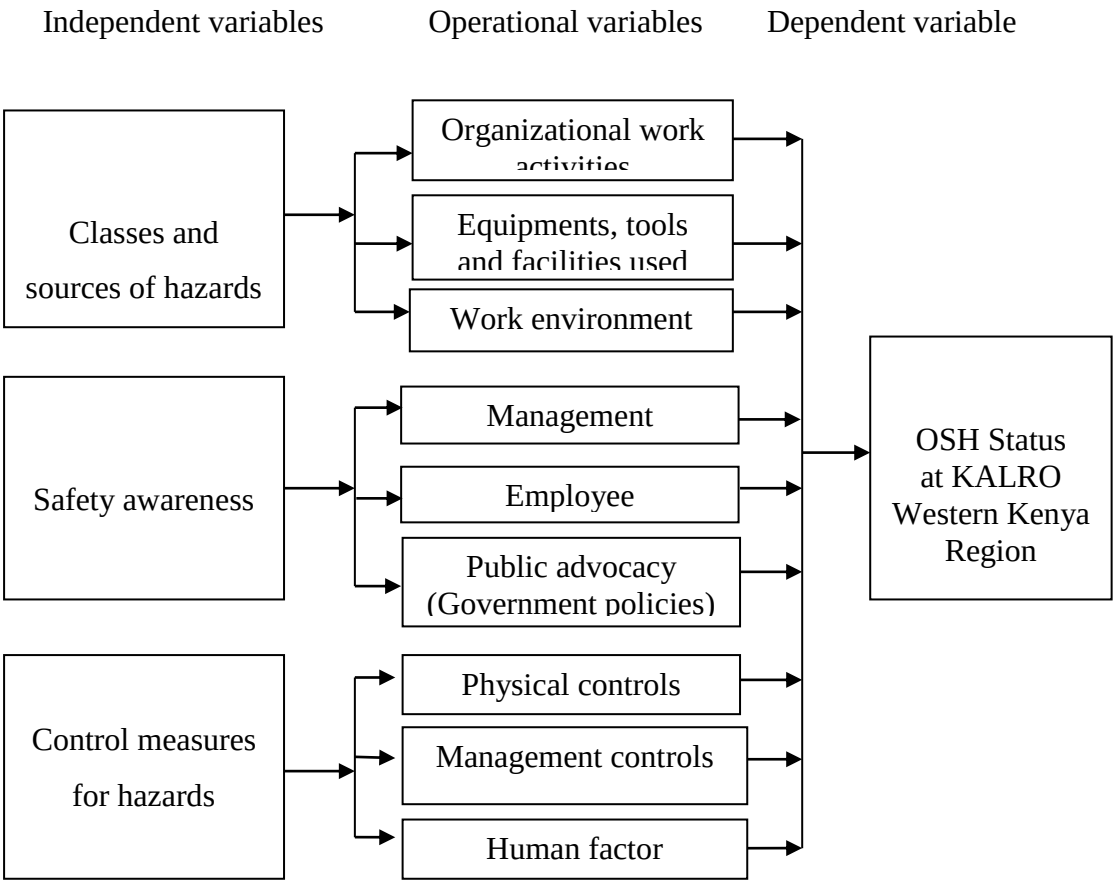

Figure 1.1: The conceptual framework.

The dependent variable in the study was the OSH status at KALRO Western Kenya Region and the independent variables that were used to check the OSH status in the

organisation were hazard control strategy measures established for high risk factors at the workplace The variables involved in study included; age of employees, educational level of workers, work experience, safety of equipment and machinery use of personal protective equipment and good operational practices put in place to control hazards at institutional level.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews Literature based on national and international guidelines on sources of hazards, classes of hazards and the explored effectiveness for hazard control measures used for assessing the OSH status at organizational level .

2.2 Theoretical Principles

2.2.1 Occupational Safety and Health Development - Industrial Revolution

During the days of the ancient Babylonians, circa 2000 B.C., the ruler Hammurabi developed his Code of Hammurabi which encompassed all the laws of the land. In relation to safety and health the code contained clauses dealing with injuries, allowable fees for physicians, and monetary damages assessed against those who injured others (David, 2005). In the Egyptian civilization during the reign of Rameses II, while undertaking the construction of the Ramesseum temple, the Pharaoh created a medical service to care for the workers. The workers were required to bath daily in the Nile and were given regular medical examinations and the sick were isolated (David, 2005).The Romans were also concerned with safety and health of workers as may be seen in the remains of their construction projects. They built aqueducts, sewerage systems, public baths, latrines and well-ventilated houses. As civilization progressed safety and health development came into being (David, 2005). From the early 1900s to the present time, employers and safety practitioners adopted the philosophy of the three E's (engineering, education, and enforcement) to guide their safety-related interventions. To make a difference in the health and safety of employees, the three Es of safety focus on: 1.) developing engineering strategies that decrease the probability of an employee engaging in at-risk behaviours; 2) educating and training employees regarding equipment, environmental hazards,

policies and procedures; and 3) enforcing the policies and procedures related to operating equipment, wearing proper personal protective equipment, and handling specific hazardous substances (Pettinger, 2009). The Great Factory Act was passed in Britain in 1844 and by 1850, industrial engineers were improving the physical working conditions by increasing ventilation, improving lighting, and providing guarding for dangerous moving machinery. Industrial safety engineering research has suggested that injuries occur as a result of excess energy between the body and the work environment (Geller, 2000).

2.2.2 Common Hazards in Agricultural Research Institutes

Some of the hazards encountered as noted in Laboratory safety Hand Book (Tonui, 2007) include; physical hazards (extreme temperatures, noise, vibration, Slips, trips and falls, moving machinery, on-site transport); skin contact with chemical hazards (irritants, solvents, sensitizers, exposure to controlled and uncontrolled pesticides, fungicide and acaricide applications); biological hazard agents (animals, bacteria, parasites); ergonomic hazards (manual handling, repetitive work, tools poorly designed for the intended task) (GOK, 2007c). Frequent or common injuries in research institutes include cuts and wounds, eye infections, skin problem, fever and headaches caused by excessive heat or by exposure to pesticides while working in the agricultural fields (ILO, 2000).

2.2.2.1 Micro-climate

In the Agricultural research institutes, the safety and health professional is concerned with high temperature exposure to the workers especially in screen and green houses for specialized research. It is of significance to note that there is a range of temperature that a worker can be exposed to without experiencing heat strain or any other adverse effect. Heat stress is the net heat load that a worker is exposed to from combined contribution of metabolic cost of work, environmental factors (air temperature, humidity, air movement and radiant heat exchange) and clothing requirements (ACGIH, 2002). The micro-climate in research institutes can vary

widely depending on the nature and design of work methods required. Micro-climate associated with roofing tiles types of asbestos or poly vinyl materials and heat radiation are factors that can cause certain occupational diseases such as cataracts and pathological conditions of the alimentary tract and blood circulatory system (Ayah, 2011). Protective measures, such as shielding, remote work posts, medical surveillance, rest periods, protective clothing and correct body liquid and salt balance are necessary (Duffey & Saul, 2008).

2.2.2.2 Heat Exhaustion

This disorder is caused by loss of salt and water from the body through excessive sweating. It usually develops gradually and often affects people who are not acclimatized to hot/humid condition (Rukunga, 2001). People who are unwell especially those with illness that cause vomiting and diarrhoea are more susceptible than others to developing heat exhaustion. A dangerous and common cause of heat exhaustion occurs when the body produces more heat than it can cope with warm environment, such as those that workers in greenhouse are exposed to, may result into a person becoming overheated and dehydrated. These effects can lead to heatstroke or even death (St. John Ambulance Canada., St. Andrew's First Aid., & British Red Cross Society., 2011)

2.2.2.3 Heatstroke

This condition is caused by failure of 'thermostat' in the brain which regulates body temperature. The body becomes dangerously overheated usually due to high fever or prolonged exposure to heat. Heatstroke can also result from use or exposure to chemicals/drugs. In some cases heatstroke follows heat exhaustion when sweating ceases, and the body then cannot be cooled by evaporation of sweat. Heatstroke can develop with little warning resulting into unconsciousness or feeling unwell to a casualty (St. John Ambulance Canada. et al., 2011). Help administered to a casualty worker exposed to excessive heat may include the following strategies; casualty to be moved to a cool shady place, encourage him to lie down and raise and support his

legs; give him plenty of water to drink; oral hydration of salt or isotonic drinks can help or prevent the health condition or even call emergency (St. John Ambulance Canada. et al., 2011).

2.2.2.4 Manual Handling and Lifting

Manual handling leads to a number of injuries. Such as back injury which is one of the most common injuries at workplace. From compensation point of view, almost one-fourth of all workers compensation claims involve back injuries (Jeremy, 2006). According to the California Workers' Compensation Institute, medical care costs are 43 percent higher when part of workers' compensation claim than when part of group medical plan (GOK, 2007b). Automation and mechanization are the only way to reduce many of the traditional hazards associated with the handling of material as back- injuries problems continue to affect workers in agricultural research institutes. Very few of the back injuries are reported by the workers or organisations. The time lost due to back problems is reflected by sick leaves. Training on proper lifting methods and the increased safe use of mechanical devices wherever available will decrease the number and severity of injuries -ergonomic issues (GOK, 2007c).

2.2.3 Hazard Hierarchy Control Measures

Hazards and risks to workers' safety and health require identification and assessment on an ongoing basis. Preventive and protective measures are implemented in a hierarchical order; elimination of the hazards can be achieved at the design stage through engineering controls; hazards at source can be minimised through the use of engineering controls or organizational measures; substitution of hazardous substance with less hazardous without compromising the product; isolation of the hazardous area through use of barriers; minimize the hazard by the design of safe work systems which include administrative control measures. Where residual hazards cannot be controlled by collective measures, the employer provides for appropriate personal protective equipment, including clothing, at no cost and implement measures to ensure its use and maintenance (Barasa, 2014). Hazard prevention and control

procedures or arrangements are established and adapted to the hazards and risks encountered by the organization. They are reviewed and modified on regular basis in order to comply with national laws and regulations considering the current state of knowledge, including information or reports from organizations. These may include labour inspectorates, occupational safety and health services, and other services as appropriate (ILO-OSH, 2001a). The impact on OSH of internal changes (such as those in staffing or due to new processes, work procedures, organizational structures or acquisitions) and of external changes (for example, as a result of amendments of national laws and regulations, organizational mergers, and developments in OSH knowledge and technology should be evaluated and appropriate preventive steps taken prior to the introduction of changes (ILO, 2004). A workplace hazard identification and risk assessment are carried out before any modification or introduction of new work methods, materials, processes or machinery are commissioned (Benjamin, 2008). Such assessments are done in consultation involving workers and their representatives; the safety and health committee, where appropriate. The implementation of a "decision to change" ensures that all affected members of the organization are properly informed and trained in emergency prevention, preparedness and response (Jeremy, 2006). These arrangements identify the potential for accidents and emergency situations and address the prevention of OSH risks associated with them. The arrangements are made according to the size and nature of activities of the organization for ensuring that the necessary information, internal communication and coordination are provided to protect all people in the event of an emergency at the worksite. (NIOSH, 2010).

2.2.3.1 Safety and Health Training

Safety frequently depends on individuals in a place like research institute having the knowledge and skills to perform tasks safely. If safety training is to make contribution to the 90% improvement goal that Johnson and others working with the Management Oversight and Risk Tree Analysis see as attainable, safety training must integrate traditional and effective training methods with new approaches and

methodologies to improve its output and effect on performance of people (Richard, 2004). In training, an operation or activity is selected for which trainings is needed. This is done once hazards with an adverse effect have been identified. In the training effort, attention may be focused on the hazards that will be encountered during the performance (or non performance) of the workers. The ultimate responsibility for successful implementation of training programs is with the top management (ILO-OSH, 2001b). Full involvement of management in safety training is a very important factor for hazard control (Charles, 2003). The top management aims to achieve and maintain high levels of safety through knowledge of the hazards, their effects and the techniques to counter those effects. The employer has a responsibility of ensuring that employees of all levels have correct knowledge and sound technical background about hazards present at work. The provision of that knowledge through training, instruction and information constitutes a major contribution towards high safety performance. In providing the training, account of the level of employee's knowledge must be taken into consideration (Channing, 2013). Among the applications of the general systems model to safety activities, one of the most useful activities due to its contribution to understanding of development of safety training is the risk management process. The risk management process is the systematic application of management policies, procedures and practices to the tasks of communicating, establishing the context, identifying, and analysing, evaluating, treating, monitoring and reviewing risks (AS/NZS, 2004). Research Institutes must have risk management process in order to safeguard the safety and health of worker. KALRO Western Kenya research institutes, like all other workplaces in Kenya must conduct risk assessment and the management /to establish appropriate measures to mitigate hazards encountered at work (GOK, 2007b). Risk assessment can be defined as the characterization of the potential adverse health effects of human exposures to environment hazards (Draggan, 2007). Four steps in the process of risk assessment are as follows; Hazard identification; determination of whether a particular chemical is casually linked to health effects, Dose-response assessment; determination of the relationship between the magnitude of exposure and the probability of occurrence of

the health effects in question, exposure assessment; determination of human exposure before or after application of regulatory controls and risk characterization; description of the nature-and often the magnitude-of human risk, including attendant uncertainty (Draggan, 2007).

2.2.3.2 Monitoring, Evaluation and Internal Audit

Procedures to monitor, measure and record OSH status/performance on a regular basis is to be developed, established and periodically reviewed. Responsibility, accountability and authority for monitoring at different levels in the management structure are allocated. The selection of performance indicators are based according to the size and nature of activity of the organization and the OSH objectives (ILO, 2004). Both qualitative and quantitative measures appropriate to the needs of the organization are considered. These are based on the organization's identified hazards and risks, the commitments in the OSH policy and the OSH objectives; support the organization's evaluation process, including the management review (ILO, 2009). Performance monitoring and measurement are used as a means of determining the extent to which OSH policy and objectives are being implemented. Risks are controlled and include both active and reactive monitoring, and are not based only upon work related injury, ill health, disease and incident statistics that are recorded (Lehtinen, 2009) Monitoring provides ongoing development on OSH status. Information to determine whether the day-to-day arrangements for hazard and risk identification, prevention and control are in place and operating effectively and the basis for decisions about improvement in hazard identification and risk control, and the OSH management system. Active monitoring contains the elements necessary to have a proactive system and includes: monitoring of the achievement of specific plans, established performance criteria (Richard, 2004). The systematic inspection of work systems, premises, plant and equipment and surveillance of the working environment, including work organization, surveillance of workers' health, where appropriate, through suitable medical monitoring or follow-up of workers for early detection of signs and symptoms of harm to health in order to determine the

effectiveness of prevention and control measures and compliance with applicable national laws and regulations, collective agreements and other commitments on OSH to which the organization subscribes (ILO-OSH, 2001a). Arrangements to conduct periodic audits are to be established in order to determine whether the OSH management system and its elements are in place, adequate, and effective in protecting the safety and health of workers and preventing incidents. An audit policy and programme developed includes designation of auditor competency, the audit scope, and the frequency of audits, audit methodology and reporting. The audit includes an evaluation of the organization's OSH management system elements or a subset of these, as appropriate (ILO-OSH, 2001b). The audit conclusion determine whether the implemented OSH management system elements or a subset of these: are effective in meeting the organization's OSH policy and objectives, are effective in promoting full worker participation, respond to the results of OSH performance evaluation and previous audits, enable the organization to achieve compliance with relevant national laws and regulations, fulfil the goals of continual improvement and best OSH practice (Armstrong, 2001). Audits are conducted by competent persons internal or external to the organization who are independent of the activity being audited. The audit results and audit conclusions should be communicated to those responsible for corrective action. Consultation on selection of the auditor and all stages of the workplace audit, including analysis of results, are subject to worker participation, as appropriate (Pius, 2009)

2.2.3.3 Continual Improvement for Establishing a Safety Culture

Barasa (2014) observes that plans for continual improvement ideally are established and maintained continuously for promoting a safety culture in an organisation. These arrangements take into account: setting up an effective safety objectives in its organisation.

KALRO established safe working procedures from the results of; hazard identifications and assessments, performance/status through monitoring and

measurements, investigation of work-related injuries, diseases, ill health and incidents, recommendations of audits, management review, recommendations for improvement from safety and health committee, and changes in national laws or policy regulations and voluntary programmes.

Establishment of good OSH activities as per Agricultural research institute have capability to fulfil a few OHSMS requirements as defined in several standards and guideline which is positive sign for possibilities of OHSMS implementation at organisational level. Healthier and safer working environment is always appreciated. In summary, the implementation of OHSMS is done in a sequential manner taking into consideration the following, setting up an effective safety organisation, establishing; a clear company safety policy; setting company rules and regulation; having down safe working procedures; establishing rules, regulations and procedure as a safety handbook or manual; providing safety training for all employees (Jeremy, 2006).

2.3 Legal Framework on Occupational Safety and Health

In order to encourage employers and employees to reduce workplace hazards and to implement safety and health program, Kenya has ratified ten out of fifty ILO conventions that are related to OSH (ILO, 2013).

2.3.1 Occupational Safety and Health Law in Kenya

Safety and health was introduced in Kenya in 1951 when the country was a British colony (David, 2005). Development of safety and health has depended on law enforcement as a driving force with limited understanding on the part of the industrialists. Lack of coordination on matters related to safety has led to lack of reliable data on occupational accidents and occupational diseases by the department given the responsibility of safeguarding the safety and health of the workers (Channing, 2013). Unlike other countries where noted improvement has been due to pressure from legislation promoting safety and health, Kenya has lacked the political

goodwill from the legislatures who do not fully follow-up the enactment of safety and health. This is evidenced by the lack of ratification of important International Labour Organization tools such as the Occupational Safety and Health Convention No. 155 since 1981 (Sommer, 2003). However, lack of ratification of the convention No. 155 does not mean Kenya has not incorporated the recommendations made through the said convention.

Promulgation of a new Constitution in August 2010 provides for the rights and fundamental freedom of all citizens. Although the Constitution does not address OSH specifically, it provides for the rights of every person to fair labour practices, reasonable working conditions, and a clean and healthy environment (ILO, 2013).

ILO in its effort to create safety and health awareness promotes decent, safe and healthy work conditions through convention No. 155 as one of its blue prints to deal with occupational safety and health and the workers. This right of decent, safe and healthy work conditions and the environment has been reaffirmed in the 1944 Declaration of' Philadelphia and the ILO Declaration on social Justice for a fair Globalization (Benjamin, 2008). All branches of economic activities are supposed to comply with the occupational safety incorporated in the national laws addressing the safety and health of' employees. Article 16 OSHA 2007, requires employers to ensure so far as is reasonably practicable, workplaces, machinery, equipment and processes under their control be safe and without risk to the health of the worker and that chemical, physical and biological substances and agents under their control are also without risk to health by ensuring measures are put in place for the worker protection (ILO-OSH, 2001b). Employers are required to provide, where necessary, adequate protective clothing and protective equipment to prevent risk from accidents or from adverse effects on health. Under the Occupational Safety and Health Act of 2007 which replaced the previous law, there is provision of securing the safety, health and welfare of persons at work. The act governs the safety, health and welfare of workers and persons present legitimately at places of work from hazardous exposure. Employers are given duties under the law to ensure the safety, health and

welfare at work for all persons in their workplaces (GOK, 2007a). The employer is to prepare a safety and health policy that will govern all activities in the workplace and also bring this document to the awareness of the employees. It is also a requirement of the law that a risk assessment be done to determine the significance of the various hazards in the work environment (GOK, 2007a).Workers are obligated by the law to cooperate with the employers for their safety and observation of all health and safety requirements. They are to ensure their own safety and that of others by removing workplace hazards that they can or reporting the presence of the hazards which they are unable to remove. Where personal protective appliances are provided by the employer the worker is expected to use them (GOK, 2007a). Writing on occupational health and safety law in Southern African countries indicated that there has been an active process of revising occupational safety and health legislation in most of the South African countries (Loewenson, 1997). Kenya introduced the act OSHA in October 2007. The OSHA legislations are applicable to research organisations and are meant to ensure the employees plus persons legally present in the workplace are protected against risk to safety and health arising in connection with work activities. This was meant for identification of hazards, recognition of those at work and inclusion of workers in identifying risks and ensuring safe work environment (Loewenson, 1997). While complying with Government of the Republic of Kenya, (2007), research institutions are required to carry out appropriate risk assessment on safety of persons employed and on the basis of their finding, adopt preventive and protective measures on the safety and health. Prevention and protection against workplace health hazards are addressed by having a safety and health management system in the workplace. Research Institutes should have their workplaces audited on safety and health once every twelve months by a safety and health advisor (GOK, 2007c). The OSH services in Kenya are governed by two pieces of legislation: the Occupational Safety and Health Act, 2007 (GOK, 2007c) and the Work injury Benefits Act, 2007 (WIBA, 2007). The purpose of OSHA 2007, is to secure the safety, health and welfare of people at work, and to protect those not at work from risks to their safety and health arising from, or in connection with, the activities of

people at work. The purpose of WIBA is to provide compensation to employees for work-related injuries and diseases contracted in the course of their employment, and for connected purposes. There are also several regulations and subsidiary laws that deal with OSH issues as formulated by DOSHS (GOK, 2007c).

2.3.2 Subsidiary Laws that Deal with OSH Issues in kenya

2.3.2.1 The Factories (First Aid) Rules, L.N. No. 160/1977

These rules apply to workplaces, and require the occupier to put in place appropriate measures to ensure that those injured at work receive necessary medical attention. The rules specify the contents of the first-aid box in accordance with the number of workers, and the training of first-aiders (GOK, 2007c).

2.3.2.2 The Factories (Eye Protection) Rules, L.N. No. 44/1978

These rules apply to workplaces, and require the occupier to protect their employees against exposure that is injurious to the eyes (GOK, 2007c).

2.3.2.3 The Factories (Electric Power Special) Rules, L.N. No. 340/1979

These rules apply to the generation, transformation, conversion, switching, control, regulation, distribution and use of electrical energy in workplaces. They require the occupier to put appropriate measures in place to eliminate electrical hazards within their premises by the insulation of conductors, and by the provision of circuit breakers and personal protection (GOK, 2007c).

2.3.2.4 The Factories and other Places of Work (Safety and Health Committees) Rules, L.N. No. 31/2004

These rules apply to workplaces with 20 or more regular employees. They require the occupier to set up safety and health committees with equal representation of management and workers. The functions of the committee include conducting safety

and health inspections, investigating accidents, and making recommendations to the occupier on improvements for the promotion of a safe and healthy working environment. In order for workplaces to secure a safe work environment, cooperation of the management and workers through formation of Safety and Health Committees has been found to be necessary. An active safety and health committee is important in improving the safety of the workplace. The primary purpose of the safety and health committee is to enable management and workers to work together to monitor the work environment, prevent accidents and improve working conditions (GOK, 2007c). Occupiers of research institutes are expected to establish their Health and Safety Committees. Among the duties of the safety and health committees are to advice on the adequacy of safety and health measures for hazardous activities in the research Institute operations. Safety and Health committee members are able to identify hazards in the Agricultural Research Institutes operations through awareness of occupational hazards (GOK, 2004). Hazard awareness in the workplace is achieved through training of workers to help in identifying occupational hazards and cases of ill health among workers in the workplace. Occupational hazards identified in the Agricultural research institute may sometimes require the employer to monitor and evaluate hazards and risks by more knowledgeable persons. Training as one of the educational activities on safety and health risks, raises awareness of both workers and employers about the need to of safety and health at work (JISHA, 2001).

2.3.2.5 The Factories and other Places of Work (Medical Examination) Rules, L.N. No. 24/2005

These rules apply to workplaces where employees are engaged in occupations that expose them to hazards that might harm their health. They specify occupations requiring medical examinations, and the types of examination of employees at the employer's cost. According to the medical examinations rules, workers in manufacturing units are to undergo medical examinations if they are exposed to specific occupational health hazards for the purposes of preventing and controlling occupational diseases (GOK, 2007c). Medical examinations are required for

Agricultural research institute employees especially due to exposure to chemicals or pesticides particles when mixing or using them. Kenya agricultural research institutions are expected to seek the designated health practitioners to perform medical examinations as part of worker screening programs, for both predictive and preventive purposes. Pre-placement and medical surveillance are thus offered to comply with the occupational safety and health standards to ensure a worker is not affected by an Occupational hazard (Levy *et al.,* 2006).

2.3.2.6 The Factories and other Places of Work (Noise Prevention and Control) Rules, L.N. No. 25/2005

These rules apply to workplaces where activities result in noise levels that could impair or damage employees' hearing ability. They specify the permissible levels of noise, and require the occupier to carry out noise measurements, develop a noise prevention programme to reduce noise levels, and provide hearing protection (GOK, 2007c). Occupational exposure to noise levels in excess of OSHA standards places workers at risk of noise induced hearing loss (Reese, 2003). One of the ways of providing a safe workplace where noise is concerned is taking practicable steps to ensure occupational exposure limits of noise are not exceeded. The noise level exposure to workers is determined through a noise assessment to show where levels are exceeding exposure limits (GOK, 2005). Where noise levels exposures in agricultural research farm mechanisation section exceeds the continuous equivalent of eighty five decibels for eight hours, an effective noise control and hearing conservation program shall be developed (GOK, 2007c). The programme is to address noise measurement, education and training, hearing protection and hearing tests. KALRO-western Kenya management is required to inform all workers in writing the results of any noise exposure measurements done. Unit Mechanisation Section operators are expected to ensure that all workers exposed to harmful noise levels are fully trained on the hazard, and are instructed in the measures available for prevention, control and protection against high level noise exposure. Before hearing

protectors are given, employees require training in fitting, selection, use, care, and maintenance of appropriate hearing protectors (GOK, 2007b).

Noise levels in the industry should be measured to establish levels and duration of exposure to the workers and identify the sources of noise and exposed workers in order to come up with control measures. Harmful effects of noise can be categorized as exposure to high level over a significant period of time which may cause both temporary and permanent damage, noise that interferes with speech communication and warning signals that which interferes with work performance and the noise that interferes with relaxation and sleep (Duffey, R $ Saul, 2008). Stress causing noise may contribute to heart disease, ulcers and other stress related problems (Ayah, 2011) Control or mitigating measures will be necessary where the exposure levels are above the statutory recommended standards. Sometimes it is important to put in place mitigating measures where the stipulated standards are not being exceeded. Mitigating or control measures will also require monitoring of the effectiveness of the control methods being implemented to ensure, Noise Induced Hearing Loss does not result either due to failure of Personal Protective Appliances in use or other modes of control in place (GOK, 2005). Control of noise can be done is various ways. The equipment in use can be changed or modified through engineering controls to reduce level of noise being emitted. Noise being emitted by a process can be insulated through glazing or use of silencers or the process itself can be isolated. These noise control methods can be applied where a large number of workers are being unnecessarily exposed. Well maintained machinery is known to be less noisy as compared to poorly maintained ones (Reese, 2003). Vibration hazards are closely related or associated with noise hazards because tools that produce vibration typically also produce excessive levels of noise. The most common vibration-related problem is known as hand-arm vibration syndrome (HAV). The condition strikes an alarming number of workers who use vibrating power tools day in day out as part of their jobs (Osha, Service, & Unit, 2007).

2.3.2.7 The Factories and other Places of Work (Fire Risk Reduction) Rules, L.N. No. 59/2007

These rules apply to workplaces, and require the occupier to put appropriate measures in place to prevent the occurrence of fires within their premises. They address the safe handling, storage and transportation of flammable substances. They also require the occupier to provide means of evacuation, fire detection systems, fire fighting equipment, and fire fighting teams. The Rules prescribe annual fire safety audits, the formulation of a fire safety policy, and training of workers on fire safety issues (GOK, 2007c).

2.3.2.8 Factories and other Places of Work (Hazardous Substances) Rules, L.N. No. 60/2007

These rules apply to workplaces where workers are likely to be exposed to hazardous substances. They require the occupier to prevent employees from exposure to such substances by putting various control measures in place, or, where these are not reasonably practical, to ensure that personal protective equipment (PPE) is provided. They prescribe occupational exposure limits (OEL) for hazardous chemical substances, safe handling, use and disposal of hazardous substances (Tonui, 2007). A hazardous substance is any material that poses a threat to human health and or environment. Typical hazardous substances found in agricultural research institute are; pesticides, fungicides and acaricide exposures when mixing or when using them. Green/screen house aerosols and dust exposures are common chemical hazards present; storage and disposal of containers used for control of pests, fungus and ticks may generate fumes in environment. The fumes and dust in the smoke emitted from such process become air pollutants as they elevate surrounding temperatures that have possibility of contributing to ill health (Afubwa & Mwanthi, 2014). The hazardous substances rules require that where in a workplace such as agricultural research production materials used or process done could give rise to exposure to any hazardous substances such as dusts and fumes, appropriate safe work procedures

should be written and the employee instructed on proper use of them (GOK, 2007b). An issue that may be considered to be one of the largest single occupational problems is airborne substances. Some toxic agents and potentially hazardous substances exposure in Agricultural institute are aromatic hydrocarbons, benzopyrene, from pesticides, fungicides and acaroids, dust particles, aerosols (from animal waste) and fumes (from improper storage of excess pesticides in store) (Afubwa & Mwanthi, 2014). These types of hazards will not only affect the workers but also the surrounding community that may be having residential houses nearby. The organic pollutants have been known to contribute to respiratory problem and most seriously lung cancer, asbestosis, cancers of the stomach and mesothelioma (ILO, 2009).

Other Laws and regulations covering aspects related to OSH but issued under other Ministries include: The Environmental Management and Coordination Act, 1999: The Bio safety Act, 2009; The Public Health Act, Cap. 242; The Pest Control and Product Act, Cap. 346; The Radiation and Protection Act, Cap. 243

2.4 Previous Related Studies

In a study carried out in USA (Schulte & Chun, 2009a); climate change and Occupational Safety and Health, developed a framework based on the review published scientific literature from 1988-2008 included climate effects, their interaction with occupational hazards and their manifestation in working population. Four categories to climate related hazards and their effects on workplaces were identified through this framework related to this study; increased ambient temperature, Ozone depletion leading to increased UV radiation, Extreme weather and Changes in the built environment. Creation of awareness and mitigation strategies for adverse climate change is necessary in research Institutes for their success in their mandate at workplaces.

Table 2.1: Health Hazards and Effects Related to Climatic Change

Climate-Related Change	Health Hazards/ Effects	Nature of Evidence
Increased Ambient temperature	Heat stress/stroke Decreased chemical tolerance Fatigue Impact on immune function	Heat-related deaths among farm labourers and construction workers. Mortality in cities during heat extreme events. Outdoor workers and those who work in thermally inefficient buildings without air conditioning or proper ventilation system will be most exposed.
Ozone depletion leading to increased UV radiation	Increased UV radiation Eye effects and skin cancer Disturbed immune function	Association between the ambient UV exposure, average. Daily maximum temperature and the incidence of skin cancer and cortical cataract. Suppression of cell mediated immunity, increased susceptibility to infection
Extreme weather	Flood cleanup Mental stress Lightning Disruption of industrial hygiene Services	Association between weather disaster and death, injury. Communicable diseases and mental health disorders. Increased frequency or intensity of floods, droughts, and fires; economic disruption, population displacement, and Fatalities from sea level rise and flood events. Exposures to mould, chemicals, biological agents, floodwaters, dust and dried flood sediment, flood debris, and noise were potential health hazards. Safety hazards such as broken glass and skin contact with floodwater posed a risk to disaster relief workers during cleanup operation after Katrina.
Changes in the built Environment	Tight buildings Radon	Tight buildings for energy efficiency lead to radon build up. Office workers may be exposed to a wide range of indoor air contaminants due to increased indoor activities from more hot days and high air pollution. Occupational radon exposure of miners and indoor workers.

Source: (Schulte & Chun, 2009)

In a research carried out in Tanzania (Augustino *et. al.,* 2013); adaptation to climate change; proposed strategies taken to enable communities or working population to have ability to survive with the state of climate shift. Adaptive capacity of the systems to adjust to climate change has three components namely awareness, ability and action. Adaptive capacity is among the determinants of vulnerability of exposure and sensitivity (Augustino et al., 2013). Farmers adaptation strategies to adverse climatic stresses (prolonged dry spells , unpredictable flood, pests and disease) identified in the article based on responses in farming and non farming activities included crop diversification, changing crop calendar, adopting modern farming techniques (Augustino *et al.,* 2013).

According to article from La paz County, Bolivia (Haj-Younes *et al*., 2015) Sale, storage and use of legal, illegal and obsolete pesticides; study shows limited knowledge on pesticides safety measures and use of PPE, both among pesticide retailers and farmers at their workplace. The very toxic WHO class I and II pesticides were found to be sold by the retailers and stored in the farmers' homes. Sixty per cent of the pesticides found among the farmers were obsolete and an estimation of the accumulated amounts of obsolete pesticides that exist officially at recognized dumping site was alarming. The survey data included information about pesticide stocks, the handling, storing and reuse of pesticide containers; the participants' knowledge and experience with pesticide use, the hygienic measures taken by researcher, farmers and retailers. The safety, security and hygiene of pesticide storage and handling knowledge is necessary at any workplace.

A study carried out in USA by Langley & Morrow, (2010) indicated that animal contact is often ranked as the first or second leading cause of injuries on the farm. In addition to direct trauma from the animal, other injuries may occur from injection of medications, chemical splashes from cleaning the facility, and repetitive motion injuries. Exposures to toxic gases from decomposition of animal waste such as in manure pits and exposure to animal allergens may cause adverse health effects in humans at workplace. One additional consideration is the risk of developing various

zoonotic infections (Channing, 2013). Livestock handlers are involved in a variety of activities such as feeding, moving animals to different locations, loading animals on trucks/trailers, artificial insemination, shearing, grooming, basic animal care such as hoof care, dehorning, and cleaning animals, roping animals, applying topical insecticides, giving vaccinations, applying topical or administering oral medications, castrating, pulling teeth, ear tagging, milking, branding, shoeing, assisting with delivery of newborns, and assisting veterinarians with treatment or handling of injured animals. Other activities involving animals may include work tasks such as ploughing fields; pulling equipment such as wagons to transport farm goods; riding animals, primarily horses, for farm or ranch activities such as corralling cattle; teaching others to ride; butchering animals for food; and, rarely, euthanizing or destroying sick or aggressive animals. Numerous hazards exist on poultry and livestock farms. In a study carried out in USDA Lindahl *et al.,* (2013) livestock handling in dairy production is associated with a number of health and safety issues (Lindahl et al., 2013). A large number of fatal and nonfatal injuries still occur when handling livestock. The many animal handling tasks on a dairy farm include moving cattle between different locations, vaccination, administration of medication, hoof care, artificial insemination, and ear tagging, milking, and loading onto trucks. There are particular problems with bulls, which continue to cause considerable numbers of injuries and fatalities in dairy production. In order to reduce the number of injuries during animal handling on dairy farms, it is important to understand the key factors in human-animal interactions. These include handlers' attitudes and behaviour, animal behaviour, and fear in cows (Lindahl et al., 2013). Care when in close proximity to the animal is the key for safe handling, including knowledge of the flight zone, and use of the right types of tools and suitable restraint equipment. Thus, in order to create safe working conditions during livestock handling, it is important to provide handlers with adequate training and to establish sound safety management procedures on the farm.

In a study carried out in USA by Fiske and Earle-Richardson (2013) titled Research to Practice points out why innovation safety is important component in research

Centres for Disease Control and Prevention (CDCP). National Institute for Occupational Safety and Health (NIOSH) has a mission of conducting applied research in support of workers health and safety at workplace before commercialisation of farm products (Fiske & Earle-Richardson, 2013). All of the excellent research in the world will not help workers if the products of that research are not effectively integrated into widespread use in industry. Creating simple health and safety designs easily fabricated on farms is an alternative to expensive manufacturing efforts. For this reason, Research to Practice has been a major program emphasis within NIOSH regulatory factors present in this sector (NIOSH, 2010).

2.5 Research Gaps

The transference of safety innovation from research into wide use with the industry can usually only occur when there is demand from Industry. For this demand to exist, Industry must believe there is a reasonable likelihood of serious worker Injury and that innovation will reduce that risk. Many agricultural operations are under severe financial stress, and do not feel that they are able to invest in safety.

Most of the information in the recent medical literature has primarily focused on respiratory symptoms in pork production facilities, and injuries primarily involving cattle and horses, especially recreational activities with horses. There is very little published on injuries associated with handling swine or other farm animals.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study Design

Descriptive cross sectional survey was used. It was an interactive cross-sectional study that involved survey, interviews, observation and photography in order to collect the necessary information (data).

3.2 Study Area.

This study was carried out at KALRO - Western Kenya which comprises of Non-ruminant Research Institute (Kakamega) and Food crop Research Institute (Kitale). Both institutes cover approximately 100ha of land each, for research, pastures and commercial farming.

3.3 Target Population.

The target population included managers, supervisors and workers at various levels of production. The organisation had 500 workers engaged on casual and contract basis during planting and harvesting, with a technical team of 142 officers (scientists, laboratory technicians, research officers, and research assistants); leading to a total population of 642 employees. The location of the site is as presented in Figure 3.1

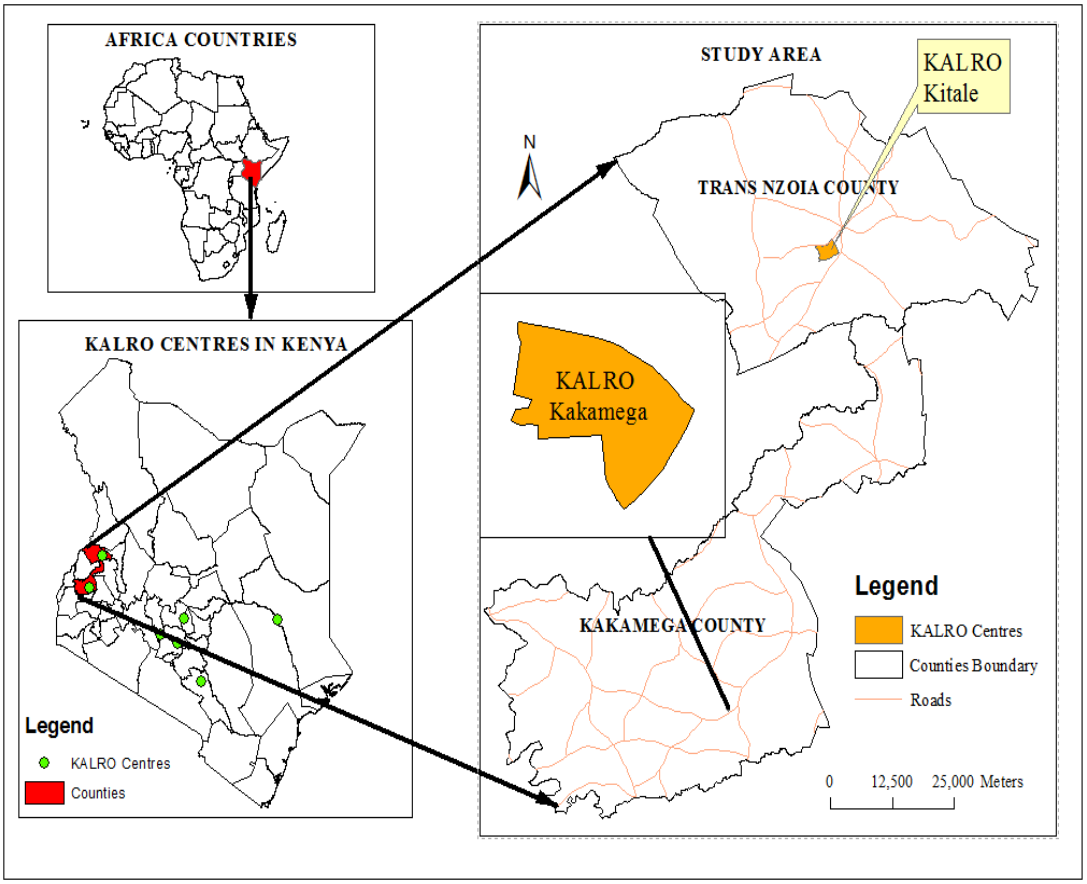

Figure 3.1: Location of KALRO-Western Kenya (KALRO, 2017)

KALRO-Kakamega has an annual rainfall ranging from 1280.1mm to 2214.1mm per year. The rainfall pattern is evenly distributed all year round, march to July experiences heavy rains while December to February receiving light rains. Temperatures range from 180C to 290C. January, February and March are the hottest months with other months having relatively similar temperature except for July and August which have relatively cold spells. The County has an average humidity of 67^{o}

KALRO-Kitale has a high equatorial climate with an annual rainfall ranging between 900mm to 1400mm and a mean temperature of 18.6 ^{0}C which ranges as low as 10^{o}C to 30^{o}C high. It also has favourable climate for both livestock and crop production.

3.4 Sampling Procedure

The study used stratified sampling method. In the stratified sampling the population was divided into four strata using work category criterion and then a given number of cases were randomly selected from each population sub groups namely; Scientists, Lab technicians, Technical assistants and Casuals. The sample size was then divided between KALRO Kakamega and Kitale station. The steps followed to come up with sampling frame involved: Identification of population to be sampled, defined criterion for stratification, a list of the population according to defined strata or sub group , the sample size determined and appropriate representation in each strata was sought using random numbers as appropriate number of subjects for each strata.

3.5 Sample Size Determination

Since the population was heterogeneous, the Cochrans formula for categorical data (1960) was used as described by Bartlett, Kotrlik and Higgins (2001) and calculated as follows;

$$SSo = \frac{z^2 \; x \; P \; x \; (1-p)}{c^2}$$

Where**: SSo** is the sample size

Z=1.96 for a confidence level of **95%**

P is the standard deviation, fixed p at 0.5

C is confidence interval, fixed in 0.05

P x (1-p) is the estimate of variance

Hence using the above formula, the sample size is;

$$\left(SSo = \frac{(1.96)^2 \, x \, 0.5 \, x \, (1 - 0.5)}{(0.05)^2} = 384 \right)$$

When sample size exceeds 5% of the population, the formula is corrected in the following way;

$$\left(\mathbf{SS_1} = \frac{\mathbf{SSo}}{\mathbf{1} + \frac{SSo}{Pop}} \right)$$

Where:

SS1 is the corrected sample

Pop is the population which in this case is represented by the total number of workers present at KALRO-Western Kenya (642). The required sample is thus;

$$SS_1 = \frac{384}{1 + \frac{384}{642}} = 240$$

The sample size in each stratum was calculated using proportionate stratified random sampling which generates more accurate primary data as follows:

$$\frac{\text{Size of the strata}}{Total\ population} \; X \; Required\ sample\ size$$

Table 3.1: Sampling frame for data collection

Strata's	Population size	Sample size	Sample size percentage
Scientists	72	27	11%
Lab technicians	18	7	3%
Technical officers/ Technical assistants	52	19	8%
Casuals	500	187	78%
Totals	642	240	100%

3.6 Research Instruments

The study used observational method as one of the data collection tool. Cameras were used to capture photographs (Plates), questionnaires for both workers and managers (Appendix 1 and 2), comprehensive Checklist and workplace observation checklist (Appendix 3 and 4) were used to collect the required data. The research tools were hand delivered to the workers/supervisor of KALRO who were responsible for implementation of safety and health management systems. The questionnaires were tailored so as to determine the three specific objectives. One checklist per workplace was used at workplace in the two research institutions.

3.7 Data Analysis

Statistical Package for Social Scientists (SPSS) Program was used to analyze data from respondents, edited to completeness, relevance and accuracy. The data was then coded to enable the responses to be grouped into categories for both closed and open ended questions. The statistical analysis and mode (descriptive statistics); bar charts, Tables and frequencies were included and inferential analysis (measure of dispersion) was conducted for goodness of fit and contingency analysis.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter presents findings, interpretation and discussion using bar graphs and Tables. The main purpose of carrying out this study was to assess the OSH practises at KALRO western Kenya region. The study sought to assess the classes and sources of hazards encountered by workers and management, to assess safety awareness of workers and management team and explore hazard control implementation measures at KALRO western Kenya region.

4.2 Response Rate

A total of 240 questionnaires were administered in KALRO western Kenya, 120 were filled and returned from KALRO Kakamega, while 96 were well filled and returned from KALRO Kitale. This represented 90% response rate, which is considered very good to make conclusions. According to Mugenda and Mugenda (2003), 50% response rate is adequate, 60% good and above 70% rated very good. The high response rate was attributed to good data collection procedures. This ensured that only 10% of participants were left with the questionnaires. The participants had also been adequately sensitized about the exercise.

4.3 Demographic Characteristics of Respondents

4.3.1 Distribution of Employees in the Kakamega and Kitale Stations

It was found important to determine respondents' gender in order to ensure the gender balance. It was also necessary to consider gender because exposure to various hazards could cause different outcomes to different gender groups. The results of gender distribution are shown in Figure 4.1:

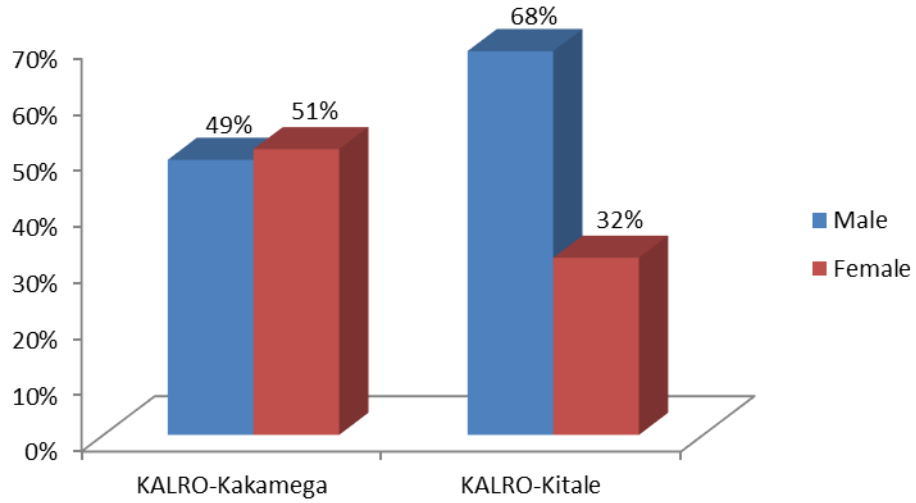

Figure 4.1: Gender Distribution in KALRO Western Kenya

The findings from this study indicated that KALRO-Kakamega had 49% male and 51% female of the total population of workers in research institute, while KALRO-Kitale had 68% male and 32% female out of each research institute accordingly.

4.3.2 Age Distribution of Employees

The study found it necessary to determine age distribution among the respondents. This was in order to determine if there was age variation of the study findings based on age (Figure 4.2).

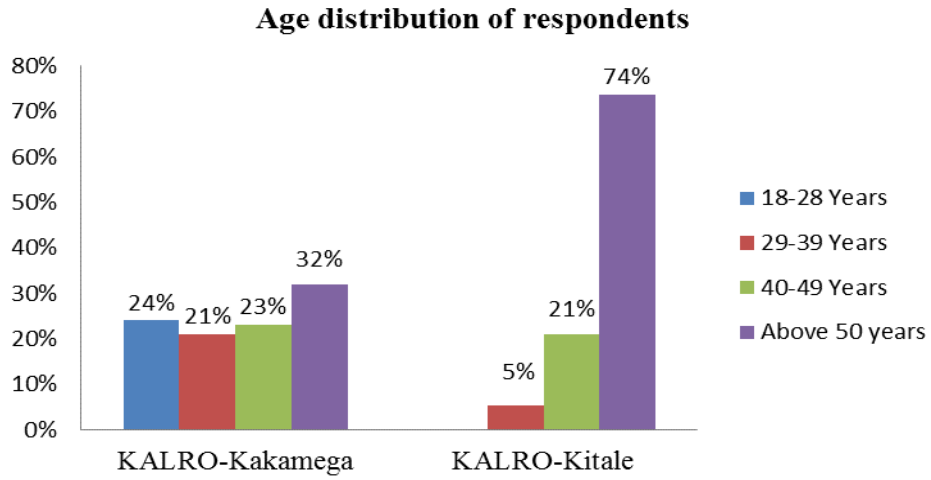

Figure 4.2: Workers Age Distribution

32% and 74% population of Kakamega and Kitale KALRO centres were above 50 years of age. The average age of population of workers below 50 years was 23% and 9% in KALRO Kakamega and KALRO Kitale respectively. Most of agricultural farm activities carried out by workers in KARLO Kakamega involved manual handling which was best done by workers of years (18-23) and below. KALRO Kitale had more aged population who carry out their research farm activities by use of machines hence attracting less young population of years (40-49) and below.

4.3.3 Staff composition

The study focused on the distribution of workers who directly work in the two research centres and participated in the research.

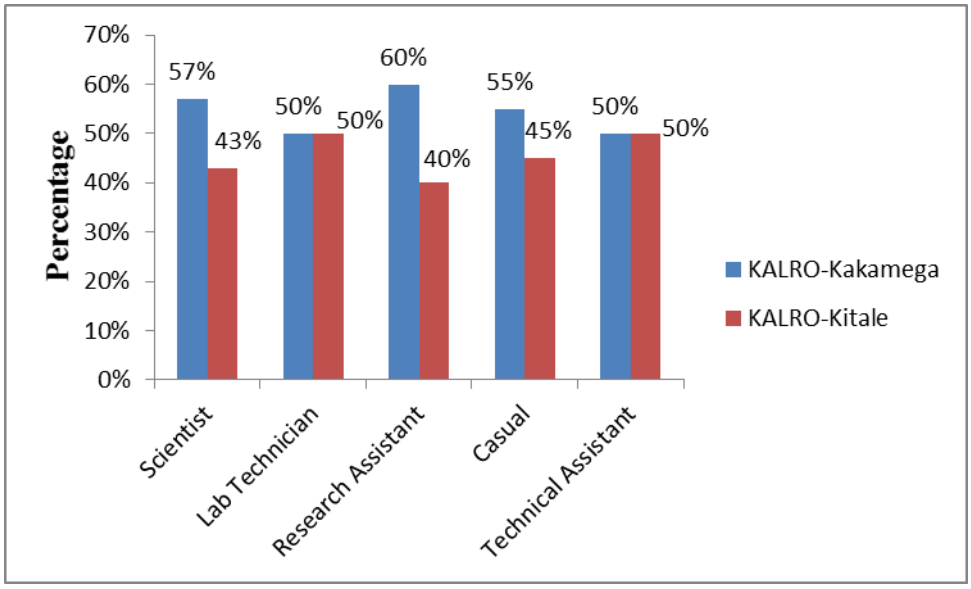

Figure 4.3: Composition of staff who participated in the survey

Respondents from the two research institutions who participated in the study survey were uniformly sorted out (Figure 4.3).This was attributed to good work category criterion to identify participants and data collection procedures used.

4.4 Classes and Sources of Hazards

Health hazards in the two research institutions are chemical, biological, ergonomic and physical (Table 4.1). Njeru (2015), in a study on evaluation of OSHMS at Egerton University, observed similar classes and sources of hazards emanating from research farming activities such as livestock keeping, wheat, maize and horticultural activities at workplaces.

Table 4. 1: Specific classes and sources of hazards exposure at workplace in KALRO-Western Kenya

Classes of health hazards	Sources of hazards
Chemical hazards	Usage of potential toxic chemicals in laboratories, field trials; pesticides, heavy metals such as mercury and lead ,disinfectant and cleaning detergents (kerol and hypochlorite solutions)
Biological hazards	Working with animals while removing birds and animal droppings. Working with plants while transplanting in field trials
Ergonomic hazards	Awkward postures when planting, weeding , applying pesticides, in confined spaces and work station arrangements
Physical hazards	Exposure to extreme high temperatures for heatstroke and exhaustion occurrence in green houses and open field

4.5 Chemical Hazards

Working with potentially hazardous chemicals is an everyday occurrence in research laboratories and field trial settings. Only a small number of chemicals have been tested thoroughly enough for their dangerous properties to be known (MSDS) (Tonui, 2007). Exposure to pesticides and other agrochemicals constitute a major occupational risk which result in poisoning and death (ILO, 2OO1); Nearly all workers in KALRO-Kakamega handle chemicals (100%) and a significant 84% in

KALRO- Kitale as illustrated in (Figure 4.4). Statistical test conducted indicated that there was a statistical difference (χ^2=17.465, df=1, p=.000) in terms of exposure in the research institute due to their specialized activities carried out in centres. The exposures to chemical fumes may arise from machine designs if not properly constructed as per standards from manufacturer's safety design instruction manual which was also supported by; (Plate1 and 2).

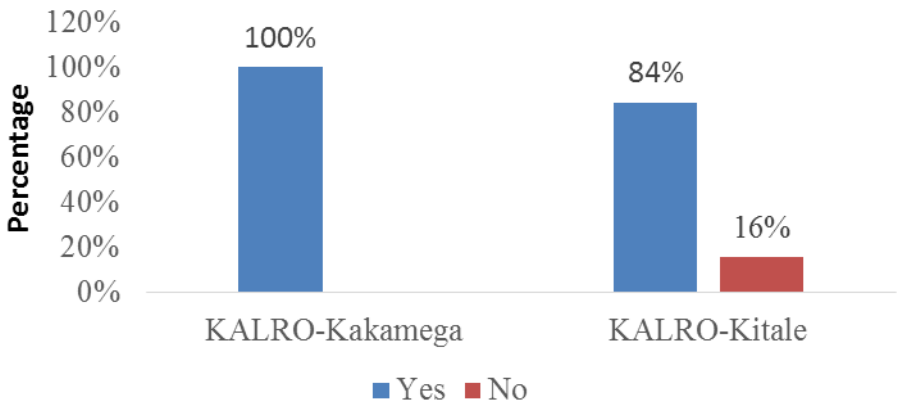

Figure 4.4: Exposure to Chemicals at workplace

Risks of exposure to harmful chemicals exists in form of solids, liquids, gases, mists, dusts fumes, vapours and smoke that exerts toxic effects by inhalation (breathing), absorption (through direct contact with skin) or ingestion (eating or drinking). The degree of worker risk from exposure to any given chemical depends on the nature and potency of the toxic effects, the magnitude and duration of exposure (Kohn *et al*., 1996). Common chemicals used at workplace include organic solvents such as formaldehyde, chloroform, mercaptoethanol, Ethylbromide, Kerol and hypochlorite solutions. Inorganic solutions include acids, bases and heavy metals such as lead and mercury. Improper usage of fume hood may lead to adverse exposures to chemical fumes in particular when moveable sash window is not in down position and intact while in use (Figure 4.5).

Figure 4. 5: Improper usage of fume hood chambers

Fumehood is designed to protect / shield the user and room occupants when working with potentially explosive or highly reactive materials.

4.5.1 Chemical/Pesticides Procurement, Storage and Disposal

Table 4.2: Pesticides Procurement and Storage

	Respondents	Availability of specific places for storage of chemicals/pesticides in the institution		Total
		Yes	No	
	Research officers	4%		4%
	Procurement officer	75%	21%	96%
Total		79%	21%	100%

KALRO-Western-Kenya procures their Chemicals (pesticide) through the procurement department as requested by the user sections (Table 4.2). Research findings revealed that pesticide storage in farm store faces a myriad of challenges

including excessive purchase of chemicals/pesticides and storage of excessive unused chemicals/ pesticides which is not a good practice as per occupational health and safety regulation. Chemicals/Pesticides are supposed to be stored in a well ventilated and proper system of lighting for easy retrieval of the same to minimize aerosol exposures to them which is a good practice as per occupational safety and health regulation Act (2007).

From the interviews and questionnaires from managers/supervisors, excess chemicals/pesticides not used is often sprayed on barren land and containers perforated before disposal. Safe disposal of pesticides should involve decontamination of unutilized toxicants and proper disposal methods such as Label instructions reading before using chemicals to be sought.

4.6 Biological hazards

Employees in both KALRO-Kakamega and Kitale indicated that they are exposed to biological hazards but at different levels as indicated in (Table 4.3). (χ^2=11.821, df=7, p=.107),

Table 4.3: Employee exposures and percent protection

	Exposures and percent protections to parasites, fungus, aerosols from plants and animal wastes					Chi square tests
	Face shields	Having a clean workplace	Not protected	Using disinfectants	Using protective gear	(χ^2 = 11.821
KALRO-Kakamega	4%	2%	47%	2%	34%	df=7
KALRO-Kitale	0%	0%	74%	0%	26%	Assymp sig=.107
Total	3%	1%	54%	1%	32%	

Occupations that deal with animals, plants or their products expose workers to biological hazards. From animal and plant activities, generation of aerosols, bites,

scratches and kicks leads to infections with zoonotic diseases to workers (Tonui, 2007). The principles of good practices in the farming activities should be embraced; to minimize emissions, release and spread of hazardous substances to human health; taking into account all relevant routes of exposure – inhalation, skin and ingestion; control exposures by measures that are proportionate to human risk; choose the most effective and reliable control option; provide PPE when exposure cannot be controlled by other means; review regularly all elements of control measures to their continuing effectiveness; inform and train all employees on the hazards and risks from substances with which they work with and the use of control measures developed to minimize the risks; ensure control measures do not increase the overall risk to health and safety (GOK, 2007a).

4.7 Ergonomic Hazards

Ergonomic hazards involve the science of human factor engineering that evaluate full range of tasks including ,but limited to lifting, holding ,pushing, walking and reaching. According to result, majority of workers (46%) perform their duties while sitting followed by those walking (42%), standing and kneeling (40% &24%) respectively (χ^2=17.246, df=3, p=.001), as indicated in (Table 4.4)

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Table 4.4: Work performed at the work station

		Sitting	Walking	Standing	Kneeling/ Bending	Cochran tests
KALRO-Kakamega	% within institute of work	40%	43%	43%	30%	Cochrans Q = 17.246
KALRO-Kitale	% within institute of work	63%	37%	32%	5%	df = 3
Total		46%	42%	40%	24%	Assymp sig. = .001

The respondents also gave multiple selections on posture when performing their duties. Workers in KALRO-Kakamega are required to move around a given area for performing task compared to KALRO-Kitale who are inclined to one posture (sitting) There are also extended and frequent reaches that are required to perform their intended tasks and substantial downward forces or manual lifting of heavy objects that was significant . (χ^2=17.246, df=3, p=.001).

Sore feet, stiff legs, stiffness in neck and shoulders, high blood pressure, heart and circulatory problems, restricted blood flow, and low back pain result from long hours of standing at work which have adverse health and safety consequences to workers (Tonui, 2007). Workers who are tired of awkward standing are less alert increasing the risk of incidents at their work stations (Afubwa & Mwanthi, 2014).

Workers in a prolonged standing position should thus be in a proper position like facing what they are working on, with their body close to the work; have enough space to change working position; use a foot rail or portable footrest to shift their body weight from both legs to one or the other leg; and using a seat whenever possible while working, or at least during rest breaks (Hughes & Ferrett, 2008).

Workers can also be provided with comfortable footwear which is appropriate for the workplace hazards; wide enough to leave room to move toes; have arch supports to prevent flattening of the feet, and a heel with a firm grip to prevent slipping; lace-up shoes which allow the worker to tighten the in step of the footwear, ensuring the foot does not slip inside the shoe or boot; and if the worker is standing on a metal or cement floor, the foot should be cushioned with a shock-absorbing insole (Hughes & Ferrett, 2008).

4.7.1 Ergonomic hazards while handling work at KALRO western Kenya

Work in the two institutes is repetitive in nature as indicated Kakamega 79%, Kitale 84%, of workers which may be a risk factor if not properly identified and assessed (Figure 4.6) which showed there was no significance in the two research centres (χ^2=.440, df=1, p=.507).

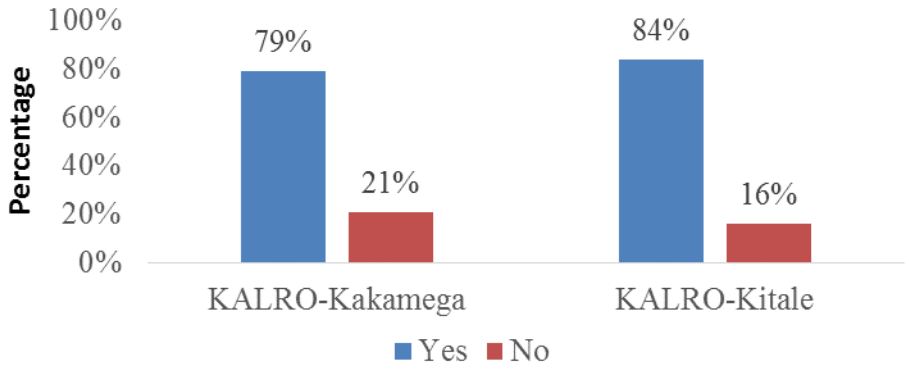

Figure 4.6: Repetitive Mode of handling work at KALRO Western Kenya

Repetitive type of work has physical demands that include force required, duration of work postures and local contact stresses. The aspect of layout and conditions for work stations might bring about human engineering factors like working reaches, working heights, seating and floor surfaces. Characteristics of objects handled include size and shape, load condition and weight distribution and container to

equipment handles. The mode of work on the farm which was repetitive in nature also contributes to stress at workplace as noted by Rukunga (Rukunga, 2001)

4.8 Physical Hazards

4.8.1 Experience of illness as a result of workplace environment

Table 4.5: Response of Management/supervisor about work environment at two workplaces

	Ever heard workers complain of illnesses as a result of their working environment		Chi square tests
	Yes	No	
KALRO Kakamega	31%	69%	(χ^2 = .258
KALRO Kitale	40%	60%	
Total	36%	64%	Asymp sig = .611 df = 1

According to managers/supervisors response indicated in (Table 4.5) supports the idea that workers complain about their work environment. There was no significant difference between the two centres as per managers/supervisors opinion towards illness as a result of working environment with 36% agreeing and 64% of respondents disagreed to that opinion (χ^2=.258, df=1, p=.611)

4.8.2 Heatstroke/Heat exhaustion

Presence of any medical condition such as, heatstroke or heat exhaustion among workers is sign of being exposed to physical hazard. Heatstroke and heat exhaustion health condition was identified in KALRO Western Kenya as a result of their specialised nature of work carried out in green houses and worker's exposures to global climate change; KALRO-Kakamega 19%, KALRO-Kitale 5%(Figure 4.7).

There was significant difference of such like medical conditions in the two centres (χ^2=4.000, df=1, p=.046,).

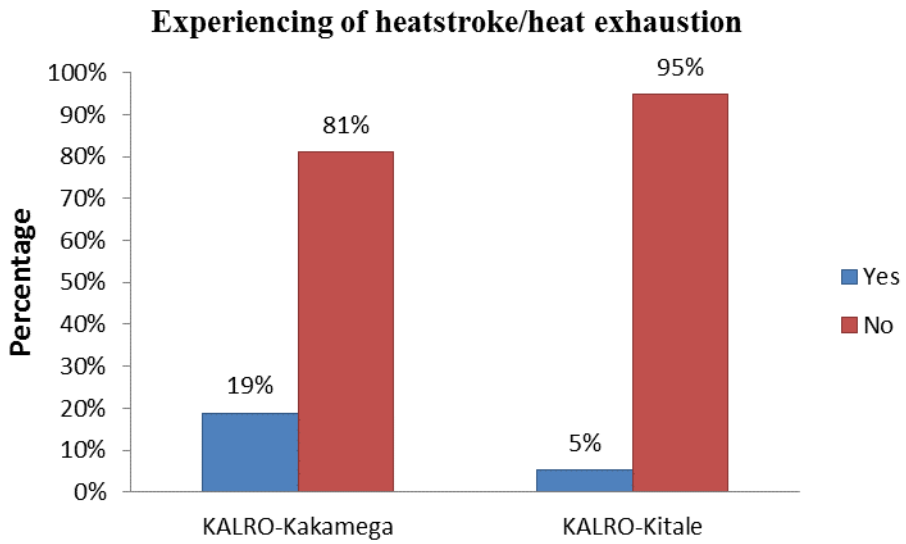

Figure 4.7: Respondents' experience of heatstroke/heat exhaustion

Exposure to physical hazards was from workplace environment and equipment/tools used to perform certain specialised tasks in the two research institutions. Heat stress is an example of a physical hazard whose outcome manifestation is heatstroke or heat exhaustion in any given population (St. John Ambulance Canada. et al., 2011).

4.9 Safety Awareness at KALRO-Western Kenya

4.9.1 Safety and Health Policy

Table 4.6: Response from Management/supervisor to presence of safety and health policy in two research centres

	Presence of safety and health policy in the institute		Chi square tests
	Yes	No	
KALRO Kakamega	92%	8%	$\chi^2 = 3.877$
KALRO Kitale	60%	40%	
Total	75%	25%	Asymp sig = .049 df = 1

Managers/supervisors indicated that there was a safety and health policy in both institutions with 92%from Kakamega and 60% from Kitale as indicated in the (Table 4.6) this was significant at two the research centres (χ^2=3.877, df=1, p=.049) .

Accordingly, majority of employees were aware of the policy at the two institutions as illustrated in Figure 4.8 with 75%from Kakamega and 79% from Kitale of the respondents. There was no significant difference for safety and health policy awareness between the two workplaces (χ^2=.187, df=1, p=.665).

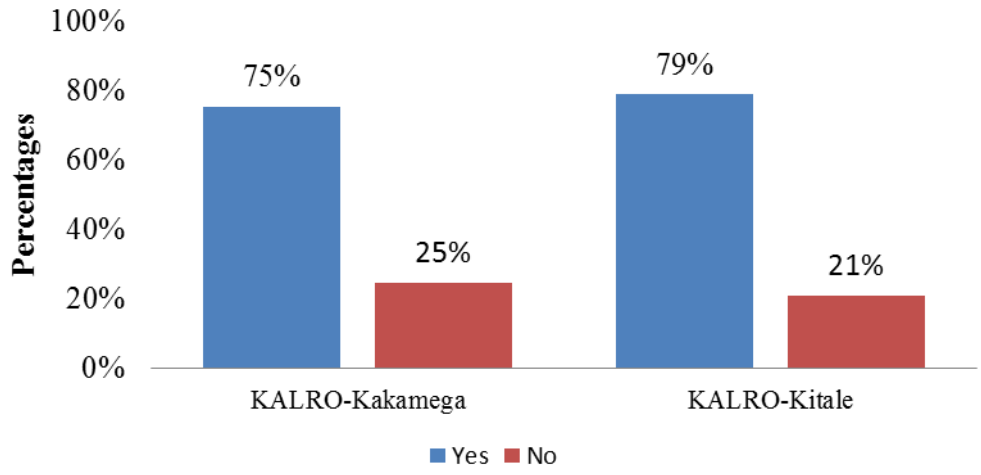

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Figure 4.8: Employee awareness of Safety and Health Policy

Awareness of safety and health policy will enhance the performance of an organization through personal development of workforce in avoiding accidents to reduce Insurance financial premium losses (Hughes & Ferrett, 2008).

4.9.2 Workers Access to Safety and Health Policy

Majority of workers in KALRO-Western Kenya; Kakamega (55%), Kitale (63%), have access to a copy of the health and safety policy, while 45% of workers in Kakamega research institute and 37% in Kitale research institute have no access as illustrated in (Figure 4.9) (χ^2=.813, df=1, p=.367).

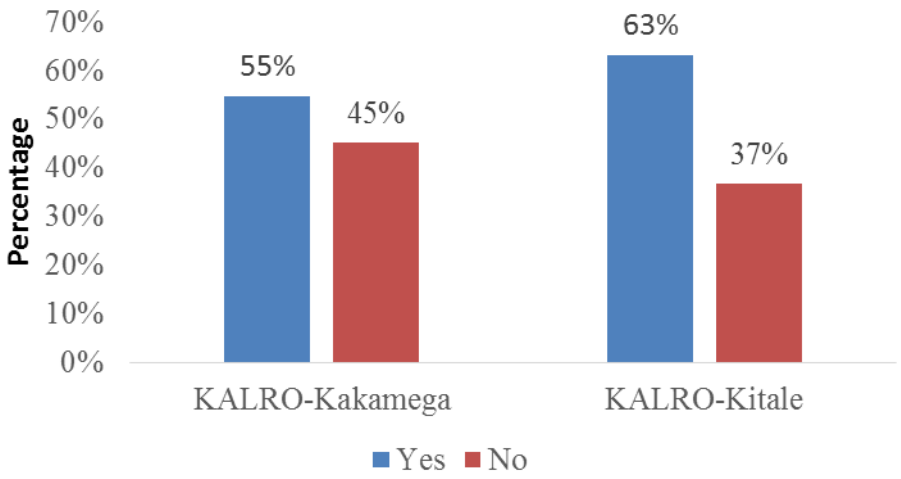

Figure 4.9: Accessibility to Safety and Health Policy

4.9.3 Awareness of policy provisions on safety and health

The employee awareness on safety and health policy provided per age are represented in (Table 4.7).

Table 4.7: Employee Awareness on Safety and Health Policy provisions as per age

Respondents' Age brackets		Respondents awareness of safety and health policy in the institute		Total	**Chi-Square Tests**
		Yes	No		value 13.674
s	18-28 Years	38%	62%	100%	df=3
	29-39 Years	83%	17%	100%	
	40-49 Years	94%	6%	100%	
	Above 50 years	81%	19%	100%	Asymp. Sig. (2-sided) .003
	Total	76%	24%	100%	

Although there is a large number of worker saying they have access to a safety policy, the significance (χ^2=13.674, df=3, p=.003) which is less than .05 suggest that there is a big difference between those who access and those who do not access as per age. The chi square value asymptotic significance indicates the awareness of safety and health policy was significant in raising safety awareness.

4.9.4 Awareness of Safe Work Procedures

Among the total number of employees in KALRO-Western Kenya, Kakamega (70%), Kitale (63%) were aware of safe work procedure in their respective research institute for routine operations in the workplace activities with no significant difference between the two centres. (χ^2=.570, df=1, p=.450).

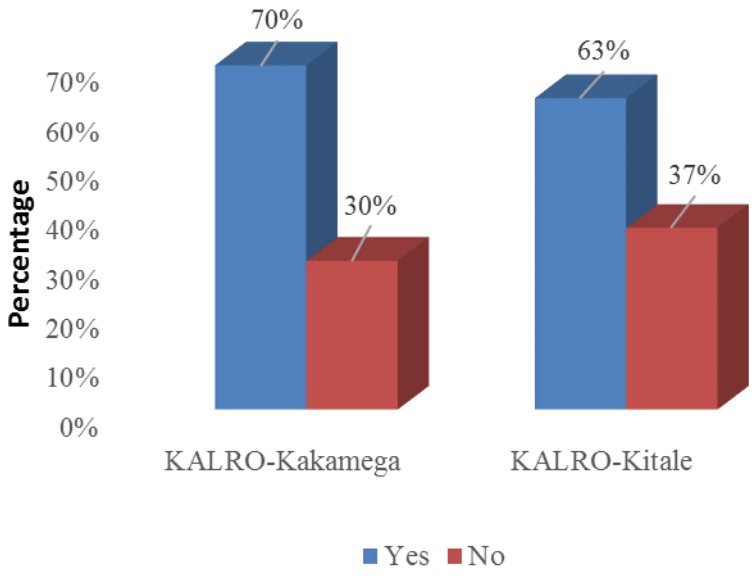

Figure 4.10: Employees awareness of safe work procedures

Workers who do not follow safe work procedure observed in the population did not go through either secondary, college or university education were prone to accidents. During safe work procedures development, hazards that are likely to cause injuries are identified, assessed, evaluated and controlled, having positive impact towards raising level of safety awareness at workplace. The high percentage of health and

safety awareness in research institutions is due to high pronouncement of safe work procedures in their daily activities (Figure 4.11& 4.12)

Figure 4.11: Safety Awareness

A poster of Confined field trials in Kitale water efficient Maize for Africa project (WEMA). Its aim was to evaluate drought tolerant and pesticide reduction maize variety development. The trials are conducted under the terms and conditions set by various governmental regulatory bodies (GMO drought tolerant maize variety that may lead to reduction in pesticides use).

Posters and signage help manage hazards and risks on site, and build safety and health awareness at workplace. Disinfecting foot-dips,wheel dips and sterilisation of infected materials is of paramount importance to control infectious diseases when entering or leaving the site..

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Figure 4.12: Before Entry into Confined Field trial ,poultry house or animal shade (Kerol/ disinfectant)

Table 4.8: Age of Respondents and Compliance to Written Work Procedures

Age of Respondents	Availability of Written work procedures to be followed while working		Total
	Yes	No	
18-28 Years	46%	54%	100%
29-39 Years	83%	17%	100%
40-49 Years	88%	12%	100%
Above 50 years	61%	39%	100%
Total	68%	32%	100%

Majority (54%) KALRO-Western Kenya employees in the age brackets 18-28 years do not follow written work procedure at their workplace as in (Table 4.8) .

4.9.5 Label Reading before Using Pesticides/Chemicals

The respondents in both KALRO institutions read labels before using the chemicals KALRO Kakamega (88.7%) and KALRO-Kitale (84.2%), (Table 4.9). There was no significant difference between the two centres (χ^2=.511, df=1, p=.475)

Table 4.9: Employees reading labels on chemicals /pesticides before use

	Reading labels on chemicals/pesticides before use by respondents		Total	chi square tests
	Yes	No		p value = .511
KALRO-Kakamega	88.7%	11.3%	100.0%	df = 1
KALRO-Kitale	84.2%	15.8%	100.0%	assymp sig (2 sided) = .475
Total	87.5%	12.5%	100.0%	

4.9.6 Perception of Importance of Pesticide Labels to a User;

Population that use pesticides and recognize the importance of pesticide labels as indicated in Table 4.10:

Table 4.10: Level of Agreement on the Importance of Pesticides Labels

	Information contained on labels of chemicals/pesticides important to user						**Chi square tests**
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total	value = 2.471
KALRO-Kakamega	4%	0%	0%	28%	68%	100%	df=2
KALRO-Kitale	0%	0%	0%	21%	79%	100%	Assymp. Sig (2 sided) = .291
Total	3%	0%	0%	26%	71%	100%	

The population that is exposed to pesticides and totally agree that proper packaging and labelling is important was (97 %) (Table 4.10) with no significant difference between the two centres. (χ^2=2.471, df=2, p=.291).. Warning labels help prevent

accidents but the questions remain about how well the labels can be expected to work (Mc grath, 2011). Majority of workers at their workplace either handling or not handling chemicals agree with the importance of proper packaging and labelling of pesticides. Chemicals being poisonous ought to be handled with extreme care and precaution in order to avoid hazards associated with them (Tonui, 2007). Guidelines for safe handling of chemicals/ pesticides are posted on the label pasted on the container, detail information is provided in the leaflet enclosed with package which has to satisfy certain requirements depending upon the type of the pesticide. Therefore, effective labelling and suitable design of chemicals container are two major factors that are considered in ensuring their safe handling to minimize health hazards and environmental pollution. Kamotho (2004) noted that labels should be read as they are a very important source of information to researchers on how to use the product safely.

4.9.7 Respondents awareness of Procedures for Mixing Categories of Pesticides

From the results, 51% in KALRO-Kakamega and 42% in KALRO-Kitale indicated that they mix various categories of pesticides before using them (Table 4.11. The statistics tests indicated that there was no significant difference between the two centres when it comes to knowledge of mixing pesticides to achieve sound results (χ^2=.875, df=1, p=.350) Mixing and loading remain a potential source of pesticide exposures (Kariathi *et al*., 2016). This was supported by (Galvin, Krenz, Harrington, Palmandez, & Fenske, 2016) study that pesticides must only be issued to staff who has appropriate training. The trained operators will be aware of the pesticides being used and is able to carry out spraying safely and take precaution in case of a spill.

Table 4.11: Employees directly exposed to chemicals through mixing them

	Mixing of various categories of pesticides by respondents		Total	Chi square tests
	Yes	No		χ^2 = .875
KALRO-Kakamega	51%	49%	100%	df=1
KALRO-Kitale	42%	58%	100%	Assymp sig (2 sided) = .350
Total	49%	51%	100%	

4.9.8 Perception of Handling Plant and Animal Waste

The level of agreement that animal and plant waste are handled in a hygienic manner was high in KALRO Kakamega with a percentage of (62%) followed by KALRO Kitale (42%) as in (Table 4.12) with no significant difference between the two centres (χ^2=5.986, df=4, p=.200).

Table 4.12: Employees Perception of handling plant and animal waste

		Animal and plant wastes handled in a highly hygienic manner in the institute						Chi square tests
Institute		Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total	value 5.986
	KALRO-Kakamega	6%	19%	11%	53%	9%	100%	df=4
	KALRO-Kitale	16%	21%	21%	37%	5%	100%	Assymp sig (2
	Total	10%	19%	16%	47%	8%	100%	sided) = .200

The overall agreement was at (55%) in KALRO Western Kenya in handling wastes and protection of workers from biological agents while working. The protection may be rated as moderate/fair in KALRO Western Kenya. There is no significance difference between the two centres when it comes to knowledge in handling plant and animal wastes.

4.9.9 Chemicals/Pesticide Poisoning and Emergency Action Plan Awareness

Workers emergency action plan in case of chemicals/ pesticide poisoning and any other form of emergency was at Kakamega (51%), Kitale (63%).

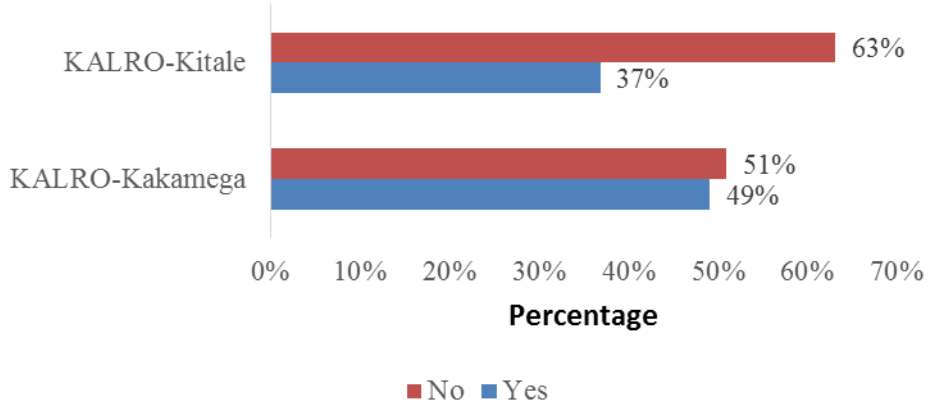

Figure 4.13: Awareness on availability emergency measure and guidelines at work place for chemical and pesticides poisoning.

There were only (49%) respondents from Kakamega and (37%) from Kitale employees respondents that are aware of emergency measures in case of emergency or chemical/pesticide poisoning due to their specialized task undertaking at their workplace. There is no significant difference between the two centres when it comes to chemical emergency action plan. In the event of chemical/pesticide poisoning, the first aid procedure and arrangement for calling ambulance and rescue team is not well known to the staff in KALRO-Western Kenya (χ^2=1.681, df=1, p=.195). There is a need to put in place a more detailed emergency plan which may take account of findings of initial risk assessment for incidents/accidents at workplace. Emergency

procedure is about control procedure and equipment to limit the damage to people and property caused by an incident/accident. For instance, pesticides should always be applied in the direction of the flow of wind. Application of pesticides should be started near downward edge of the field and should proceed upward with the back to the wind so that the operator is always in an untreated area. If there is substantial drift/windy period, pesticides should not be applied. Mathew. (1985) noted that if pesticides are accidently swallowed, medical advice should be sought without delay.

4.9.10 Machinery and Equipment Safety Perception

Table 4.13: Perception on Maintenance of Equipment and Tools

	Equipments provided are well maintained by qualified service engineers						Chi square tests
	Strongly disagree	Disagree	Not sure	Agree	Strongly agree	Total	value = 9.482
KALRO-Kakamega	9%	17%	9%	42%	3%	100%	df = 4
KALRO-Kitale	26%	11%	11%	47%	5%	100%	Assymp sig (2-sided) = .050
Total	14%	15%	17%	43%	11%	100%	

Most (54%) workers agree that equipment and tools used on the farm are well maintained as in (Table 4.13). The level of agreement was higher in KALRO-Kakamega at (55%) compared to KALRO-Kitale at (52%) There was significant difference in terms of maintenance of equipment and tools in the two centres due to administrative priority put to safety of machines and equipment s(χ^2=9.482, df=4, p=.050). Work equipment needs to be properly maintained so that it continues to operate safely and in the way it was designed to perform. The amount of

maintenance will be stipulated in manufacturers' instructions and will depend on the amount of use, the working environment and type of equipment. High speed, high-hazard machines, which are heavily used in adverse environment, may require very frequent maintenance, whereas simple hand tools may require very little maintenance.

KALRO-Western Kenya workers and managers are generally aware as to why equipment maintenance is important in order to control machinery risks and poor ergonomic issues.

4.10 Control Measures for Hazards Present at KALRO-Western Kenya

4.10.1 Presence of safety and Health Officer/Committees in KALRO-Western Kenya Region

Table 4.14: Response from managers/supervisors about safety and health officer in the two research institute

	Presence of officer in charge of safety and health in the institute		Chi square tests
	Yes	No	
KALRO Kakamega	77%	23%	$\chi^{2\,s} = 3.877$
KALRO Kitale	40%	60%	
Total	57%	43%	Asymp sig = .049
			df = 1

Table 4.14 indicates presence of a safety and health officer in both institutions with (57%) on average agreeing according to managers/supervisors respondents, presence of a safety health officer was significant for hazard controls and promotion of safety culture at the two workplaces. (χ^2=3.877, df=1, p=.049).

Safety and health committee in KALRO-Western Kenya was present (Figure 4.11). There was no significant difference in two the research centres (χ^2=.010, df=1, p=.922) .

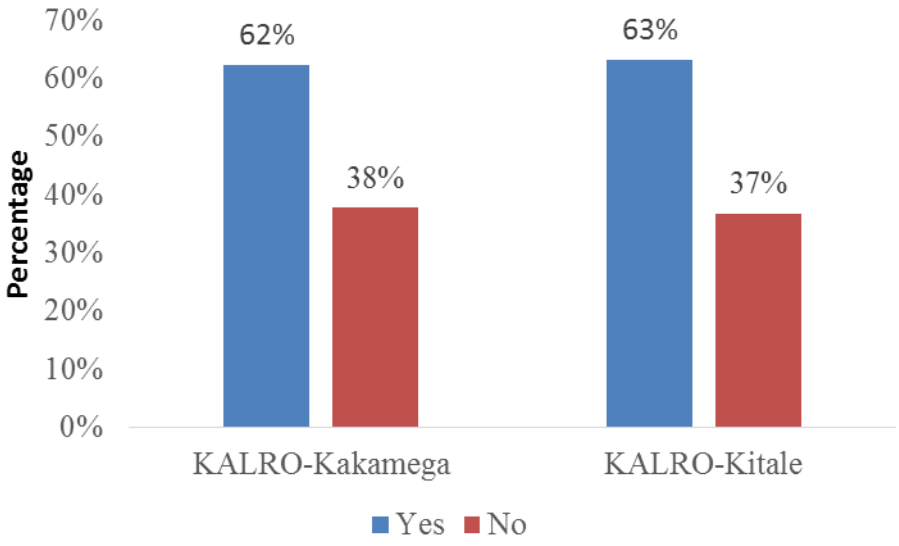

Figure 4.14: Agreement Levels on the Presence of a Safety and Health Committee

The safety committees monitor day-to-day problems and any concerns of the employees' safety and health practices. Safety committee team in any organisation studies all reports of accidents to see how they are to be avoided and implementation of the lesson learned from them. New employees are safely instructed by a safety committee on how to be safe while working. They also raise the safety awareness campaign in the institution by use of posters signage to reach a large population to control hazard exposures to workers. OSH practices however, are influenced more by culture of organisation, type of work being undertaken and sector that an organisation operates in (Pinder *et al.*, 2016)

4.10.2 Training on Workplace Health Hazards

Table 4.15 shows that induction programs do not involve safety and health training topics with (46%) on average of managers who were in agreement with that perception but (54%) of the respondents disagreed with that perception which was not significant in both institutions. (χ2=.537, df=1, p=.464).

Table 4.15: Management/supervisor response about inclusion of safety and health topics in induction programme of workers caption

Institute	Induction programme of workers includes safety and health training		Chi square tests
	Yes	No	
KALRO Kakamega	54%	46%	χ^2 = .537
KALRO Kitale	40%	60%	
Total	46%	54%	yAsump sig = .464
			df = 1

4.10.3 Employee Training on Identification of Hazards at the Workplace.

Workers from KALRO-western Kenya region reported to have received training on workplace health hazards identification (40%) from Kakamega and 47%) from Kitale (Figure. 4.15). There was no significant difference in the two centres to hazard identification training. (χ^2=.690, df=1, p=.406)

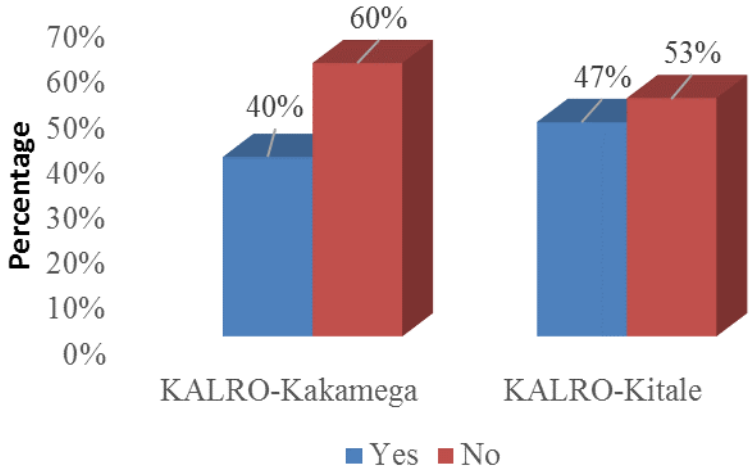

Figure 4.15: Level of Agreement on Employee Training on Identification of Hazards at the Workplace

4.10.4 Medical Examination Conducted in KALRO- Western Kenya Region

Table 4.16: Response from management/supervisor about workers medical examination at their workplace

Respondents institute	Workers undergo any medical examination at their workplace		Chi square tests
	Yes	No	
KALRO Kakamega	46%	54%	(χ^2 = .537
KALRO Kitale	60%	40%	Asymp sig = .464
Total	54%	46%	df = 1

From Table 4.16 (46%) of managers/supervisors from Kakamega and (54%) from Kitale affirmed that workers undergo medical examination with an overall average of 54% in both institutions. On average (54%) of the respondents form both Institutions agreed and 46% of them disagreed to this perception. (χ2=.537, df=1, p=.464).

4.10.5 Level at which Medical Examination is Practiced at KALRO Western Kenya

Considering the level of agreement on medical examination in both research Institutions, workers have not undergone any medical examinations related to the workplace activities (Figure 4.16}. There was no significant difference between the two centres to medical examination conducted to employees (χ^2=.500, df=1, p=.479).

Pre employment medical examination was performed as a prerequisite condition for new employees to prospective employee being accepted as a full time employee who may involve certain tests and procedures to be typically performed to detect untreated pathological conditions and asymptomatic diseases.

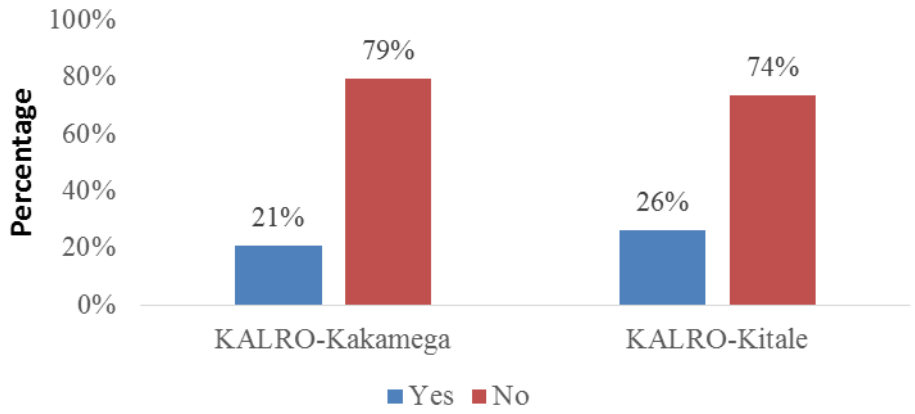

Figure 4.16: Level at which medical examination practised at KALRO Western Kenya

KALRO-Western Kenya has not embraced periodic medical examination for early pathogen detection or random medical examination for chronic diseases to its workers. Medical examination is very crucial in monitoring the health status of the employee for early detection and control of illness to an employee at work place.

4.10.6 First Aid

Majority workers in KALRO-Western Kenya are sensitised on first aid issues (KALRO-Kakamega (72%), KALRO-Kitale (63%), (Figure 4.17). There was no significant difference between the first aid training of staff in the two centres (χ^2=.961, df=1, p=.327).

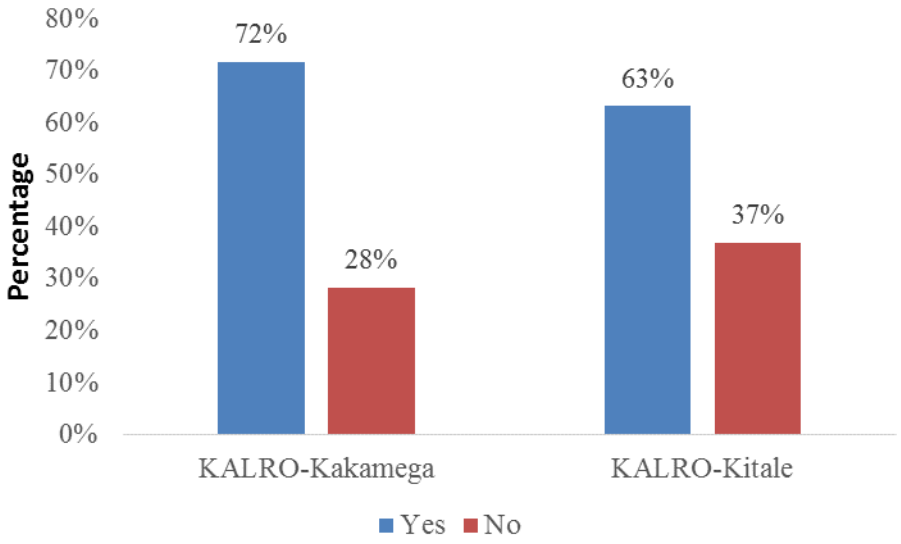

Figure 4.17: Level of Employee training on First aid

Training first aiders and proper equipment usage is key to hazard control at workplace. Employer must provide sufficient first –aid equipment, facilities, personnel and must inform his/her employees of the first-aid arrangement made..First-aid personnel should be available at all times and staff should know who they are (GOK, 2007c)

4.10.7 Fire Safety

Workers in the two institution are trained and sensitised as fire fighters/or fire marshal at 72% and 68% level at KALRO-Kakamega and KALRO-Kitale

respectively (Figure 4.18.) There was no significant difference between two centres when it come to training on fire safety (χ^2=.15, df=1, p=.703) .

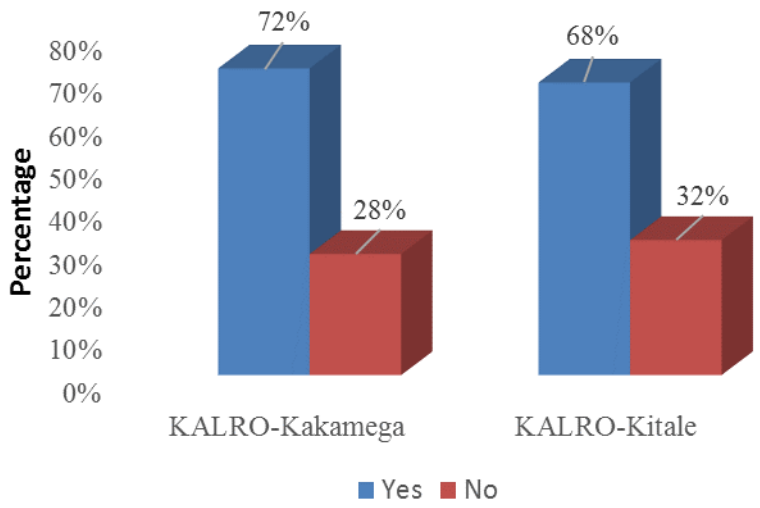

Figure 4.18: Employees trained as fire fighters or fire marshals

4.10.8 Maintenance and Inspection of Equipment/Tools at KALRO-Western Kenya

Regular calibration of tools/equipment at KALRO-Western Kenya was averagely practised (Kakamega and Kitale 53%). (Figure 4.19). There was no significant difference between the two centres on equipment calibration and maintenance (χ^2=.000, df=1, p=.983).. When equipment/tools are not well maintained, they can easily break down and, repairs (cleaning and adjustment) may take some time presenting difficulties in operation during this period. Proper machinery guarding and doing equipment maintenance according to manufacturer's recommendations can help prevent accidents and incidents.

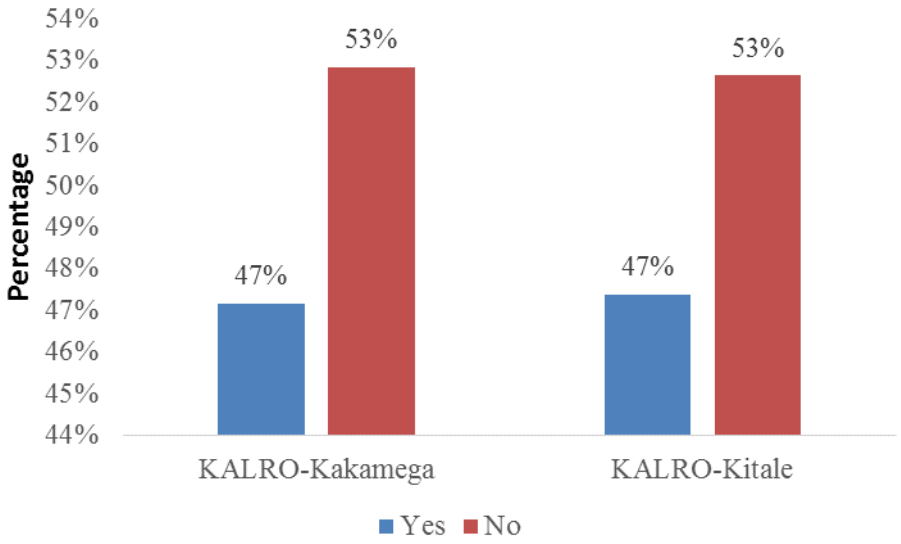

Figure 4.19: Agreement Level on Carrying of inspections and Regular calibration of equipment and tools

4.10.9 PPE Provision to Workers

Table 4.17: Provision of PPE's

Institute	PPE provided to workers		Total	Chi square tests
	Yes	No		P value = 3.887
KALRO Kakamega	77%	23%	100%	df = 1
KALRO Kitale	100%	0.0%	100%	Asymp sig (2
Total	83%	17%	100%	sided) = 0.049

KALRO-Western Kenya management provide personal protective equipment as supported by 77% and 100% of workers in Kakamega and Kitale respectively (Table 4.17). There was significant difference in provision of PPE by management between the two centres (χ^2=3.887, df=1, p=.049). More emphasises was observed in Kitale in the provision of PPE which is also supported by(plate 3.) The law requires that PPE are used during working hours, provided by employer, routinely inspected, cleaned and laundered and replaced when necessary. PPE presents many challenges for

pesticide handlers such as; heat decontamination, interference with work (Michigan State university, 2003).

4.10.10 Types of PPE Provided to Workers at the two KALRO Centres - Western Kenya

Table 4.18: Level of Agreement on Provision of Different Types of PPE's at Work Place.

	PPE provided								
	Hand gloves	Lab coat/ gown	Splash proof apron	Face shields	Safety helmet	Safety shoes/ gum-boots	Ear plug/ muff	Filtering respirator mask	Safety glasses/ goggles
KALRO-Kakamega	84%	78%	22%	40%	18%	73%	16%	24%	27%
KALRO-Kitale	89%	94%	6%	56%	17%	72%	0.0%	61%	22%
Total	86%	83%	18%	44%	18%	73%	11%	35%	25%

Table 4.19: Ranking according to PPE provided in the two centres

Item	Mean Rank	Cochran tests
Hand gloves	3.34	Cochrans Q = 409.016
Lab coat/gown	3.47	
Splash proof apron	6.03	
Face shields	4.97	
Safety helmet	6.03	
Safety shoes/gumboots	3.84	Assymp sig = 0.01
Ear plug/muff	6.28	
Filtering respirator mask	5.34	
Safety glasses/goggles	5.72	

The lowest rank indicate the highest percentage of PPE provided in the two centres (Cochran Q=409.016, p=0.01)

In KALRO-Western Kenya, workers are provided on average with hand gloves (85%), lab coats (83%) and safety shoes (73%) (Table 4,18) Other specialized PPE are not adequately provided in handling work that is highly hazardous Face shields, ear plug/muff and filtering respirators as indicated by average total percent of 89% and splash proof apron, safety glasses and safety helmet, average 60%. The use of PPE by workers minimizes occupational risks or hazards. PPE only protects the person wearing the equipment, relies on people wearing the equipment at all times, must be used properly, be replaced when it no longer offers the correct level of protection. The benefits of PPE include giving immediate protection to a worker. However, there must be continual health education and supervision to ensure that PPE are adequate, suitable and properly used at all times.

4.10.11 Training of PPE Usage in KALRO-Western Kenya region

In KALRO Western Kenya, 58% and 68% of workers in Kakamega and Kitale respectively reported of not being trained on proper usage of PPE despite the fact that they are provided with the same. There was no significance difference on training among the employees between the two centres (χ^2=1.161, df=1, p=.281).

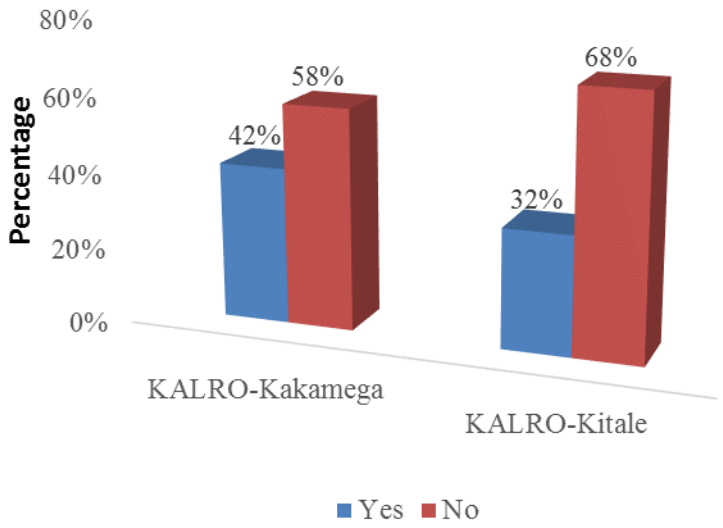

Figure 4.20:Status of employees training on how to use PPE's

4.10.12 Protection from Outdoor Workplace Harsh Weather Conditions

Table 4.20: Employee mode of protection from harsh environments

Institute	Staying in the shade	Wearing protective clothing	Regularly applying high factor sun screen	Friedman tests
KALRO-Kakamega	37%	65%	4%	Chi square = 60.190
KALRO-Kitale	65%	35%	0.0%	df = 2
Total	42%	55%	3%	assymp sig = .001

The key significant protection from excessive heat exposures in KALRO-Western Kenya is highly pronounced in wearing protective clothing at 55% than opting to stay in any shade 42% or applying any high factor sun screen (3%) (Table 4.20).

Outdoor work is associated with greater exposure to hotter or cold temperatures. (χ^2=60.190, df=2, p=.001). Exposure to ultraviolet (UV) radiation is markedly elevated in outdoor compared with indoor occupations (Knibbs, 2014).

FAO (2002) notes that PPE should be used according to the instructions on the container label, in the open field, when mixing, decanting or spraying. The PPE in use should be appropriate to the task suitable for the wearer, readily available, clean and in full operational condition.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

Identified common hazards and sources in KALRO-Western Kenya included; chemical (exposures to pesticide dust in field trials and research laboratories), biological (when working with animals and plants) ergonomic (when planting, weeding, sitting or standing), and physical (when exposed to excessive heat in greenhouses or in open field) being classes and sources of hazards in the two research institutes. The management and the workers in KALRO-Western Kenya access the safety and health policy, comply with safe work procedures in their daily operations, read the labels first before directly handling and mixing the pesticide/chemicals for application in the farm.

5.2 Conclusion

The machinery maintenance was handled by qualified service engineers as predictor factor for high safety awareness at workplace. . KALRO-Western Kenya has not embraced periodic medical examination for early pathogen detection, lacks enough first aid kits and are not trained for hazard identification for effectiveness of control implementation. However, there was a good practice for regular provision of PPE to workers at the two research institutions. .

There were limited physical, management and human factor controls in place to prevent worker's exposure to work related hazards, very high association of safe work procedures and worker's suffering from accident was significant with average safety awareness being high.

5.3 Recommendations

i. Registration of the two workplaces as required by OSHA 2007 act and provision of general register for every accidents and cases of occupational disease..
ii. The management needs to intensify the safety and health policy campaign to sensitize workers in KALRO-Western Kenya for the policy document to be adequately accessible and owned by workers
iii. There is need for management to consider instituting periodic medical examination on workers in KALRO-Western Kenya so as to establish their health status for proper management of their health.
iv. There is a need for pronouncement of risk policy on KALRO-Western Kenya innovative activities and fire audits as supported by (plate 4 and 5)
v. There is need for the management to enhance good working environment by eliminating/minimising sources and variant types of hazard exposure, increasing the sensitization of safety awareness, and improve on the physical, management and human factor controls.

5.4 Areas for Further Research

i. Effectiveness of professionals involved in occupational safety and health contributions towards preventing workers exposure to hazards in KALRO-Western Kenya.
ii. Epidemiological research on occupational hazards, their prevention from affecting workers and management of occupational diseases in relation to reduction of medical health conditions in KALRO-Western Kenya.
iii. Determination of exposures to indoor air pollution, biocides and the levels of particulate matter such as dust, soot, ash and micro organism present

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APPENDICES

Appendix 1: Questionnaire for workers in KALRO-Western Kenya institutes

INFORMED CONSENT

I am CHARLES WAFULA Student at IEET of JKUAT pursuing MSc. In Occupational Safety and Health. I kindly request you to answer the following questionnaire designated to provide information on **Occupational Safety and Health status of KALRO-Western Kenya**. The information that you provide shall remain anonymous and shall not be disclosed to anybody else. So feel free to provide the true information.

1. Which institute do you work

   KALRO-Kakamega [ ] KALRO-Kitale [ ]

2. Age

   18 – 28 Years [ ] 29 – 39 Years [ ] 40 – 49 years [ ]

   50 – 59 years [ ] 60 – 69 Years [ ] 70 Years and above [ ]

3. Gender

   Male [ ] Female [ ]

4. Education level

   Primary [ ] Secondary [ ] College [ ]

   University [ ] None [ ]

5. What section/department do you work?.....

6. How long have you worked in your current station?

   Less than 5 Years [ ] 6 – 10 Years [ ] 11 – 15 Years [ ]

   15 – 20 years [ ] Above 20 Years [ ]

7. Is there any policy on safety and health at your Research Institute ?

   Yes [ ] No [ ]

8. Do you have access to it?

   Yes [ ] No [ ]

9. Are you aware of its provision?

   Yes [ ] No [ ]

10. Is there any safety and health committee in your Research Institute?

    Yes [ ] No [ ]

11. Are members of the committee trained?

    Yes [ ] No [ ]

12. Are there people trained in first aid at your research institution?

    Yes [ ] No [ ]

13. Are there people trained as fire fighters in your Research Institute?

    Yes [ ] No [ ]

14. Do you use chemicals/pesticides?

    Yes [ ] No [ ]

15. Where are the chemicals/pesticides stored?

    ……

    ……

16. Are you familiar with safe work procedure for handling chemicals/pesticides?

Yes [ ] No [ ]

17. Do you mix pesticides?

    Yes [ ] No [ ]

18. Do you read chemicals/pesticides labels before using?

    Yes [ ] No [ ]

19. The information contained in the labels of chemicals/pesticides is important to the user.

    (1)Strongly disagree [ ] (2) disagree [ ] (3) Not sure [ ]

    (4) Agree [ ] (5) strongly agree [ ]

20. Have you ever been trained on how to identify hazards at your workplace work?

    Yes [ ] No [ ]

21. If yes, name the hazards and the trainer

    ……

    ……

    ……

22. Indicate by ticking the personal protective equipment provided by your Research Institution from the list below:

    Hand gloves [ ] Lab coat/gown [ ] Splash proof apron [ ]

Face shields [ ] Safety helmet [ ] Safety shoes/gumboots [ ]

Ear plug/muff [ ] Filtering respirator mask [ ] Safety glasses/goggles [ ]

23. Have you ever been trained on proper usage of personal protective equipment?

    Yes [ ] No [ ]

24. Are there any written work procedures that you follow while working?

    Yes [ ] No [ ]

25. Have you ever suffered from an accident at workplace?

    Yes [ ] No [ ]

26. If yes, what type of accident was it?

    ……

    ……

    ……

27. Are there guidelines for emergency measures in case of chemicals/pesticide poisoning or any other emergency?

    Yes [ ] No [ ]

28. If yes, what is your role?

    ……

    ……

29. Have you ever undergone any medical examination?

    Yes [ ] No [ ]

30. If yes, which one

    Pre-employment [ ] Periodic [ ]

31. Do you have quality working tools/equipment's that you require?

    Yes [ ] No [ ]

32. Workers from KALRO-Western research Institutes are provided with equipment and tools that are well maintained by qualified service engineers.

    (1)Strongly disagree [ ] (2) disagree [ ] (3) Not sure [ ]

    (4) Agree [ ] (5) strongly agree [ ]

33. How would you rate your working environment?

    Fair [ ] Good [ ] Excellent [ ]

34. How do you perform your duties in your work station?

    Standing [ ] Kneeling/Bending [ ] Sitting [ ]

35. Is your type of work repetitive?

    Yes [ ] No [ ]

36. Indicate whether you have ever experienced the following problems while working:

    Back pain [ ] Eye strain [ ] Headache pain [ ]

    Hand and arm discomfort [ ] Leg discomfort [ ] lifting injuries [ ]

37. Animal wastes are handled in a highly hygienic manner in the institute

    (1)Strongly disagree [ ] (2) disagree [ ] (3) Not sure [ ]

(4) Agree [ ] (5) strongly agree [ ]

38. Have you ever experienced heat exhaustion or heatstroke?

    Yes [ ] No [ ]

39. How are you protected from harsh weather conditions in the open field?

    Staying in the shade [ ]

    Wearing protective clothing [ ]

    Regularly applying high factor sun screen [ ]

40. How are you protected from kicks, parasites and infectious aerosols from animal and plant wastes?

    ……

    ……

Appendix 2: Questionnaire/interview for managers/supervisors

INFORMED CONSENT

I am CHARLES WAFULA Student at IEET of JKUAT pursuing MSc. In Occupational Safety and Health. I kindly request you to answer the following questionnaire designated to provide information on **Occupational Safety and Health status of KALRO-Western Kenya**. The information that you provide shall remain anonymous and shall not be disclosed to anybody else. So feel free to provide the true information.

1. How long have you worked in your current station?.....
2. Does your research Institution have a safety and health policy?

   Yes [ ] No [ ]
3. Is the safety and health policy accessible to all workers?

   Yes [ ] No [ ]
4. Does the induction of workers include healthy and safety topics?

   Yes [ ] No [ ]
5. Is the facility audited regularly?

   Yes [ ] No [ ]
6. Procurement of chemicals/pesticides and other agricultural farm inputs are done by professionals?

   Yes [ ] No [ ]
7. How are the chemicals/pesticides stored?

……

……

8. Does KALRO-Western Research Institutes provide personal protective equipment to workers?

   Yes [ ] No [ ]

9. Do workers report accidents/incidents at work place?

   Yes [ ] No [ ]

10. If yes, how do they report?

    ……

    ……

    ……

11. Do workers undergo l medical examination at their workplace?

    Yes [ ] No [ ]

12. Have you ever heard workers complaining of illness as a result of working environment?

    Yes [ ] No [ ]

13. Kindly indicate sources of hazards as per the Table below in your research institute :

Classes of health	**Sources of hazards**

hazards	
Chemical hazards	
Biological hazards	
Ergonomic hazards	
Physical hazards	

14. Do you have a person in charge of safety and health in your research Institute?

    Yes [ ] No [ ]

15. If yes, what is the title of the person?

    ……

Appendix 3: KALRO Institute research workplace inspection checklist

Security			
Topic/Subtopic	Yes	No	Actions and Notes
Controlled access to:			
Research institutes			
Building			
Research laboratories			
Main stockroom(s)			
Compressed gas storage			
Chemical waste storage			
Dual use chemicals and controlled substances			

Safety			
Topic/Subtopic	Yes	No	Actions and Notes
Hallway and laboratory entry area			
Enough doors			
Doors and exit paths clear			
Signs/information for hazards			
Hazard Information /PPE requirements;			
Contact information posted			
Hazard information for responders			
Exit signs			
Emergency assembly point posted			

Fire alarms			
Present			
Clear access			
Fire extinguishers			
Correct types			
Inspected in past year (note date of inspection tag)			
Clear access and visible sign			
Safety showers present			
Eyewashes present			
PPE present and of proper size/type			
No chemicals stored in the hallway/gangway (especially flammables)			
Safety equipment	Yes	No	Actions and Notes
Fire alarms			
Present			
Clear access			
Fire extinguishers			
Correct types			
Inspected in past year (note date)			
Clear access and visible sign			
Fire blanket			
Safety showers			
Clear access			
Handle reachable			
Modesty curtain			

Eyewashes			
Clear access			
Clean			
Personal protective equipment(PPE)			
Appropriately used			
Clean, undamaged, proper sizes and types			
Working telephone in lab			
Emergency numbers on telephone or prominently posted			
First aid kit present and stocked			
Chemical spill cleanup kit present			
Laboratory Hoods			
Proper airflow (check face velocity)			
Exhaust duct integrity			
Exhaust duct location			
Exhaust treatment or filtration			
Flow alarm or indicator			
Sash			
Intact			
In down position unless in use			
Operating sash height marked			
Items 15 cm in from sash			
Apparatus in hood are not blocking flow			
Drains are protected from hazardous material spills, etc			
No chemicals being stored in hood			

No interference from room ventilation			
Away from fans			
Away from open windows or cross drafts			
Away from Room-air-supply-air ducts			
Labelled-hood numbers, restrictions (i.e. perchloric acid hood)			
Motor located outside			
Chemical storage			
Chemicals stored in compatible groups			
Compatible group chart is posted			
Refrigerators and freezers appropriate and labelled			
All chemicals labelled			
Liquid chemicals stored in secondary containment			
No old/special chemicals present			
All chemicals storage cabinets are closed unless actively in use			
Peroxide-forming chemicals labeled with date received and safe storage temperature. Stored at or below proper temperature in ventilated storage, and not over 12 months old.			

Compressed gas cylinders			
Separated by type			
Secured to wall or bench			
Regulators removed and cylinder caps in place on cylinders that are not in use			
Liquids are stored below eye level and not directly on the floor			
Waste and handling			
Waste chemicals stored in compatible groups			
Compatible groups chart is posted			
Liquids waste chemicals stored in secondary containment			
Refrigerators and freezers appropriate and labelled			
All containers labeled and dated clearly, without abbreviations , and hazards identified			
Compressed gas cylinders			
Separated by type			
Secured to wall bench			
Cylinder caps in place			
Stored in protected, well ventilated and dry location away from combustibles			
Sharps waste in d container(s) separate from trash			
General housekeeping			

Aisles clear			
Nothing stored on floor			
No hazardous materials are stored in, around, under or above sinks			
All chemical containers not actively in use are closed (no open funnels in container)			
Chemicals not stored on benches			
Glassware washed and stored (not cluttering sink or bench areas)			
Combustibles are kept away from all heat and flame sources			
Separate broken glass waste container in use, absent of paper/other trash			
Vacuum pumps have secondary containment for oil			
All equipment with moving parts (i.e. vacuum pumps) have protective guards or housings			
All lab coats not in use hung up away from heat or flame sources			
Lab bench tops uncluttered			
No evidence of food, drinks or cosmetics present			
No evidence of smoking in lab			
Electrical			
No overloaded circuits			
No frayed power cords or daisy chains			

No cracked or broken plugs			
– Proper circuit breaker location(s) unobstructed			
Circuit breakers labelled			
Proper location of electrical outlets			
Any high voltage equipment (>600 is labelled, grounded and insulated			
Operational practices			
All experiment vessels labelled and dated clearly, without abbreviations, with name/initials of user, major hazards clearly identified			
SOPs are posted or stored near instruments or equipment			
All hot plates & flame sources are turned off when not in use			
Gloves removed and hands washed when leaving lab			
Areas where acutely hazardous substances are in use have a hazard sign posted			
up- Safety Data Sheets (M SDS) are to-date and readily available			
up- Laboratory chemical inventory is to-date and readily available			

Other comments/Notations

Inspection by (name, not initials)

Inspection date

_____

_____

Appendix 4: Workplace observation Checklist

Inspection Area: _____ Month: _____

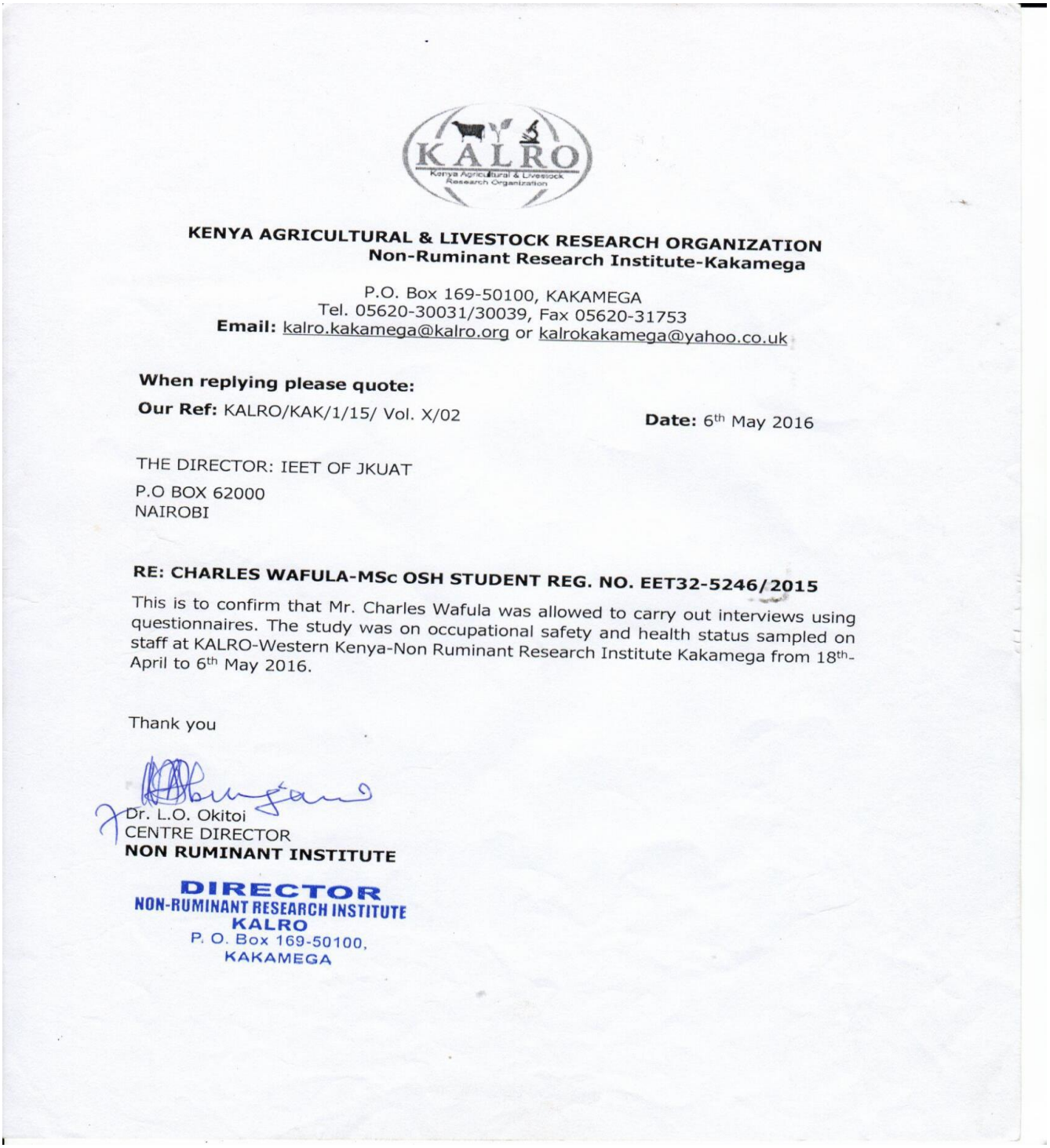
Date of inspection:_____

TYPE OF HAZARD	DETAILS OF HAZARD	LOCATION OF HAZARD	Priority/Significance (A, B,C)
Chemical			
Biological			
Ergonomic			
Physical			

A – High risk B – Medium risk C – Low risk

Inspection conducted by (Name & Signature required):

Appendix 5: Non-Ruminant Research institute KALRO - Kakamega Approval



KENYA AGRICULTURAL & LIVESTOCK RESEARCH ORGANIZATION
Non-Ruminant Research Institute-Kakamega

P.O. Box 169-50100, KAKAMEGA
Tel. 05620-30031/30039, Fax 05620-31753
Email: kalro.kakamega@kalro.org or kalrokakamega@yahoo.co.uk

When replying please quote:

Our Ref: KALRO/KAK/1/15/ Vol. X/02 **Date:** 6th May 2016

THE DIRECTOR: IEET OF JKUAT
P.O BOX 62000
NAIROBI

RE: CHARLES WAFULA-MSc OSH STUDENT REG. NO. EET32-5246/2015

This is to confirm that Mr. Charles Wafula was allowed to carry out interviews using questionnaires. The study was on occupational safety and health status sampled on staff at KALRO-Western Kenya-Non Ruminant Research Institute Kakamega from 18th-April to 6th May 2016.

Thank you

Dr. L.O. Okitoi
CENTRE DIRECTOR
NON RUMINANT INSTITUTE

DIRECTOR
NON-RUMINANT RESEARCH INSTITUTE
KALRO
P. O. Box 169-50100,
KAKAMEGA

Appendix 6: Food Crops Research institute KALRO – KITALE Approval

KENYAAGRICULTURAL&LIVESTOCKRESEARCHORGANIZATION

FOOD CROPS RESEARCH INSTITUTE KALRO - KITALE

Phone: 020-3509161
Email: kalrokitale@kalro.org

P O Box 450-30200
KITALE
Kenya

OUR REF: KALROKIT/4/74/XXI/91 **Date: 16/05/ 2016**

THE DIRECTOR,
IEET OF JKUAT,
P.O BOX 62000,
NAIROBI.

RE: Charles Wafula, Reg No: EET32-5246/2015, Msc Occupational Safety and Health (OSH)

This is to confirm that the above named student was allowed to carry out interviews on **Assessment of Occupational safety and health status in KALRO Western Kenya** at KALRO Kitale as one of the study Centers. The questionnaires were administered to staff as from 16th May 2016 to 3rd June 2016.

Thank you

Awalla BJ
Outreach & Partnership (Students attachement) – KALRO Kitale
For: Centre Director,
Institute Director - FCRI

FOOD CROPS RESEARCH INSTITUTE KALRO KITALE
CENTRE DIRECTOR

Appendix 7: Published paper

International Journal of Environmental & Agriculture Research (IJOEAR) ISSN:[2454-1850] [Vol-3, Issue-8, August- 2017]

Occupational Safety and Health Practices In Agricultural and Livestock Research Organisations, Western Kenya Region

Charles Wafula Buyela[1*], Charles Mburu[2], Paul Njogu[3]

Institute of Energy & Environmental Technology, JKUAT University, KENYA

Abstract— *The Kenya agricultural and livestock research organisation (KALRO) western region is divided into KALRO-Kakamega (non-ruminant) and KALRO-Kitale (food crops) mandated to innovate, improve technological activities that touch on the environment and the livelihood of people. Such practices should comply with occupational safety and health Act (OSHA, 2007) standards. The aim of the study was to assess safety awareness at KALRO-Western Kenya region during the months of April to June 2016. Structured questionnaires, checklist, photographs and observation tools were used for data collection and analyzed using statistical package (SPSS). Study shows that75% of the respondents in KALRO-Kakamega and 79% of the respondents in KALRO-Kitale (χ^2=.187, df=1, p=.665) agreed that both institutes had safety and health policy. Respondents in KALRO-Kakamega (55%) and respondents in KALRO-Kitale (63%) (χ^2=.813, df=1, p=.367) had access to such policies necessitating requirement for sensitization to access policy document. Respondents in KALRO-Kakamega(55%) and respondents in KALRO-Kitale (52%) (χ^2=9.482, df=4, p=.050) indicated that only qualified service engineers maintained machines and equipment. The respondents in both KARLO institutions read labels before using the chemicals KARLO Kakamega 88.7% and KARLO-Kitale 84.2% (χ^2=.511, df=1, p=.475).Compliance to Safe work procedure as per institution (KALRO-Kakamega 70%, KALRO-Kitale 63%) (χ^2=.570, df=1, p=.450). From the research findings, there were no significant differences in predictor factors for safety awareness at both KALRO-Kakamega and KALRO-Kitale. Training of workers to identify, classify and quantify hazards should be enhanced at the two institutes in order to raise their safety awareness levels as per (OSHA, 2007) standards.*

Keywords— *food crops research, health, KALRO, Non-ruminant research, safety.*

PLATES

Plates of photographs Captured From KALRO- Western Kenya and JKUAT. Possible chemical fumes exposures to a worker in KALRO Western Kenya and that of JKUAT due to the design of the facility operations**.**

Plate 1: Atomic absorption spectrophotometer (AAS) KALRO Western Kenya design

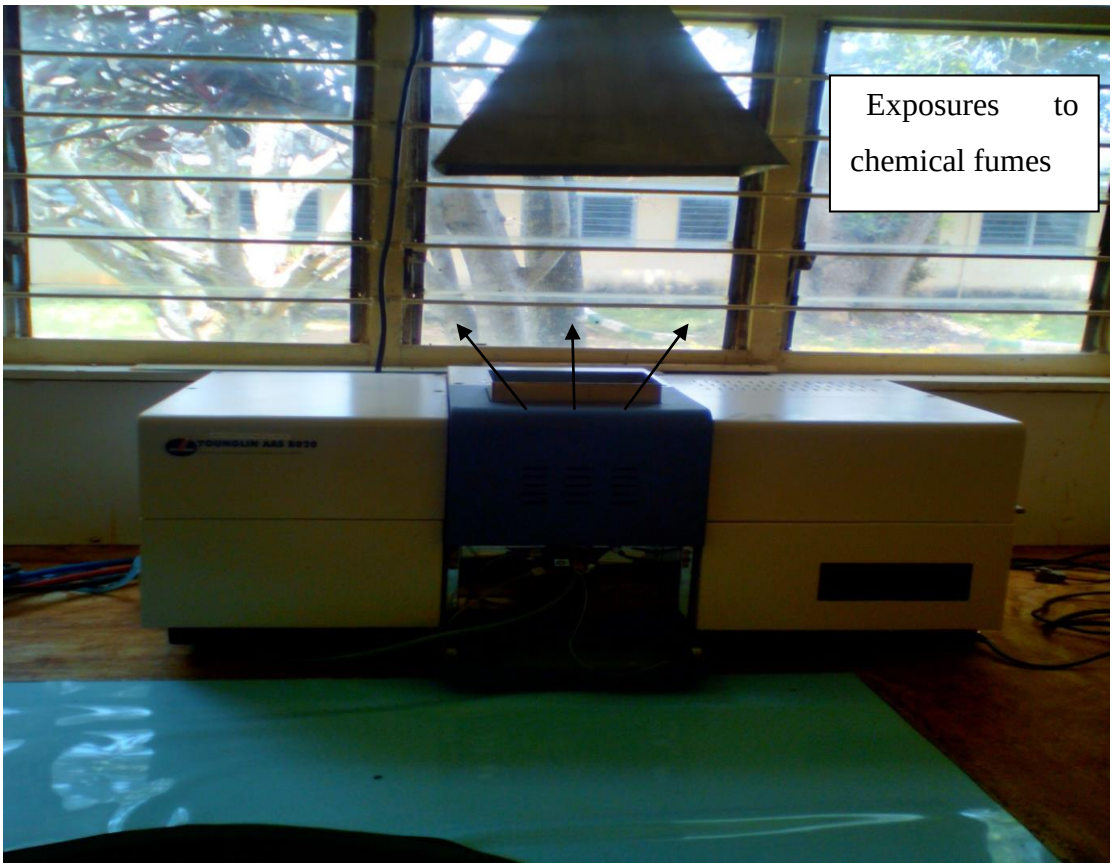


Plate 2: JKUAT (AAS) design for fume hood extractor

Improper practices observed for placement of fire fighting equipments and fume hood chamber that may lead to injuries and chemical exposure to a worker respectively in KALRO Western Kenya and Jkuat Workplaces..

Plate 3: In confined field trial (usage of PPE is emphasized)

Plate 4: Fire extinguisher with display message indicating need for audit

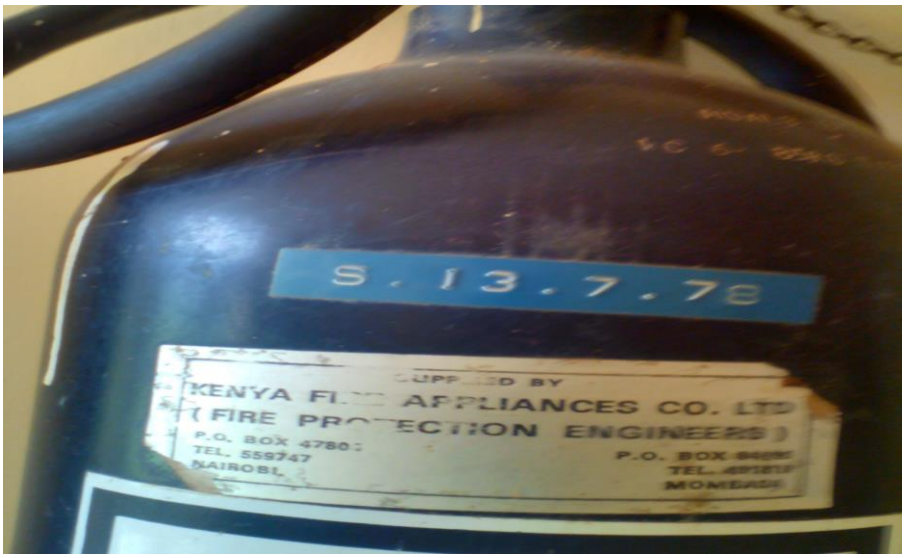


Plate 5: Improper placement of fire Extinguishers