COMPLIANCE ASSESSMENT FOR SAFETY AND HEALTH MEASURES IN A GEOTHERMAL DEVELOPMENT COMPANY: A CASE STUDY OF BARINGO-SILALI GEOTHERMAL DRILLING SITES

Edwin Murithi Nyaga
C50/73983/2012

A Project Report Submitted in Partial Fulfilment of the Requirements for the Award of the Degree of Masters of Arts in Environmental Planning and Management of the University of Nairobi

DECLARATION

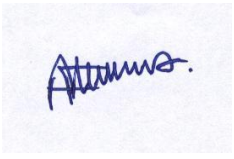
This research project is my original work and has not been presented for examination in any university.

Signed:  ……Date: **28/11/2022**……...

Edwin Murithi Nyaga

C50/73983/2012

This research project has been submitted for examination with the approval of the assigned supervisors.

Signed:  Date: 28th Nov 2022

Francis Mwaura, PhD

Associate Professor

University of Nairobi

DEDICATION

To my family, who have been the main source of strength during the project development.

ACKNOWLEDGEMENTS

First, I would like to thank God for the gift of life and His blessings this far. Secondly, I thank my family for the support they gave both moral and financial during the development of project. Further, I appreciate the University of Nairobi especially the Faculty of Geography and Environmental Studies for the opportunity they offered me to undertake my master studies.

I would like also to put in record my gratitude and sincere appreciation to my esteemed supervisor Prof. Francis Mwaura at University of Nairobi for the invaluable supervision, academic support and tutelage during the course of my Master degree. I register my gratitude to the academic and administrative staffs of University of Nairobi for moulding me with relevant knowledge and the right attitudes towards this realization.

I acknowledge all my peers in the Masters of Arts in Environmental Planning and Management (University of Nairobi, Class 2022) who rendered support that promoted synergy for mutual learning. Finally, my appreciation also goes out to all the study respondents for their participation and sincerity during the process of data collection.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF ABBREVIATIONS AND ACRONYMS

DOSHS: Directorate of Occupational Safety & Health Services

GDC: Geothermal Development Company

ILO: International Labour Organization

KPLC: Kenya Power and Lighting Company

NACOSH: National Council for Occupational Safety and Health

NACOSTI: National Commission for Science, Technology and Innovation

NEMA: National Environment Management Authority

OSHS: Occupational Safety and Health Services

PPE: Personal Protective Equipment

SPSS: Statistical Package for Social Sciences

TVET: Technical Vocational Education and Training

USA: United States of America

ABSTRACT

Workers are among the most valuable assets an organization has and this implies that there is need to guarantee safe and healthy workplace for them. Some of the safety and measures that organizations have in place include formulation of safety and health policies as well as establishing safety committees. The main objective of the study was to assess the compliance with safety and health measures at GDC's Baringo-Silali geothermal drilling sites. The study was guided by the following specific objectives: to identify the existing workplace hazards at GDC's Baringo-Silali geothermal drilling sites; to identify the existing safety and health measures at GDC's Baringo-Silali geothermal drilling sites and to establish the level of compliance with safety and health measures at GDC's Baringo-Silali geothermal drilling sites. The study was carried out in Baringo-Silali geothermal drilling sites that is located in Baringo County in the Rift Valley Region of Kenya. Descriptive cross-sectional study design was utilised as it uses both quantitative and qualitative data collection methods. The study population was 156 workers engaged in geothermal drilling operations categorized as drilling operations, drilling maintenance and drilling support services at Baringo-Silali geothermal drilling sites. A simple random sample of 112 drilling workers was employed to collect primary data using questionnaires and observation guides. Descriptive statistics were used to analyze data to derive percentages and frequencies. The qualitiative data from open-ended questions was analysed using content analysis and presented in narratives. The findings showed that 80% of the sampled employees are aware of any existing workplace hazards at GDC's Baringo-Silali geothermal drilling sites. At least 70% of all sampled workers confirmed existence of health and safety policies at Baringo-Silali geothermal drilling sites while 75.3% perceived a compliance with the safety and health measures. The study concluded that while GDC's Baringo-Silali geothermal drilling sites have various safety and health measures in place, workers perceived that a 100% compliance with the measures was yet to be achieved. The study recommended that improved awareness of drilling hazards and higher compliance with safety and health measures could be achieved through a concerted training and development programme for drilling workers.

CHAPTER ONE: INTRODUCTION

1.1 Background to the Study

Access to electricity across the globe has, throughout history, served as a catalyst for the growth of the industrial sector, improvements in social welfare, and advances in medical care, and this role is only growing in significance (Salahuddin & Alam, 2016). Electricity has become an increasingly important component of the global energy supply as a result of widespread electrification of end-user sectors such as the transportation, heating and industries. One of the renewable sources for producing electricity is geothermal energy (Graditi & Di Somma, 2022). According to Vidadili, *et al*., (2017), geothermal energy, which is considered to be one of the greatest promising renewable energy sources, has been shown to be dependable and as a result, its use for the production of power is growing. Despite the significance attached to geothermal energy, its production involves activities like geochemical analysis and drilling that threaten the health and safety of its workers as well as the environment. This calls for adoption of and compliance towards various safety and health measures (Holdren, *et al*., 2021).

Safety and health measures refers to the initiatives taken by an organization or employers for protecting the mental, social and physical wellbeing of workers and non-workers in a workplace (Park, *et al*., 2017). Safety and health encompass security, protection and well-being of workers, which is essential to their productivity. By guaranteeing health and safety for workers, organizations ensure that the workplace is safe, efficient, productive and wealthy. Graditi and Di Somma (2022) assert that the aim of safety and health measures is preventing injuries, illnesses and deaths in workplace and the misery and monetary crisis that the operations in work could cause for employees, their relatives and workplace neighbors as well image of the employer. In other words, the safety and health measures could as well safeguard work colleagues, relatives, employers, consumers, vendors, adjacent neighborhoods, and other members of the general public who are affected by the workplace environment (Kim, Park & Park, 2016).

Notwithstanding the importance of safety and health measures, compliance with these measures is the key to ensuring workplace safety (Brauer, 2016). Workplace safety hugely relies on the enactment of occupational safety policies and workplace environmental management measures to guarantee compliance with health and safety standards. Reese (2018) asserts that when it is not possible to completely eliminate occupational risks, compliance might be achieved by making

concerted efforts to mitigate their effects. Occuptational hazards and associated risks could be substantially reduced by working in an atmosphere that has clear directions on safety and health. In order to comply with safety regulations, one must be compliant and obedient in response to powerful influences, which can be diverse and varied depending on the activities that are being monitored (Puah, Ong & Chong, 2016).

Globally, countries worldwide have acknowledged that the human right to safe and sound working conditions is universal, inalienable, interdependent and indivisible (Ndegwa, Guyo, & Orwa, 2014). In USA, more than three (3) million workers suffered from workplace related injuries and accidents in 2017 alone despite having health and safety measures in place (Acharya, *et al*., 2017). In the United Kingdom, at least two million people are established to have a disease that is believed to be caused or worsened by their current or previous work (Farnacio, *et al*., 2017). In Africa, majority of nations and institutions have ignored issues of occupational health and safety practices to stem employment crises (Muthelo, 2022). The ILO confirmed that there were 63,900 work-related fatalities in African nations and an approximated 1,560,000 work-related injuries (Kim, et al., 2016). Despite the fact that several countries in Africa have holistic legislation concerning health and safety standards and working period, as well as systems to ensure compliance, the actual observance of these laws is typically weak and under-funded in a number of institutions (Jilcha & Kitaw, 2016).

In Kenya, companies' administration and other stakeholders are increasingly concerned about the status of occupational safety and health conditions (Sawe, 2013). All measures for safety and health are tailored towards promoting a safe and healthy work environment (Abuga, 2012). Most organizations are concerned with providing a safe and healthy working environment for their employees (Ndegwa, et al., 2014). For geothermal development company (GDC), safety has been key in conducting operations of geothermal development that is deliberated to be an undertaking with high risks. The companies make effort to adhere government requirements highlighted in the Occupation Safety and Health Act 2007. The management of company is dedicated to guaranteeing safety directions are adhered to for both compliance and as well guarantee safety is accomplished at higher standards (Mola, 2022). This study sought to conduct a compliance assessment for safety and health measures in geothermal development company.

1.2 Statement of the Research Problem

Workers are among the most valued assets any company or organization has and this underlines the need to guarantee safe and healthy workplaces for them (Kachila, 2020). The drive towards safe and healthy workplaces often include formulation of relevant policies, worker sensitization and training as well as establishing internal structures such as safety and health committees. Despite the adoption of safety and health measures by almost every organisation across the globe, reports show that around 6,300 employees suffer daily from work-related injuries (Ncube & Kanda, 2018). Though accidents may be a normal occurrence at workplaces, most injuries could be attributed to failure in compliance with safety and health measures in place (Jilcha & Kitaw, 2016).

For Kenya's Geothermal Development Company (GDC), safety and health is a crucial component for its achievement and its operations as it makes sure that employees are safeguarded from illness, diseases and injuries coming from the workplace activites (Irungu, 2017). This is because drilling and related works expose the workers to a range of risks with machines and manual work. The GDC management has put in place various safety and health measures aimed at promoting increasingly higher compliance and higher safety standards (Mola, 2022). However, the extent to which such measures achieve their intended outcomes has not been established. Moreover, despite the fact that the government has put in place legislations to safeguard and policies for ensuring safety and health of workers, the number of accidents at workplaces has continued to increase (Kamau, 2014). This could be as a result of failure to comply and enforce the workers' safety and health laws within the Geothermal Development Company.

There are limited studies conducted assessing compliance assessment for safety and health measures in geothermal energy sector. Some of the existing relevant studies include Beth (2018) who did an examination of occupational safety compliance in small-scale gold mines in Siaya County, Kibe (2016) did an assessment of health and safety management on construction sites in Kenya: a case of construction projects in Nairobi County while Kachila (2020) looked at the assessment of the effects of geothermal well drilling occupation on the safety and health status of workers in Menengai geothermal project. However, the studies failed to explicitly to establish the statuses of compliance with safety and health measures at the study sites. Similarly,

no studies have explicitly identified safety and health measures at the GDC workplace. This study sought bridge these knowledge gaps by conducting a compliance assessment for existing safety and health measures at Kenya's geothermal development company. The study findings will be useful to environmental policy and practice in the geothermal energy industry.

1.3 Research Questions

The following research questions guided the study:

i. What are the existing safety and health hazards at GDC's Baringo-Silali geothermal drilling sites?
ii. What are the existing safety and health measures at GDC's Baringo-Silali geothermal drilling sites?
iii. What is the level of compliance with safety and health measures at GDC's Baringo-Silali geothermal drilling sites?

1.4 Objectives of the Study

14.1 Main Objective

The main objective of the study was to assess the compliance with safety and health measures at GDC's Baringo-Silali geothermal drilling sites.

1.4.2 Specific Objectives

The study was guided by the following specific objectives:

i. To examine the existing workplace hazards at GDC's Baringo-Silali geothermal drilling sites.
ii. To evaluate the existing safety and health measures at GDC's Baringo-Silali geothermal drilling sites.
iii. To assess the level of compliance with safety and health measures at GDC's Baringo-Silali geothermal drilling sites.

1.5 Research Hypotheses

The study sought to test the following null and alternate hypothesis:

H_{01}: There is no significant relationship between existing safety and health hazards and level of compliance with safety and health measures at GDC's Baringo-Silali geothermal drilling sites

H_{a1}: There is a significant relationship between existing safety and health hazards and level of compliance with safety and health measures at GDC's Baringo-Silali geothermal drilling sites

H_{02}: There is no significant relationship between existing safety and health measures and level of compliance with safety and health measures at GDC's Baringo-Silali geothermal drilling sites

H_{a2}: There is a significant relationship between existing safety and health measures and level of compliance with safety and health measures at GDC's Baringo-Silali geothermal drilling sites

1.6 Justification of the study

Given the importance attached to safety and health measures in any organization, this study would be important to stakeholders in energy sector. First, the study would be of benefit to staff at geothermal development company as it would highlight the existing safety and health measures and compliance status in the company. This would enable the GDC to identify the safety and health measures that they have not effectively complied with and hence strategize on how to improve compliance with the safety and health measures and create a workplace environment that is healthy and safe within the firm.

The findings would be beneficial for policy makers who would make use of the findings to formulate policies that guarantee compliance with all safety and health measures at every GDC's drilling sites. This would go a long way in reduction of the number work related illness and injuries. The study would also provide the officers from National Council for Occupational Safety and Health (NACOSH) with an insight on safety and health compliance status at geothermal development company. This would allow them to take the necessary actions to ensure safety and health measures are fully complied with at the company.

The study would be of benefit to industry practice, researchers and academicians as they would use this study as a foundation for conducting future studies on compliance assessment for safety and health measures in other companies in Kenya. The study contributes to knowledge on compliance assessment for safety and health measures in energy generating companies.

1.7 Scope and Limitations

The focus of the study was on GDC's Baringo-Silali geothermal drilling sites to examine the compliance with safety and health measures. The study specifically sought to identify the existing safety and health hazards, identify the existing safety and health measures and establish the level of compliance with safety and health measures. The study targeted workers at Baringo-Silali geothermal drilling sites. The study was conducted for six months. However, the study did not address the effect of safety and health measures on company operations.

The study anticipated facing various limitations which hindered accessibility of the information being sought in the study. There was reluctance among the study participants while giving data as they feared the data they provided could be used for intimidation or portray a negative image of themselves. However, the researcher addressed this limitation by assuring the participants that data provided was treated with utmost confidentiality was kept. Moreover, the researcher presented to the participants the introduction letter from university and research permit from NACOSTI to assure them that the data was to be utilised for purposes for academics only. The other limitation of the study was that the findings relied on the degree to which the participants were willing to give precise, impartial and credible data. This was handled by conducting data quality auditing through a reliability and validity tests. The study was also limited to Baringo-Silali geothermal drilling sites as a representation of others sites at geothermal development company.

1.8 Definition of concepts

This section presents the definition of key concepts and terms adopted in the study.

Compliance assessment: Refers to a process of assessing and documenting the current status of compliance oversight, management and linked risks in a given area of compliance. In this study, compliance with every health and safety measures are assessed.

Compliance: Refers to acting according to certain accepted standards. In this study, the study looked at how Baringo-Silali geothermal drilling sites complied with all safety and health measures

Geothermal drilling: Refers to the process of digging boreholes in the earth to extract the earths heat. In this study, drilling at Baringo-Silali geothermal sites is evaluated.

Hazards: Refers to any type of substance, condition or object that can injure workers. It is a condition that has the potential to cause someone harm or to have a negative impact on their health.

Health: Refers to a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity.

Safety and health measures: Refers to the science of anticipating, recognizing, evaluating, and controlling hazards in the workplace that could have an effect on the health and well-being of employees.

Safety: Refers to the state of safeguarding and preventing humans from getting hurt or harmed as a result of hazards that are present in their places of employment.

Workplace: Refers to a location where someone works for their employer or a place of employment.

Welfare: Refers to the provision of facilities to preserve the health and well-being of individuals at the workplace.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter captures a review of literature that is relevant to the compliance assessment for safety and health measures. It reviews studies that have been carried out on safety and health measures. The key areas of focus include workplace hazards, safety and health measures, compliance with safety and health measures and research gaps. It also identifies certain key theoretical foundations and conceptual framework showing the interrelationships between the variables.

2.2 Workplace Hazards

Workplace hazards are the sources of probable harm or damage to individuals or something in any environment of work (Acharya, et al., 2016). It could be a piece of material or any interaction that, under certain circumstances, has the potential to result in injuries. According to Seker and Zavadskas (2017), a hazard may be defined as a danger to workers that is integral in a specific profession, in geothermal activities, employees are exposed to various hazards which are inimitable to the profession. These include physical, physiological, chemical, intuitive, mechanical, safety and psychosocial hazards. Geothermal activities have distinct and innate features that set them apart from other types of workplaces and result in a unique set of risks to workers' safety and health (Sovacool, 2016).

A study conducted by Irungu (2017) on impacts of ambient hydrogen Sulphide exposure to workers in Olkaria Geothermal Power Station, Kenya, established that workers are exposed to hazards such as ambient hydrogen Sulphide within 2.0-7.0 ppm levels which causes nausea, eye tearing, headaches, loss of sleep and airway problems. Another study conducted by Ngaruiya, et al., (2019) on occupational health risks and hazards among the fisherfolk in Kampi Samaki, Lake Baringo, established that workers encountered workplace hazards like cuts, irritability of eyes, sunburns, skin burn, cold, falls, and musculoskeletal injuries. Further, Oluoch, et al., (2007) who looked at the effect of occupational safety and health hazards' exposure on work environment, established that workers in the water service industry in Kisumu County are exposed to biological, chemical ergonomics, physical and psychological hazards. These studies did not

explicitly identify all the workplace hazards that are relevant to geothermal drilling sites. This study focuses on the following are the common workplace hazards:

2.2.1 Mechanical Hazards

Mechanical hazards are dangers that can be caused by the use of or proximity to motorized or manually controlled equipment, machinery, or plant (Benos, Tsaopoulos & Bochtis, 2020). The majority of mechanical injuries are brought on by either direct contact with machinery or becoming entangled in its moving parts. The devices, equipment, gear, and plant that are utilized in operations of geothermal drilling could have a range of adverse impacts on the health of the workers (Tilli, 2021). Most of the machines that are utilised to carry out the duties associated with geothermal drilling have moving parts, sharp edges, and hot surfaces, which have the potential to cut, stab, crush, strike, or hurt employees if they are handled without the appropriate protective gear (ILO, 2018). Machines can cause severe injuries such as, amputations, fractures, lacerations or crushing injuries. Operations of geothermal drilling necessitate the mobility of both staff and workplace (drilling rig and auxiliary equipment) from one well site to another. The whole process of down rigging, moving components of the rig and equipment to new sites as well as up rigging at the new sites are intricate and extremely mechanized process which come with a lot of hazards (Kachila, 2020).

2.2.2 Chemical hazards

According to Bernaldez and Soriano (2017), chemical hazard is a substance that has the potential to cause harm to life or health. These are the dangers that could be caused by fluids, particles, debris, gases, fumes, or vapors. Workers have a potential risk of exposure to naturally occurring compounds such as hydrogen sulfide as well as other chemicals such as ammonia and glycols. In the event that work necessitates cutting or drilling through concrete, there is a chance that silica dust particles will be released into the air. The inhalation of these substances can lead to breathing difficulties, dermatitis or other forms of skin rashes, and exposure to chemicals on the skin (ILO, 2018). Chemicals found in workplaces can lead migraines, eye irritation of eyes, disorientation, fainting, tiredness, and impairments in reasoning and synchronization. They are also known to cause damage to the skin, liver, kidney, and heart and lungs in addition to the damage they cause to the central nervous system (Kibe, 2016).

2.2.3 Biological Hazards

Biological hazards are organic substances that present a threat to the health of people and other living organisms. These dangers consist of micro-organisms including bacteria, virus, fungus, and worms that can spread disease to employees who are exposed to them and put them at risk. Poor conditions in workplace and potential exposure to biological risks are common at geothermal drilling sites (Abbasi, 2018).

2.2.4 Psychosocial Hazards

According to Metzler and Bellingrath (2017), contend that psychosocial hazards are linked to the way work is premeditated, prearranged, and accomplished and the work context economically and socially. These dangers are also linked to psychological and physical harm or sickness for those who are exposed to them. Long shifts are typical for employees at geothermal sites because of the nature of the work. Many professionals are required to commute considerable distances, and they may be absent from their families for several days or even weeks at a time. Many workers and their families experience anxiety as a direct result of these circumstances, and the personal lives of many people are negatively impacted as a result. If the operations in the workplace have not been adequately researched and the accompanying health hazards have not been eradicated or regulated, then the workplace itself may be the most important cause of health problems. As per the Mensah, *et al*., (2022), severe stress at work cause of uncertain nature of employment, inadequate poor work life balancing, lower salaries, long job shifts and impractical expectations of job might increase vulnerability of workers to other forms of hazards in work place.

2.2.5 Physical hazards

As per Hassan, *at al*., (2017), physical hazards refer to any potentially dangerous element of ones surroundings. The common physical hazards linked with ill health include noise, dust, heat, fire, ionizing radiation and vibration. Noise refers to any sound that is not wanted and that disrupts concentration, stimulates stress, and makes it difficult to work efficiently. Rock ripping, rock shredders, the sound of engine drillers, and the sound from dumping trucks and lorries can all generate high noise levels, which puts workers at risk for noise-induced hearing loss. In addition, geothermal site operations involve rock breaking or soil removal and these operations generates lot of dust and stones which causes various of respiratory ailments among the workers in the site

(Beth, 2018). Further, workers at drilling sites are unprotected to hand-arm and whole-body vibration. The first type is produced by devices like compressed air drills, bolt cutters, and chain saws, whereas the second type is produced by quarry automobiles and some stationary industrial facilities (Stave & Wald, 2016).

2.2.6 Blow-Out hazard

A blow out is a fluids flow in an uncontrolled manner from a wellhead or wellbore. In the event that the hole breakthroughs into a fragmented or porous stratum in which the pore pressure is greater than the static head of the drilling fluid, the formation fluid will flow into the wellbore, the phenomenon is known as a "kick," and the flow of formation fluid into the wellbore needs to be managed (Yamamoto & Morooka, 2019). In the event that control of that flow is lost, the resulting catastrophe is known as a "blowout," which will, at the very minimum, lead to very high costs and, at the worst, could lead to the loss of lives as well as equipment and the drill rig itself, in addition to causing damage to the environment. The primary goal of well control programs is to reduce the likelihood of a blowout, which could send extremely high-temperature steam, hot fluids that are corrosive or acidic, and poisonous fumes up into the rig floor, where employees are located (Kachila, 2020).

2.3 Safety and Health Measures

Safety and health measures refers to the concept of anticipating, recognizing, evaluating, and controlling hazards in the workplace that may have an adverse effect on the workers health and well-being. The purpose of safety and health measures is preventing workplace injuries, diseases, and mortalities, and the distress and economic struggles that these occurrences could cause for employees, their family members, and companies. A study conducted by Hoque (2018) on efficiency of programs for ensuring health and safety in workplace in academic contexts, discovered a variety of programs for health and safety like workplace analysis, accident and record analysis, control of hazards and training on health and safety. Ngwama (2016) conducted a study on framework for occupational health and safety in Nigeria, found that there are laws and regulations in place to promote health and safety, but many workers do not abide by the fundamental laws to safeguard their employees. These studies could not be generalized to cover the case of geothermal drilling sites.

A study conducted by Ojiem (2012) on occupational health and safety management practices among the electronic media houses, established that occupational safety management practices existing at electronic media houses in Kisumu County include Inspection, maintenance and repair of machines, employee protection from hazards, having efficient physical plants layout, safety education practices, proactive identification of hazards and employee empowerment. Though this study is relevant in studying safety and health measures, it is based in media houses where employees are exposed to different workplace hazards in comparison to geothermal drilling sites.

Another study conducted by Ogetii (2019) on assessment of occupational health and safety practices at construction sites in Nairobi City Region, established that the Health and Safety Practices adopted at Construction Sites include provision of PPEs, first aid facilities, safety informational notices, site fencing, fire safety and safety trainings, provision of public safety through site fencing, provision of personal protective equipment, first aid facilities and fire safety measures. Also, Oluoch (2015) conducted a study on effect of occupational safety and health programmes on employee performance at Kenya power company limited, established that health and safety programmes in place at KPLC include occupational health surveillance, health and safety committees, employee wellness programs and health and safety policy. Though these studies looked at safety and health measures at other companies whose operations differ from those of GDC's drilling sites.

Further, Kyalo (2020) looked at awareness of occupational hazards and safety practices among petrol service station employees in Nakuru County, established that there was low use of PPE among petrol station workers as operations were done without appropriate attire even by those who said had. The study also established that safety training for employees and managers is crucial and thus companies need to as well implement utilization of safety equipment and prompt disciplinary actions where essential against those who do not comply. This study did not explicitly identify every safety and health measures that may exist at GDC's drilling sites.

Some safety and health measures that this study seeks to focus on include safety and health awareness training, surveillance on worker's health, formulating health and safety policies, health and safety audits, establishing safety committee, provision of personal protective equipment and noise mapping. These are discussed below:

2.3.1 Safety and Health Awareness Training

Safety training is prospective the commonly practiced method in management fo safety and workers who get training on safety have a lower incidence of work-linked injuries than their counterparts who are not trained in safety procedures. Training in health and safety is an crucial part of keeping a workplace free from hazards, and it has long been an integral part of managing the occupational health and safety. Training gives people the fundamental practical and theoretical knowledge they need to successfully practice their trade or profession and to integrate themselves into the workplace environment (Konijn, *et al*., 2018)

2.3.2 Surveillance on Worker's Health

Medical surveillance for workers includes an evaluation of health outcomes founded as a significance of contact for employees to risks of occupational safety and health (Choi, Hwang & Lee, 2017). There is a high probability that not all of the dangers in the workplace can be eliminated. The primary function of worker health surveillance is to determine whether or not an employee is fit for the duties of a particular job (Los, *et al*., 2019). The purpose of medical surveillance is to evaluate any potential health impairments that might be the result of hazardous agents that are integral to the working processes. The health surveillance assists in detecting the situations that make a worker susceptible to the repercussions of a hazardous cause or start noticing the signs of a harmful agent in a timely manner to divert the effects on workers (Groseclose & Buckeridge, 2017).

2.3.3 Formulating Health and Safety Policies

The health and safety policy serves as the basis upon which the establishment of goals for occupational safety and health, as well as performance metrics and elements are established. This statement must indicate the behavior standard that is to be strived for in health and safety issues, as it tends to reflect the dedication of the company to health and safety on the job. It is necessary to have written policies on health and safety in order to demonstrate that top management is concerned about the protection of employees working for organizations from hazards at workplace and to suggest how protection will be provided (da Silva & Amaral, 2019).

2.3.4 Health and Safety Audits

Health and safety audits allow for a much more comprehensive review of all aspects of the policies, procedures, and practices pertaining to health and safety. Audits of workplace safety may be carried out by safety consultants as well as human resource experts; however, it is in everyone's best interest for managers, workers, and worker representatives to be engaged (Tan, Hon, Young & Sekercioglu, 2022). Hale (2019) asserts that audits are frequently carried out under the supervision of a health and safety committee, with the members of that committee playing an active role in carrying them out. Additionally, managers could be held accountable for carrying out audits in their departments, and even better, specific individuals of these departments could be trained to carry out audits in specific areas (Hale, 2019).

2.3.5 Establishing Safety Committees

According to Işık and Atasoylu (2017), safety committee is another method that can be implemented in order to reduce the risk of accidents occurring. In order to keep a healthy and safe working environment, one of the most important factors is collaboration in the workplace between managers and employees or their representatives in the areas of occupational health and safety. Joint health and safety committees offer a beneficial framework for debate and for coordinated action to enhance safety and health in the workplace (Reese, 2018). Health and safety committee need to assist in carrying out the assessment of risks and auditing of safety and make recommendations on enhancing performance of health and safety programs. The main goal of safety committee is promoting collaboration amongst the companies and its staff in examining, establishing and conducting measures to make sure that the employees' health and safety at workplace (Haas & Yorio, 2016).

2.3.6 Provision of Personal Protective Equipment

Personal protective equipment, also known as PPE, is gear that employees wear to reduce their exposure to hazards in the workplace that can cause serious illnesses and injuries. These injuries and illnesses could be caused by interaction with chemical, radioactive, physical, power systems, mechanical, or one of the many other hazards that are present in the workplace. A worker is afforded direct protection from the dangers that exist in the working environment by virtue of their use of personal protective equipment (PPE) (Wong, Man & Chan, 2020).

2.3.7 Noise Mapping

According to Kachila (2020), appropriate mapping utilising software for noise-mapping could make sure that every possible thing is undertaken in mitigating unnecessary exposure in a manner that is cost-efficient. Noise maps could indeed portray levels of noise in a coherent way by making use of colored contour lines and exterior dots based on a scale that is set by the user, which enables the best option to be noticeable. This makes it possible to run simulations for a wide variety of other rig activities as well as different configurations of the machinery that is located at the rig site. The noise map displays all of the sources of noise as well as how it is distributed, which makes it simpler to create key areas for mitigation strategies (Berndt, 2018).

2.4 Compliance with Safety and Health Measures

According to Okoye, Ezeokonkwo and Ezeokoli (2016), compliance can be defined as the application of measures that are developed to adhere to legal requirements, with regulator's primary focus being improving health and safety outcomes. Compliance with occupational health and safety metrics could lead to a reduction in accidents, which in turn can lead to an increase in industrial productivity. Accidents lead to a decrease in productivity as well as damage to property or equipment. It has been asserted that the implementation of health and safety measures does not significantly improve workers' health and safety in the workplace (Nikulin & Nikulina, 2017).

Research on OSH compliance by Howe (2015) in Hong Kong and Australia established that large companies with adequate safety personnel in place had no difficulty in comprehending and utilising information in regard to the requirements of such regulations. The study also established that as a consequence, large companies were in a stronger position to guarantee compliance with regulations than their equivalents in smaller entities, which often lacked adequate safety personnel and lacked the resources, both in terms of time and money, to read and comprehend the vast amounts of regulatory material on safety issues.

Further, Kamau (2014) conducted a study on enforcement and compliance on occupational health and safety metrics in industries in Thika municipality, found that compliance with OHS has continued to decrease as a result of low inspections levels by government officials, Public Health and National Environment Management Authority (NEMA) whose obligation is to make

sure that there is compliance with OHS measures by industries in Thika. However, this study did not explicitly conduct a compliance assessment at the industries' that could be generalized to GDC's Baringo-Silali geothermal drilling sites.

Additionally, Gatithi (2012) looked at the degree of compliance with occupational safety and health regulations at manufacturing firms in Mombasa County, established that the degree of compliance with Occupational Safety and Health regulations at workplaces stands at 71.7%. Moreover, Mwangi (2017) did an assessment of the level of compliance with occupational safety and health act 2007 in public TVET institutions in Nairobi County, found that there existed weak systems of safety management in place for enforcing safe work procedures, safety rules and the utilisation of work permits and thus reduced compliance with OSHA 2007. The findings of these studies could not be generalized to cover the case of GDC's Baringo-Silali geothermal drilling sites.

2.5 Research Gaps

Various studies have been conducted in relation to compliance assessment for safety and health measures. Some studies identified existing workplace hazards in various companies like Irungu (2017) at Olkaria Geothermal Power Station and Oluoch, *et al*., (2007) at water service industry in Kisumu County. However, these studies did not explicitly identify all the workplace hazards that are relevant to geothermal drilling sites. Further, other studies identified existing safety and health measures in several companies such as Ojiem (2012) at electronic media houses in Kisumu County, Ogetii (2019) at construction sites in Nairobi City, Oluoch (2015) at Kenya power company limited and Kyalo (2020) at petrol service station workers in Nakuru County. However, these studies could not be generalized to cover the case of GDC's Baringo-Silali geothermal drilling sites. The existing studies failed to explicitly to establish the status of compliance with safety and health measures. This study therefore sought to bridge these gaps by assessing the compliance with safety and health measures at GDC's Baringo-Silali geothermal drilling sites.

2.6 Theoretical Framework

The study was founded on domino theory of accident causation which was postulated by H.W. Heinrich in 1950s. It is also referred to as Heinrich's Law of 1:29:300. The theory states that one

unwanted condition in the place of work results to others, and ultimately to accidents. The theory was postulated by Herbert Heinrich after examining the 75,000 reports on accidents collected from industries in the 1920s in which he concluded that eighty eight percent of accidents were as a result of undesirable actions, ten percent by conditions that are undesirable whereas 2percent were unavoidable, that is, Domino theory puts the actions of the employee at the centre of accidents. From the study findings, found that accidents can be controlled through a sequence of corrective actions that are commonly regarded as the three 'E's. They include; the engineering measure that entails product design and process change (Rad, 2013).

The Hebert theory is widely utilized as an industry standard model by health and safety specialists all over the globe. On the other hand, this theory has a significant flaw in that it only focuses on the safety issues that are present in the manufacturing industry, despite the fact that safety hazards and unsafe conditions could be evenly experienced in other workplace environments that are not limited to the industries alone (Rahiman, & Mahat, 2018). The theory was partially embraced in the composition of the conceptual framework primarily to demonstrate that incidents and injuries that are not excluded could only be greatly reduced taking into account the fact that the theory also recognizes some accidents or injuries to be unavoidable (DeCamp & Herskovitz, 2015).

Although this theory was later criticized by other researchers as being too simplistic, it has still remained applicable in guiding studies related to occupational health and safety (Rad, 2013). Some of the techniques for safety management proposed by Heinrich which can be applied in construction workplaces include; workers safety trainings, safety conscious information through posters and films; risk assessments; regular safety audits; accident investigation; inspection of equipment, and changes in work procedures or processes; establishment of safety committees and arrangements for emergency and first aid. All these needs the intervention of relevant project stakeholders like the government bodies, management team, employees amongst others (Khakzad, *et al*., 2013). This theory was relevant in assessing the compliance with safety and health measures at GDC's Baringo-Silali geothermal drilling sites.

2.7 Conceptual Framework

Conceptual framework is a diagrammatical research tool with an aim of assisting the researcher in awareness development and comprehending of the situation under inspection and to communicates back (Varpio, Paradis, Uijtdehaage & Young, 2020). The conceptual framework is illustrated in Figure 2.1.

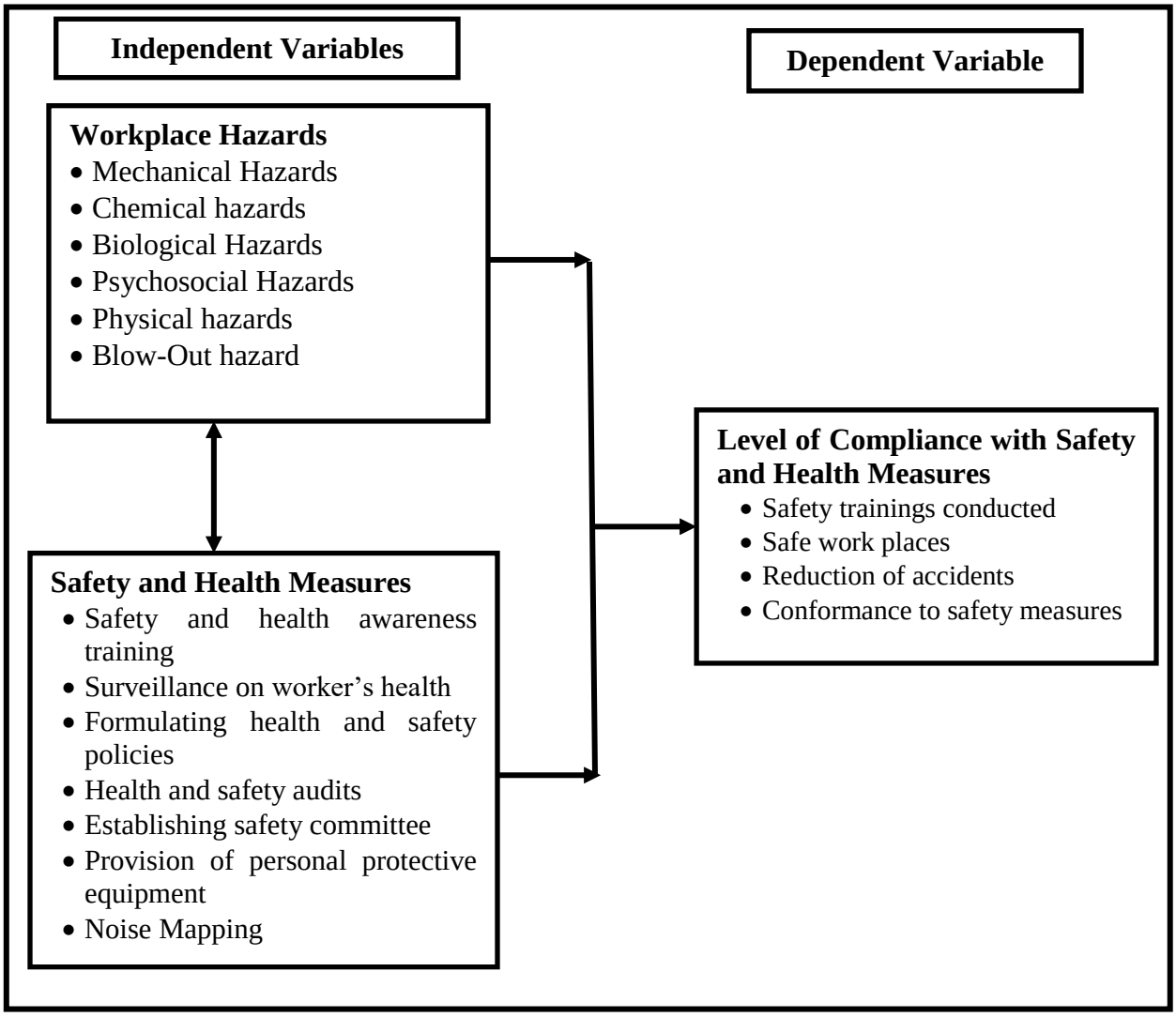


Figure 2. 1: Conceptual Framework

The framework ascertains that the independent variable was workplace hazards which is measured by looking at mechanical, chemical biological, psychosocial, physical and blow-out hazards and safety and health measures which includes safety and health awareness training, surveillance on worker's health, formulating health and safety policies, health and safety audits,

establishing safety committee, provision of personal protective equipment and noise mapping. The level of compliance is the dependent variable as it depends on the existing workplace hazards and safety and health measures. The arrows between workplace hazards and safety and health measures shows that the existing measures put in place for ensuring safety and health workers depends on the existing hazards. However, workplace hazards and safety and health measures are independent of level of compliance, though compliance depends on existing workplace hazards and safety and health measures.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

The chapter covers the research methodology that was utilised in conducting the study. The chapter give details of the study area, research design, target population, sample size and sampling procedure, sources of data, data collection methods, data analysis and presentation and ethical considerations.

3.2 Study Area

Geothermal Development Company (GDC) is a government owned company that was set up in 2008 as a special purpose vehicle to accelerate development of geothermal resources in Kenya. It has since developed geothermal steam which is mainly supplied to Ken Gen or Independent Power Producers (IPP) for generation of electricity. The company has also the mandate to generate electricity from excess steam and development of other direct use applications. The study was carried out in Baringo-Silali geothermal drilling sites that is located in Baringo County in the Rift Valley Region of Kenya as shown in Figure 3.1.

Figure 3. 1: Study Area

GDC has been conducting geothermal exploration drillings at the Paka, Korosi and Silali Prospects in the Baringo-Silali Geothermal Project. So far, seven (7) exploration wells in Paka prospect have been successfully drilled. Two wells have been drilled in Korosi, and drilling of the eighth well in Paka is underway. The Paka prospect has three rigs drilling wells in the area namely rig3, rig4 and rig 5. A rig consists of six components; Mast, Substructure, Air wing, Gensets, Tank area and Barracks. Rig staff composes of rig engineer-1, driller-1, derrick men, -2, floormen-4, and roustabouts-2. The mechanical drilling is done alongside use of water that has been pumped all the way from lake Baringo to the highest point in Paka hill where the water flows by gravity down to the rig sites. The water aids in removing of drilled cuttings from the well bottom.

Paka site is a well-defined volcano located 25 km north of lake Baringo and 15km east of Nginyang village at $00^0$55'N,$36^0$12'E. It rises 600-700m above the rift floor to reach a maximum altitude of 1697m, and in plain view has an irregular outline covering an area of 280km^2.The rift floor around Paka has a pronounced west to north-west tilt falling from 1200m in the Komol valley in the south east to less than 860m at Nginyang village in the north west. The summit area of Paka is dominated by a NW-trending fault-bounded ridge. This ridge is a constitutional feature formed by a series of coalesced eruptive centers, upon which several craters and a circular caldera 1.5km in diameter have developed (Williams et al.1984 and Hackman,1988). On the upper northern and north-eastern flanks, the base of this ridge is indicated by a prominent break of slope. The history of Paka's evolution may be broken up into two distinct periods: the first is characterized by trachytic volcanism, while the second is characterized by volcanic rock activity and criticizing. The early history of the volcano is uncertain as the older shield –forming lavas are mantled by trachytic pyroclastic deposits which cover much of the northern, western and southern flanks of the volcano. Dissection of these deposits has produced a radial drainage pattern and an irregular topography of gullies and ridges densely vegetated by acacia and grass. (Williams et al.1972 and Mohr,1972). The Baringo-Silali geothermal drilling Paka site was ideal for this study since operations at the site exposes workers to various workplace hazards. This would provide a platform to assess compliance with various safety and health measures at the site.

3.3 Research Design

Descriptive cross-sectional study design was used as it adopts both quantitative and qualitative methods in data collection. Descriptive cross-sectional surveys are utilised to refer to phenomena linked to the topic population that depicts definite features (Myers, Well, & Lorch, 2013). The approach is deliberated suitable since the study included the fact finding and inquiries on compliance assessment for safety and health measures in Geothermal Development Company.

3.4 Target Population

The target population refers to the whole group of people, units, or elements that the investigators are involved in generalizing their deductions (Otzen & Manterola, 2017). The study population was 156 workers involved in geothermal drilling operations categorized as machine operators, drilling staff, rig mechanics, geologists, safety managers, engineers and welders at Baringo-Silali geothermal drilling sites. These were selected because they are perceived to have adequate knowledge regarding safety and health measures and their compliance. The target population were distributed as shown in Table 3.1.

Table 3. 1: Target Population Distribution

	Target population	**Percentage**
Machine Operators	23	14.7
Drilling Staff	46	29.5
Rig mechanics	32	20.5
Geologists	16	10.3
Safety managers	13	8.3
Engineers	4	2.6
Welders	22	14.1
Total	**156**	**100**

3.5 Sample Size and Sampling Procedure

The sample size was computed at 95% confidence level utilising the Yamane (1967) formula showed below;

n = (N/ (1+N (e) ^2)

Where:

n = sample size,

N = Population size

e = margin of error set at 0.05

n = {156 / (1 + 156 (0.05*0.05)}

n=112

The respondents for this study were selected using random sampling technique. Random sampling is a part of the sampling technique in which each item in the population has an equal probability of being chosen. The study chose random sampling because a sample selected in random is an unbiased representation of the total population.

3.6 Sources of Data

The study utilised questionnaires and observation guides to collect primary data from the participants. The questionnaire had both open and closed ended questions. The open questions are utilized to ensure that participants to provide an in-depth and felt answer without feeling hampered in the lighting of information and the closed questions enable the participant to reply from the limited choices that have been identified. As per Popping (2015), the open-ended questions provide a thorough answer from respondents, while it is generally easier to evaluate closed or structured questions. The study used questionnaires in order to preserve time and money and as well expedite an easier analysis as they are in immediate usable form. The study also utilised observation guides to collect primary data. Observation method is defined as a method to observe and describe the behavior of a subject. The methods focused on observable aspects safety and health measures at the site. The advantage with this method is that it allows the researcher to observe what happens in a natural setting and allows the researcher to get first-hand information. This data was recorded through photography.

3.7 Data collection Methods

Primary data was collected using questionnaires. The researcher booked appointments with the respondents to administer the questionnaires utilising drop and pick later method. This method guaranteed that the respondents have adequate time to fully fill in the questionnaires. After 3 days, the researcher collected the questionnaires from the respondents. The respondents were

assured that the information they have provided was kept confidential. The researcher made use of google forms in case of physical inaccessibility of the respondents probably because of Covid-19 crisis. The researcher also visited Baringo-Silali geothermal drilling sites to conduct an observation. The observation guide sought to assess the existence of various safety and health measures like personal protective equipment, first aid kits among others.

3.8 Data Analysis and Presentation

Data analysis is the systematic process of applying arithmetical and consistent tools to explain and illustrate, summarise and assess data (Sharma, 2018). Data analysis was with the help of Statistical Package for Social Sciences (SPSS Version 25.0). Every received questionnaire was referenced and questionnaire items were coded to facilitate entry of the data. The data was cleaned by checking for errors in data entry. Quantitative data was analysed utilising descriptive statistics which include frequencies, percentages, mode and standard deviations. The findings for quantitative data were presented in tables and figures. The qualitiative data from open-ended questions and qualitative interviews were analysed using content analysis. The findings from qualitative data were presented in narratives. The hypothesis were tested using pearson correlation analysis.

3.9 Ethical Considerations

The researcher observed essential clauses in ethics of social research such as having letter of introduction from the university. In order to protect the rights of all study participants, the researcher followed the following guidelines: First, participants were informed of the purpose of the study and the confidentiality of provided data was guaranteed. The study also got informed consent from the respondents. Once permission is given, the respondents retained their opportunity to decline to participate in some study aspects. The study also retained the right not to answer any question as well as the right to withdraw data they have already provided. The researcher also obtained research permit from NACOSTI. The findings from the study would be shared with respondent through seminars and conferences and also publishing the work in refereed journals.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 Introduction

This chapter covers the study findings as per the objectives. The sections in this chapter include: response rate, background information findings, findings for assessing the compliance with safety and health measures at GDC's Baringo-Silali geothermal drilling sites. The findings are illustrated in tables and figures.

4.2 Response Rate

The study calculated the response rate to ascertain whether it was adequate for analysis. From the findings in Table 4.1, 112 questionnaires were administered to the respondents where only 77 questionnaires were fully filled and returned. This gave a response rate of 68.8%. This was substantial response rate for statistical analysis. This is as per Otzen and Manterola (2017) recommendations that a response rate above 50% is adequate for conducting data analysis.

Table 4. 1: Response Rate

		Response Rate
Response	77	68.8%
Non-response	35	32.2%
Total	**112**	**100**

Source: Researcher (2022)

4.3 Background Information of the Respondents

This section required the respondents to specify their general information including gender, their highest academic qualifications, how long they have been working at Baringo-Silali geothermal drilling sites and age bracket. The background information of the respondents was very important as to ascertaining generalization of findings regarding assessing the compliance with safety and health measures at GDC's Baringo-Silali geothermal drilling sites.

4.3.1 Gender of the Respondent

The researcher requested the respondents to specify their gender. The findings are illustrated in Table 4.2.

Table 4. 2: Gender of the Respondents

	Frequency	Percent
Male	69	89.6
Female	8	10.4
Total	**77**	**100.0**

Source: Researcher (2022).

From the findings in Table 4.2, majority of the respondents indicated to be male as shown by 89.6% while the rest of the respondents indicated to be female as illustrated by 10.4%. This implies that most of workers at GDC's Baringo-Silali geothermal drilling sites are male owing to the fact that the kind and nature of work at the sites is perceived to be best suited for male workers.

4.3.2 Highest Academic Qualifications

The respondents were requested to specify their highest academic qualifications. The findings are shown in Figure 4.1.

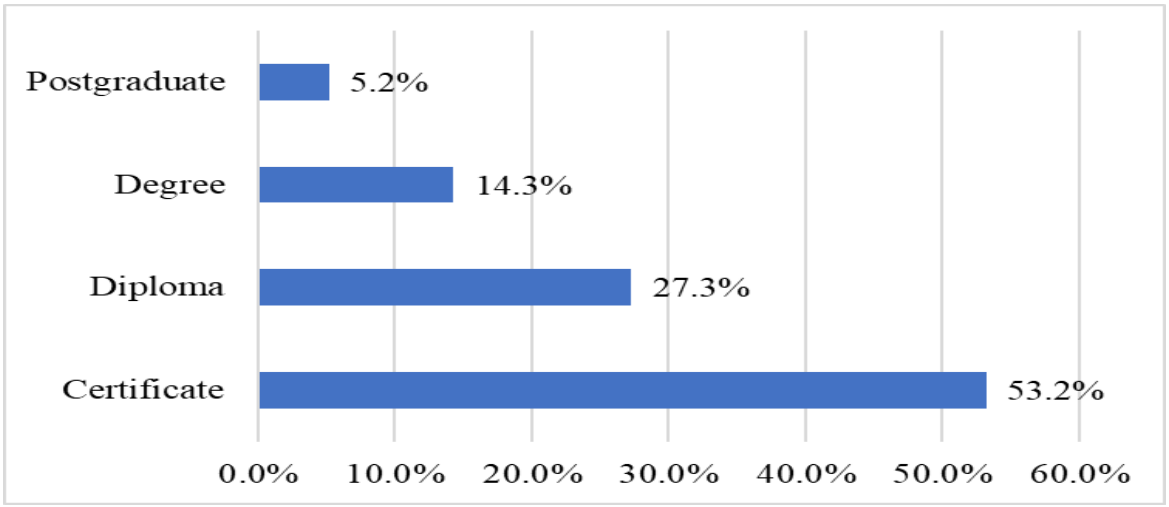


Figure 4. 1: Highest Academic Qualifications

Source: Researcher (2022)

From the findings in Figure 4.1, the respondents specified that their highest academic qualification was certificate as illustrated by 53.2%, diploma as illustrated by 27.3%, degree as shown by 14.3% and post graduate as shown by 5.2%. This shows that all the respondents had

basic qualifications to take part in the study as they could understand the questions asked in the research tools and gave credible data for the study

4.3.3 Working Experience

The respondents were asked to indicate how long they have been working at Baringo-Silali geothermal drilling sites. The findings are shown in Table 4.3.

Table 4. 3: Respondents Working Experience

	Frequency	Percent
Less than 2 years	38	49.4
2 to 6 years	32	41.6
6 to 10 years	4	5.2
Above 10 years	3	3.9
Total	**77**	**100**

Source: Researcher (2022)

From the findings in Table 4.3, majority of the respondents specified to have been working at Baringo-Silali geothermal drilling sites for less than 2 years as shown by 49.4%. Other respondents indicated to have been working at Baringo-Silali geothermal drilling sites for 2 to 6 years as shown by 41.6%, for 6 to 10 years as shown by 5.2% and for above 10 years as shown by 3.9%. This is an indication that most of the respondents had been working at Baringo-Silali geothermal drilling sites for long enough to give credible information regarding the subject under study.

4.3.4 Age Bracket

The respondents were requested to specify their age bracket. The findings are illustrated in Table 4.4.

Table 4. 4: Respondents Age Bracket

	Frequency	Percent
18-29 years	29	37.7
30-39 years	38	49.3
40-50 years	10	13.0
Total	**77**	**100**

Source: Researcher (2022)

From the findings in Table 4.4, the respondents specified to be aged between 30 and 39 years as shown by 49.4%, between 18 and 29 years as shown by 37.7% and between 40 and 50 years as shown by 13%. This implies that data collection cut across all the age brackets and information on the subject under study was from a wide scope which addressed its generalizability.

4.4 Workplace Hazards

The study sought to identify the existing workplace hazards at GDC's Baringo-Silali geothermal drilling sites. The respondents were requested to specify if they are aware of any existing workplace hazards at GDC's Baringo-Silali geothermal drilling sites. The findings are shown in Table 4.5.

Table 4. 5: Awareness on Existing Workplace Hazards

	Frequency	**Percent**
Yes	62	80.5
No	15	19.5
Total	**77**	**100.0**

Source: Researcher (2022)

From the findings (Table 4.5), majority (80.5%) of the respondents specified that they were aware of various workplace hazards at GDC's Baringo-Silali geothermal drilling sites. This implies that most workers were cognizant safety andhealth hazards at the drilling sites where they worked. Those who indicated that they were aware, indicated that existing workplace hazards at GDC's Baringo-Silali geothermal drilling sites include Noise pollution, inexistence of poisonous gas detectors, snake bites, falling objects, fire, kicks and blow outs and hot fluids. Other workplace hazards identified included community issues, poisonous gases like sulphate gas and carbon dioxide from discharging wells, worn out electrical cables, use of tools that are not in good shape, unclean drinking water, poor installation of electrical cables, work related accident, improper hygiene at the rig site especially the general mess where food is served in pathetic and rough grounds and slippery surfaces.

4.4.1 Existing Hazards that Workers are Exposed to while working at GDC

The respondents were further asked to indicate which of the existing hazards are exposed to while working at GDC's Baringo-Silali geothermal drilling sites. From the findings in Table 4.6, about 80.5% of the respondents specified that they are exposed to poisonous gases such as hydrogen sulfide (*see plate 4.6*), to work-related stress as shown by 77.9% (see *plate 4.7*), to geothermal drilling machines with sharp edges as shown by 71.4% (*see plate 4.3*) and to hot steam as shown by 70.1% (*see plate 4.1*) and to longer working hours in geothermal site operations as shown by 66.2%. The respondents also indicated that they are exposed due to lack of personal protective equipment as shown by 66.2% (*see plate 4.2*), to geothermal drilling machines with and hot surfaces as shown by 64.9% (*see plate 4.3 and plate 4.8*) and to poor working conditions as shown by 63.6%. The respondents also indicated that they are exposed to excessive dust from drilling operations as shown by 58.4% and to excessive sound from blasting of rocks, crushers of rock, sound from engine drillers and trucks for dumping rocks as shown by 53.2% (*see plate 4.9*). The respondents also indicated that they are not exposed to poor supervisor support as shown by 58.4%, to uncontrolled flow of fluids from a wellhead as shown by 57.1% (*see plate 4.4*) and exposed machine propellers as shown by 53.2% (*see plate 4.5 and plate 4.10*).

Table 4. 6: Existing Hazards that Workers are Exposed to while working at GDC

	Yes		No		Mode	Std. Dev.
	f	%	f	%		
Geothermal drilling machines with sharp edges	55	71.4	22	28.6	1	0.455
Geothermal drilling machines with and hot surfaces	50	64.9	27	35.1	1	0.480
Exposed machine propellers	36	46.8	41	53.2	2	0.502
Exposure to poisonous gases such as hydrogen sulfide	62	80.5	15	19.5	1	0.399
Exposure to hot steam	54	70.1	23	29.9	1	0.461
Work-related stress	60	77.9	17	22.1	1	0.417
Poor supervisor support	32	41.6	45	58.4	2	0.517
Longer working hours in geothermal site operations	51	66.2	26	33.8	1	0.476
Lack of personal protective equipment	51	66.2	26	33.8	1	0.476
Uncontrolled flow of fluids from a wellhead	33	42.9	44	57.1	2	0.498
Excessive sound from rock blasting, rock crushers, sound from engine drillers and dumping trucks	41	53.2	36	46.8	1	0.502
Excessive dust from drilling operations	45	58.4	32	41.6	1	0.496
Poor working conditions	49	63.6	28	36.4	1	0.484

Source: Researcher (2022)

The following plates shows exposure to various hazards existing among workers working at GDC.

Plate 4. 1: Existence of Hot Steam at Site

Plate 4. 2: Worn Out Safety Boot

Plate 4. 3: Exposure to Hot Drilling Fluid and Sharp Edges from Drilling Machines

Plate 4. 4: Existence of Well Head Fluids

Plate 4. 5: Exposed Compressor Propeller

Plate 4. 6: Discharging well with Hydrogen Sulfide

Plate 4. 7: Crane Operator Seat Placed with Cartons which is Uncomfortable

Plate 4. 8: Exposed Sharp Gears from a Power Tong Drillind Machine

Plate 4. 9: Excessive Noise from Generators and are also Hot Surfaces

Plate 4. 10: Exposed Machine Propeller for Mud Mixing Motor

In which ways they think workplace hazards have affected employees at GDC's Baringo-Silali geothermal drilling sites, the respondents indicated that workplace hazards have affected the output from employees, have caused long term health problems, led to permanent disabilities, led to sickness due to poisonous gases and led to backache due to manual handling. Other effects of workplace hazards on employees identified included spinal cord related problems, untimely operations due to community conflicts, injuries as a result of sharp objects and hot substances.

4.5 Safety and Health Measures

The study sought to identify the existing safety and health measures at GDC's Baringo-Silali geothermal drilling sites. The respondents were requested to specify if there are health and safety policies in place at Baringo-Silali geothermal drilling sites. The findings are shown in Table 4.7.

Table 4. 7: Existence of Health and Safety Policies at GDC

	Frequency	Percent
Yes	57	74.0
No	20	26.0
Total	**77**	**100.0**

Source: Researcher (2022)

From the findings in Table 4.7, about 74% of the respondents specified that there are health and safety policies in place at Baringo-Silali geothermal drilling sites. The 26% of the sample workers that were not aware of existence of safety and health measures in their workplace could be attributed to either their being new at the workplace or not having been sensitized about the measures. Other factors may beyond the scope of this study might also be possible.

4.5.1 Existence of Health and Safety Committee

Further, the respondents were requested to specify whether there is a health and safety committee at Baringo-Silali geothermal drilling sites. The findings illustrated in Table 4.8, most of the respondents specified that there is a health and safety committee at Baringo-Silali geothermal drilling sites as shown by 62.3% while 37.7% of the respondents indicated that there is no health and safety committee at Baringo-Silali geothermal drilling sites.

Table 4. 8: Existence of Health and Safety Committee

	Frequency	**Percent**
Yes	48	62.3
No	29	37.7
Total	**77**	**100**

Source: Researcher (2022)

4.5.2 Training on Safety and Health

Further the respondents were requested to specify if they have ever had any training on Safety and Health at Baringo-Silali geothermal drilling sites. The findings are shown in Table 4.9.

Table 4. 9: Whether Safety and Health Training was Conducted

	Frequency	**Percent**
Yes	17	22.1
No	60	77.9
Total	**77**	**100.0**

Source: Researcher (2022)

The findings in Table 4.9, majority of the respondents specified that they have never had any training on Safety and Health at Baringo-Silali geothermal drilling sites as shown by 77.9%.

However, 22.1% of the respondents specified that they have ever had any training on safety and health at Baringo-Silali geothermal drilling sites. These specified that they have been trained on safety equipment and use/deployment, on risk analysis, firefighting. In general, this implies that training on Safety and Health at Baringo-Silali geothermal drilling sites are rarely conducted.

4.5.3 Provision of Personal Protective Equipments

The respondents were as well requested to specify if workers at Baringo-Silali geothermal drilling sites are provided with personal protective equipments while at work. The findings in Table 4.10 showed that majority of participants specified that workers at Baringo-Silali geothermal drilling sites are provided with personal protective equipments while at work as shown by 97.4% while 2.6% were of contrary opinion.

Table 4. 10: Whether there is Provision of Personal Protective Equipments

	Frequency	**Percent**
Yes	75	97.4
No	2	2.6
Total	**77**	**100**

Source: Researcher (2022)

4.5.4 Proper Use of Personal and Protective Equipments

The researcher also requested the respondents to indicate whether personal and protective equipments are put in proper use by the staff. From the findings in Figure 4.2, most of the respondents indicated that personal and protective equipments are put in proper use by the staff as shown by 83.1% while 16.9% specified that personal and protective equipments are not put in proper use by the staff. This is an indication that personal and protective equipments are put in proper use by the staff at Baringo-Silali geothermal drilling sites.

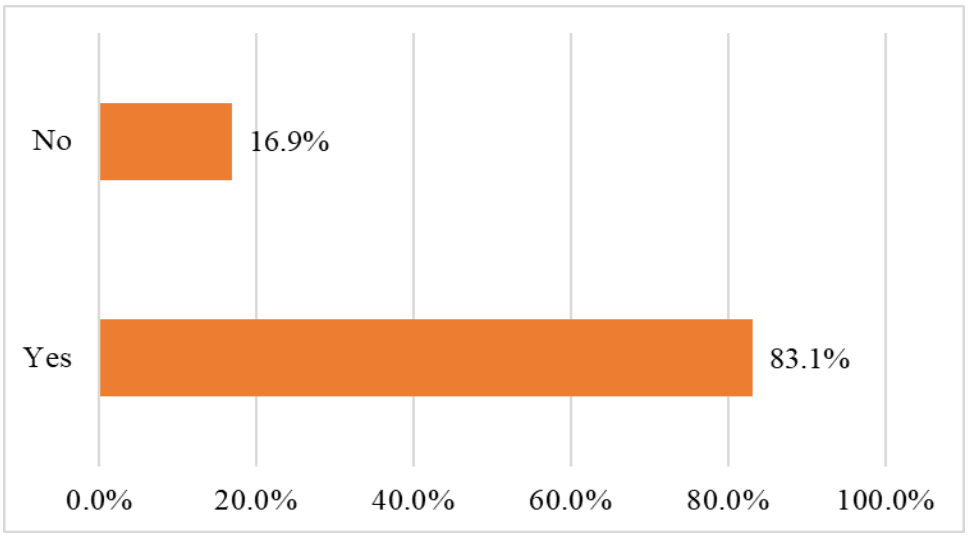


Figure 4. 2: Proper Use of Personal and Protective Equipments

Source: Researcher (2022)

4.5.5 Conducting Health and Safety Audits

The respondents were requested to specify whether the Baringo-Silali geothermal drilling sites conduct health and safety audits. From the findings in Table 4.11, the respondents specified that Baringo-Silali geothermal drilling sites does not conduct health and safety audits as shown by 63.6% while 36.4% indicated that Baringo-Silali geothermal drilling sites conduct health and safety audits. This is an indication that health and safety audits are rarely conducted at Baringo-Silali geothermal drilling sites.

Table 4. 11: Whether Health and Safety Audits are Conducted

	Frequency	Percent
Yes	28	36.4
No	49	63.6
Total	**77**	**100**

Source: Researcher (2022)

The respondents also indicated that health and safety audits is conducted by checking the standards of safety and warning are put in well located areas, by keeping records on insurance of safety occurrences, conducting regular checks and by availing / checking on the status of the fire extinguishers.

4.5.6 Existence of Health and Safety Surveillance

The respondents were asked to indicate whether there is health and safety surveillance at Baringo-Silali geothermal drilling sites. From the findings in Table 4.12, majority of the respondents indicated that there is no health and safety surveillance at Baringo-Silali geothermal drilling sites as shown by 54.5% while 45.5% of the respondents indicated that there is health and safety surveillance at Baringo-Silali geothermal drilling sites. This implies that there is no health and safety surveillance at Baringo-Silali geothermal drilling sites.

Table 4. 12: Whether Health and Safety Surveillance Exists

	Frequency	Percent
Yes	35	45.5
No	42	54.5
Total	**77**	**100**

Source: Researcher (2022)

The respondents indicated that surveillance is conducted by observing how staff are working and report on safety measures to be improved in pre- safety meetings, in safety meetings before doing any job at the site, by maintaining records on the occurrence and incidents, by conducting site visit and establishing safety committee, by doing checks on equipment, by walking through the rigs and by having safety officers are constantly on site during work hours to ensure that staff adhere to the safety codes.

4.5.7 Whether Sites are Equipped with First Aid Kits

The researcher requested the respondents to specify if Baringo-Silali geothermal drilling sites have fully equipped first aid kits appropriately located at strategic places. The findings are shown in Table 4.13.

Table 4. 13: Whether Sites are Equipped with First Aid Kits

	Frequency	Percent
Yes	26	33.8
No	51	66.2
Total	**77**	**100.0**

Source: Researcher (2022)

The findings are illustrated in Table 4.13, majority of participants specified that Baringo-Silali geothermal drilling sites have no fully equipped first aid kits appropriately located at strategic places as shown by 66.2% while 33.8% of the respondents indicated that Baringo-Silali geothermal drilling sites have fully equipped first aid kits appropriately located at strategic places. This implies that Baringo-Silali geothermal drilling sites have no fully equipped first aid kits appropriately located at strategic places.

4.5.8 Health and Safety Policies

The respondents were also asked to indicate how health and safety policies are communicated to the staff. The respondents indicated they are communicated through safety meetings, through training, is communicated by safety personnel on the ground but not enough and by having safety officers who normally oversees implementation of the safety policies. The respondents as well specified that health and safety policies are communicated during pre-safety meetings on dangers of operation which we are going to partake, through wall mounted prints, through staff mails, through sign posts and regular site meetings are conducted and briefed on the health and safety policies.

The respondents were also requested to specify how effective health and safety policies in reducing work place injuries at Baringo-Silali geothermal drilling sites. The respondents indicated that health and safety policies are very effective in reducing workplace injuries since employees are kept aware of hazards and therefore, they keep safe and because employees are being reminded of dangerous operation to take and to take extra caution. The respondents also indicated health and safety policies ensures staffs at the sites follows proper precaution and wear proper PPEs to reduce on any work place injuries if any and also reduce extend of accidents that would otherwise be avoided.

4.6 Level of Compliance with Safety and Health Measures

The study sought to establish the level of compliance with safety and health measures at GDC's Baringo-Silali geothermal drilling sites. The respondents were requested to specify if Baringo-Silali geothermal drilling sites have complied with all safety and health measures. The findings are shown in Figure 4.3.

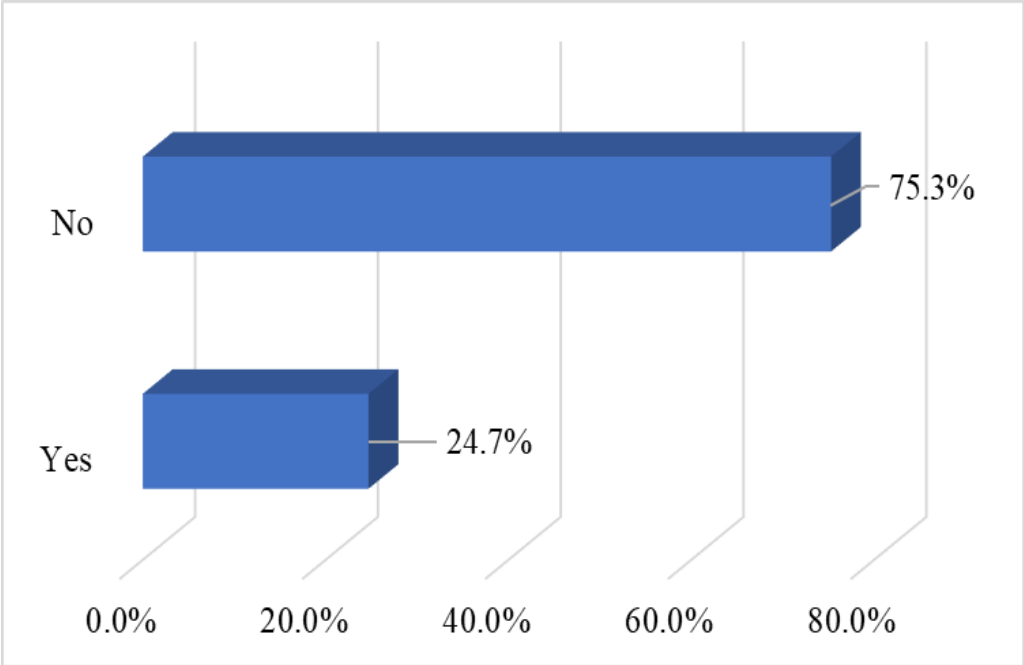


Figure 4. 3: Compliance with all safety and health measures

Source: Researcher (2022)

From the findings in Figure 4.3, most of the respondents specified that they think Baringo-Silali geothermal drilling sites have not complied with all safety and health measures as shown by 75.3% while 24.7% of the respondents indicated that they think Baringo-Silali geothermal drilling sites have complied with all safety and health measures. This implies that Baringo-Silali geothermal drilling sites have not complied with all safety and health measures.

The respondents were further requested to specify their rating of compliance with various safety and health measures at Baringo-Silali geothermal drilling sites. From the findings in Table 4.14, the respondents specified that Baringo-Silali geothermal drilling sites were compliant with provision of personal protective equipment as shown by 67.5%, with health and safety policies formulated as shown by 57.1% and with established safety committee as shown by 57.1%. Further, the respondents indicated that at Baringo-Silali geothermal drilling sites, there was non-compliance with worker's health surveillance as shown by 72.7%, with safety and health awareness Training as shown by 64.9% and with health and safety audits conducted as shown by 63.6%.

Table 4. 14: Rating of Compliance with Various Safety and Health Measures

	Compliant		Non-compliant	
	f	**%**	**f**	**%**
Safety and health awareness Training	27	35.1	50	64.9
Worker's Health Surveillance	21	27.3	56	72.7
Health and safety policies formulated	44	57.1	33	42.9
Health and safety audits conducted	28	36.4	49	63.6
Established safety committee	44	57.1	33	42.9
Provision of personal protective equipment	52	67.5	25	32.5

Source: Researcher (2022)

On whether the company is fully compliant to the safety and health Regulations, most of the respondents indicated that Baringo-Silali geothermal drilling sites are not compliant. This was attributed to the fact that there were no fully functional measures implemented, that the company is still way far in terms of implementation of policies, that there is more than acceptable exposure to so many safety hazards and no effort are made and that a lot need to be safety committee should be supported to start it's work in Baringo. However, some respondents were of the opinion that to some extend it is not but they try to fix by purchasing PPE though over size and low quality. The respondents also indicated that company should improve on welfare of the staff by conducting site visit every time.

The respondents were as well asked to specify which recommendations can you make so as to enhance the compliance of safety and health measures. The respondents recommended a need to establish a safety committee, conduct safety and health audits and formulate safety and health policies. The respondents also recommended more health and safety training should be conducted, procurement of more cleaning equipment to avoid more dirt, enhance the supply and issuance and timely replacement of PPEs to the staff, enforcement of the laid down policies. The respondents further recommended that at the rig site hydrogen detectors need to be provided, regular check on the safety equipments, to conduct day to day surveillance and personnel should be subjected to regular health check-up.

4.7 Test of Hypothesis

4.7.1 Test of Hypothesis One

The hypothesis one was tested using pearson correlation analysis. The findings are shown in Table 4.15.

Table 4. 15: Correlations Results for Hypothesis One

		Workplace Hazards	Level of Compliance
Workplace Hazards	Pearson Correlation	1	.641
	Sig. (2-tailed)		.000
	N	77	77
Level of Compliance	Pearson Correlation	.641	1
	Sig. (2-tailed)	.000	
	N	77	77

The findings showed that the p-value was 0.000 which was less than 0.05. This implies that null hypothesis one was rejected and the study accepted the alternate hypothesis one. The study hence concludes that there is a significant relationship between existing safety and health hazards and level of compliance with safety and health measures at GDC's Baringo-Silali geothermal drilling sites (r=0.641).

4.7.2 Test of Hypothesis Two

The hypothesis two was tested using pearson correlation analysis. The findings are shown in Table 4.16.

Table 4. 16: Correlations Results for Hypothesis Two

		Safety and Health Measures	Level of Compliance
Safety and Health Measures	Pearson Correlation	1	.588
	Sig. (2-tailed)		.000
	N	77	77
Level of Compliance	Pearson Correlation	.588	1
	Sig. (2-tailed)	.000	
	N	77	77

The findings showed that the p-value was 0.000 which was less than 0.05. This implies that null hypothesis two was rejected and the study accepted the alternate hypothesis two. The study hence concludes that there is a significant relationship between existing safety and health

measures and level of compliance with safety and health measures at GDC's Baringo-Silali geothermal drilling sites (r=0.588).

4.8 Discussion of Findings

4.8.1 Discussion for Objective One

The study sought to identify the existing workplace hazards at GDC's Baringo-Silali geothermal drilling sites. The study found that most workers were cognizant safety andhealth hazards at the drilling sites where they worked. Bernaldez and Soriano (2017) argue that workers have a potential risk of exposure to naturally occurring compounds such as hydrogen sulfide as well as other chemicals such as ammonia and glycols. In the event that work necessitates cutting or drilling through concrete, there is a chance that silica dust particles will be released into the air. The findings concur with Seker and Zavadskas (2017) who argues that geothermal drilling employees recognized their exposure to various workplace hazards inclusing physical, physiological, chemical, intuitive, mechanical, safety and psychosocial hazards.

The study established that that existing workplace hazards at GDC's Baringo-Silali geothermal drilling sites include Noise pollution, inexistence of poisonous gas detectors, snake bites, falling objects, fire, kicks and blow outs and hot fluids, poisonous gases like sulphate gas and carbon dioxide from discharging wells, worn out electrical cables, use of tools that are not in good shape, unclean drinking water, poor installation of electrical cables, work related accident, improper hygiene at the rig site especially the general mess where food is served in pathetic and rough grounds and slippery surfaces. The findings concur with Irungu (2017) who established that workers are exposed to hazards such as ambient hydrogen Sulphide within 2.0-7.0 ppm levels which causes nausea, eye tearing, headaches, loss of sleep and airway problems. Hassan, *at al*. (2017) notes that geothermal site operations which involve rock breaking generates lot of dust and stones which causes various of respiratory ailments among the workers in the site.

4.8.2 Discussion for Objective Two

The study sought to identify the existing safety and health measures at GDC's Baringo-Silali geothermal drilling sites. The study established that there are health and safety policies in place at Baringo-Silali geothermal drilling sites. The findings concur with da Silva and Amaral (2019) who argues that it necessary to have written policies on health and safety in order to demonstrate

that top management is concerned about the protection of employees working for organizations from hazards at workplace and to suggest how protection will be provided. Ojiem (2012) established that occupational safety management practices existing at electronic media houses in Kisumu County include inspection, maintenance and repair of machines, employee protection from hazards, having efficient physical plants layout, safety education practices, proactive identification of hazards and employee empowerment.

The study found that at Baringo-Silali geothermal drilling sites, there is health and safety committee. Haas and Yorio (2016) argues that the main goal of safety committee is promoting collaboration amongst the companies and its staff in examining, establishing and conducting measures to make sure that the employees' health and safety at workplace. Reese (2018) argues that health and safety committee need to assist in carrying out the assessment of risks and auditing of safety and make recommendations on enhancing performance of health and safety programs.

The study revealed that training on Safety and Health at Baringo-Silali geothermal drilling sites are rarely conducted. Konijn, *et al*., (2018) notes that training in health and safety is an crucial part of keeping a workplace free from hazards, and it has long been an integral part of managing the occupational health and safety. The study established that personal protective equipments are provided for worker at Baringo-Silali geothermal drilling sites while at work. Wong, Man and Chan (2020) argues that personal protective equipment (PPE) directly protects a worker against hazards in the environment of work. Personal protective equipment reduce employees' exposure to hazards in the workplace that can cause serious illnesses and injuries

The study found that personal and protective equipments are put in proper use by the staff at Baringo-Silali geothermal drilling sites. The findings agree with Ogetii (2019) who established that the health and safety practices adopted at construction sites include provision of PPEs, first aid facilities, safety informational notices, site fencing, fire safety and safety trainings, provision of public safety through site fencing, provision of personal protective equipment, first aid facilities and fire safety measures. The study established that health and safety audits are rarely conducted at Baringo-Silali geothermal drilling sites. The findings concur with Tan, Hon, Young and Sekercioglu (2022) who asserts managers could be held accountable for carrying out audits

in their departments, and even better, specific individuals of these departments could be trained to carry out audits in specific areas.

The study found that there is no health and safety surveillance at Baringo-Silali geothermal drilling sites. The findings agree with Choi, Hwang and Lee (2017) who noted that there is a high probability that not all of the dangers in the workplace can be eliminated. The primary function of worker health surveillance is to determine whether or not an employee is fit for the duties of a particular job. The study established that that noise mapping is rarely conducted at Baringo-Silali geothermal drilling sites. This concur with Berndt (2018) who argues that noise map displays all of the sources of noise as well as how it is distributed, which makes it simpler to create key areas for mitigation strategies.

4.8.3 Discussion for Objective Three

The study sought to establish the level of compliance with safety and health measures at GDC's Baringo-Silali geothermal drilling sites. The study established that Baringo-Silali geothermal drilling sites have not complied with all safety and health measures. The study found that Baringo-Silali geothermal drilling sites were compliant with provision of personal protective equipment, with health and safety policies formulated and with established safety committee. Kamau (2014) found that compliance with OHS has continued to decrease as a result of low inspections levels by government officials, Public Health and National Environment Management Authority (NEMA) whose obligation is to make sure that there is compliance with OHS measures by indus'tries in Thi'ka. Nikulin and Nikulina (2017) argues that compliance with occupational health and safety metrics could lead to a reduction in accidents, which in turn can lead to an increase in industrial productivity. Implementation of health and safety measures does not significantly improve workers' health and safety in the workplace.

The study found that at Baringo-Silali geothermal drilling sites, there was non-compliance with worker's health surveillance, with safety and health awareness training and with health and safety audits conducted. Howe (2015) argues that large companies were in a stronger position to guarantee compliance with regulations than their equivalents in smaller entities, which often lacked adequate safety personnel and lacked the resources, both in terms of time and money, to read and comprehend the vast amounts of regulatory material on safety issues. The study found that company should improve on welfare of the staff by conducting site visit every time. Gatithi

(2012) established that the degree of compliance with occupational safety and health regulations at workplaces stands at 71.7%. Mwangi (2017) found that there existed weak systems of safety management in place for enforcing safe work procedures and the utilisation of work permits and thus reduced complia'nce with OS'HA 2007. The findings agree with The study was founded on domino theory of accident causation which states that states that one unwanted condition in the place of work results to others, and ultimately to accidents. The theory was relevant in assessing the compliance with safety and health measures at GDC's Baringo-Silali geothermal drilling sites.

CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter highlighted the summary of the study findings, conclusions and recommendations for the subject of investigations based on the study objectives and questions.

5.2 Summary of the Study Findings

5.2.1 Objective One on the Existing Workplace Hazards

The study sought to identify the existing workplace hazards at GDC's Baringo-Silali geothermal drilling sites. The study found that employees are aware of any existing workplace hazards at GDC's Baringo-Silali geothermal drilling sites. Some of the existing workplace hazards at GDC's Baringo-Silali geothermal drilling sites include noise pollution, inexistence of poisonous gas detectors, snake bites, falling objects, fire, kicks and blow outs and hot fluids. Other hazards include poisonous gases such as hydrogen sulfide, work-related stress, exposure to geothermal drilling machines with sharp edges, exposure to hot steam and to longer working hours in geothermal site operations. The study also found that employees at GDC's Baringo-Silali geothermal drilling sites are exposed to lack of personal protective equipment and to excessive sound from rock blasting, rock crushers, sound from engine drillers and dumping trucks. The study also revealed that workplace hazards have affected employees at GDC's Baringo-Silali geothermal drilling sites by causing long term health problems, led to permanent disabilities, led to sickness due to poisonous gases and led to backache due to manual handling.

5.2.2 Objective Two on Existing Safety and Health Measures

The study sought to identify the existing safety and health measures at GDC's Baringo-Silali geothermal drilling sites. The study established that there are health and safety policies in place at Baringo-Silali geothermal drilling sites, that there is a health and safety committee at Baringo-Silali geothermal drilling sites and that employees have never had any training on Safety and Health at Baringo-Silali geothermal drilling sites. It was revealed that workers at Baringo-Silali geothermal drilling sites are provided with personal protective equipments while at work and that personal and protective equipments are put in proper use by the staff. The study further established that Baringo-Silali geothermal drilling sites does not conduct health and safety audits

and that there is no health and safety surveillance at Baringo-Silali geothermal drilling sites. It was also found that Baringo-Silali geothermal drilling sites have no fully equipped first aid kits appropriately located at strategic places and that there is no noise mapping conducted at Baringo-Silali geothermal drilling sites.

5.2.3 Level of Compliance with Safety and Health Measures

The study sought to establish the level of compliance with safety and health measures at GDC's Baringo-Silali geothermal drilling sites. The study established that Baringo-Silali geothermal drilling sites have not complied with all safety and health measures. However, Baringo-Silali geothermal drilling sites have complied with some of measure including provision of personal protective equipment, health and safety policies formulated and established safety committee. Further, the study found that at Baringo-Silali geothermal drilling sites, there was non-compliance with worker's health surveillance, with safety and health awareness training and with health and safety audits conducted.

5.3 Conclusions

The study concluded that there are existing workplace hazards at GDC's Baringo-Silali geothermal drilling sites that the employees are aware of. These include noise pollution, inexistence of poisonous gas detectors, snake bites, falling objects, fire, kicks and blow outs and hot fluids. Others identified include exposure to poisonous gases such as hydrogen sulfide, work-related stress and geothermal drilling machines with sharp edges. Also identified are hot steam, poor working conditions, excessive dust from drilling operations, excessive sound from blasting of rocks, crushers of rock, sound from engine drillers and trucks for dumping.

The workplace hazards have led to existence of various safety and health measures at GDC's Baringo-Silali geothermal drilling sites. These include health and safety policies, health and safety committee, provision of personal protective equipments which are put in proper use by the staff. However, the study established that there are other safety and health measures that are not conducted. The study also found that Baringo-Silali geothermal drilling sites have no fully equipped first aid kits appropriately located at strategic places and noise mapping is not conducted.

Despite the existence of the safety and health measures, full compliance with the measures was yet to be achieved. Baringo-Silali geothermal drilling sites have complied with some of measure like provision of personal protective equipment and health and safety policies formulated. However, there has been non-compliance with worker's health surveillance, with safety and health awareness training and with health and safety audits conducted at Baringo-Silali geothermal drilling sites.

5.4 Recommendations

The study recommends that management at geothermal drilling sites should ensure that there are minimal workplace hazards that may affect the health and safety of the employees. This can be done by ensuring that employees are equipped with masks to reduce exposure to poisonous gases and also ensure there is controlled flow of fluids from a wellhead. The employees should also be given provided with getting noise cancelling headphones to them from excessive sound from rock blasting, rock crushers, sound from engine drillers and dumping trucks.

It was recommended that management at geothermal drilling sites should come up with programs for raising awareness on the existing workplace hazards. This will ensure that every employee is aware of the eminent workplace hazards and hence ensure they are prepared to protect themselves against their harmful effects.

There is need for management staff at Baringo-Silali geothermal drilling sites to conduct regular health and safety audits. This will help to unearth the areas that need to be improve in terms of maintaining safe working environments and ensure all areas that pose injury risk to employees are addressed.

Management of Baringo-Silali geothermal drilling sites should develop integrated training programs for all employees on health and safety. This can be done by ensuring there are active education programs on health and safety in the company. This will equip the employees with adequate knowledge and raise awareness on how to avoid injuries within the work environment.

It was recommended that management at Baringo-Silali geothermal drilling sites should consider offering holistic corporate wellness programmes in order to maximize the benefits. This could be accomplished by using incorporated wellness programs which address workers' physical,

emotional, intellectual, monetary, cultural and emotional aspects. This helps improve the benefits of the programs for individual workers and the organization in general.

There is need for management of Baringo-Silali geothermal drilling sites to share risk and hazard information with other employers, including all those visiting or living all around factory, other site occupants and anybody visiting the factory. In order to ensure a safe and healthy environment, proper dissemination of risk information is critical. Workers must be adequately informed of the risks and inherent dangers in their jobs.

It was recommended that management of Baringo-Silali geothermal drilling sites must provide safety equipment to new employees and replace worn-out equipment, and also invest in heat-resistant individual protective gear for use in hot environments. Additionally, the management of the Baringo-Silali geothermal drilling sites should establish a regular monitoring team to ensure that employees are wearing the protective equipment provided prior to performing their duties and strictly adhering to the safety measures in place for accident prevention.

Finally, the study recommended that management of Baringo-Silali geothermal drilling sites need to ensure that health and safety surveillance is regularly conducted. This will ensure that employees are helped in detecting the circumstances that makes the employees susceptible to the consequences of workplace hazards and identify the signs of harmful agent early enough before it affects them.

5.5 Further Areas of Studies

This study only focused on Baringo-Silali geothermal drilling sites. Hence, future studies should focus on other geothermal drilling sites in Kenya and conduct compliance assessment for safety and health measures. Future studies should also look at the effect of safety and health measures compliance on employee performance at Baringo-Silali geothermal drilling sites.

REFERENCES

Abbasi, S. (2018). Defining safety hazards & risks in mining industry: a case-study in United States. *Asian Journal of Applied Science and Technology (AJAST)*, 2 (2), 1071 - 1078.

Acharya, P., Boggess, B., & Zhang, K. (2018). Assessing heat stress and health among construction workers in a changing climate: a review. *International journal of environmental research and public health*, 15 (2), 1 - 16.

Kamau, E. N. (2014). *Enforcement and compliance on occupational health and safety measures in industries in Thika municipality, Kiambu County*. (Unpublished Bachelors Degree Research Project, Kenyatta University).

Arnold, J. (2016). The death of sympathy. Coal mining, workplace hazards, and the politics of risk in Britain, ca. 1970-1990. *Historical Social Research/Historische Sozialforschung*, 91 - 110.

Benos, L., Tsaopoulos, D., & Bochtis, D. (2020). A review on ergonomics in agriculture. part II: Mechanized operations. *Applied Sciences*, 10 (10), 34 - 84.

Bernaldez, I., & Soriano, V. (2017). Risk Assessment for Small Scale Gold Surface Mining at Licuan Baay, Abra in the Philippines. In *International Conference on Applied Human Factors and Ergonomics* (pp. 851 - 856). Springer, Cham.

Berndt, A. (2018). *Safe sounding Workplaces. Occupational safety and Health Magazine*. Sage Publications

Ayoo, B. A. (2018). *Assessment Of Occupational Safety Compliance in Small-Scale Gold Mines in Siaya County, Kenya* (Unpubished MA Project, University of Nairobi).

Brauer, R. L. (2016). *Safety and health for engineers*. John Wiley & Sons.

Choi, B., Hwang, S., & Lee, S. (2017). What drives construction workers' acceptance of wearable technologies in the workplace? Indoor localization and wearable health devices for occupational safety and health. *Automation in Construction*, 84, 31 - 41.

da Silva, S. L. C., & Amaral, F. G. (2019). Critical factors of success and barriers to the implementation of occupational health and safety management systems: A systematic review of literature. *Safety science*, 117, 123 - 132.

DeCamp, W., & Herskovitz, K. (2015). The theories of accident causation. In *Security supervision and management* (pp. 71-78). Butterworth-Heinemann.

Farnacio, Y., Pratt, M. E., Marshall, E. G., & Graber, J. M. (2017). Are workplace psychosocial factors associated with work-related injury in the US workforce? *Journal of occupational and environmental medicine*, 59 (10), 164 - 171.

Gatithi, A. W. (2012). *The extent of compliance with occupational safety and health regulations at manufacturing companies in Mombasa County* (Unpubished MA Project, University of Nairobi, Kenya).

Graditi, G., & Di Somma, M. (2022). *Technologies for Integrated Energy Systems and Networks*. John Wiley & Sons.

Groseclose, S. L., & Buckeridge, D. L. (2017). Public health surveillance systems: recent advances in their use and evaluation. *Annual review of public health*, 38, 57 - 79.

Haas, E. J., & Yorio, P. (2016). Exploring the state of health and safety management system performance measurement in mining organizations. *Safety science*, 83, 48 - 58.

Hale, A. (2019). From national to European frameworks for understanding the role of occupational health and safety (OHS) specialists. *Safety science*, 115, 435 - 445.

Hassan, R. B., Asad, M. M., Soomro, Q. M., & Sherwani, F. (2017). Severity of the casing and cementing operation with associated potential hazards in the drilling process in the on and offshore oil and gas industry: a cross-sectional investigation into safety management. *Pertanika Journal of Social Science and Humanities*, 25, 129 - 138.

Holdren, J. P., Anderson, K. B., Deibler, P. M., Gleick, P. H., Mintzer, I. M., & Morris, G. P. (2021). Health and safety impacts of renewable, geothermal, and fusion energy. *In Health Risks of Energy Technologies* (pp. 141-208). Routledge.

Hoque, Z. N. (2018). *Effectiveness of workplace health and safety programs in university settings* (Master's Thesis, Memorial University of Newfoundland).

Howe, J. (2015). Possibilities and pitfalls involved in expanding Australia's national workers' compensation scheme. *Melb. UL Rev.*, 39, 472

Irungu, G. P. (2017). *Impacts of Ambient Hydrogen Sulphide Exposure to Workers in Olkaria Geothermal Power Station, Kenya* (Doctoral dissertation, JKUAT).

Işık, I. N., & Atasoylu, E. (2017). Occupational safety and health in North Cyprus: evaluation of risk assessment. *Safety science*, 94, 17 - 25.

Jilcha, K., & Kitaw, D. (2016). A Literature Review on Global Occupational Safety and Health Practice & Accidents Severity. *International Journal for Quality Research*, 10(2) 279–310

Kachila, P. J. M. (2020). *Assessment of the Effects of Geothermal Well Drilling Occupation on the Safety and Health Status of Workers in Kenya: A Case Study of Menengai Geothermal Project* (Doctoral dissertation, JKUAT-IEET).

Khakzad, N., Khan, F., Amyotte, P., & Cozzani, V. (2013). Domino effect analysis using Bayesian networks. *Risk Analysis: An International Journal*, 33 (2), 292 - 306.

Kibe, K. N. (2016). Assessment of health and safety management on construction sites in Kenya: a case of construction projects in Nairobi County (Unpublished Masters Projects, JKUAT).

Kim, Y., Park, J., & Park, M. (2016). Creating a culture of prevention in occupational safety and health practice. *Safety and health at work*, 7 (2), 89 - 96.

Konijn, A. M., Lay, A. M., Boot, C. R., & Smith, P. M. (2018). The effect of active and passive occupational health and safety (OHS) training on OHS awareness and empowerment to participate in injury prevention among workers in Ontario and British Columbia (Canada). *Safety science*, 108, 286 - 291.

Kyalo, M. J. (2020). *Occupational Hazards Awareness and Safety Practices Among Petrol Service Station Workers in Nakuru County, Kenya* (Unpublished Masters Thesis, Egerton University).

Los, F. S., de Boer, A. G., van der Molen, H. F., & Hulshof, C. T. (2019). The implementation of workers' health surveillance by occupational physicians: a survey study. *Journal of Occupational and Environmental Medicine*, 61 (12), 497 - 502.

Mensah, S. K., Siabi, E. K., Donkor, P., & Kurantin, N. (2022). Assessing the safety and health practices in the artisanal and small-scale gold mining sector of Ghana: A case of Ntotroso. *Environmental Challenges*, 6, 100-443.

Metzler, Y. A., & Bellingrath, S. (2017). Psychosocial hazard analysis in a heterogeneous workforce: determinants of work stress in blue-and white-collar workers of the European steel industry. *Frontiers in Public Health, 5*, 210.

Mohr, P.A, and Williams, A.J 1972. Geology of the eastern rift system of Africa. *Geological Society of America, Special* Paper,136,1 - 67

Mola, E. (2022). *GDC reiterates its commitment to workplace safety as it marks World Day for Safety and Health at Work*. The Geo Blog. https://www.gdc.co.ke/blog/gdc-reiterates-its-commitment-to-workplace-safety-as-it-marks-world-day-for-safety-and-health-at-work/

Mujere, N. (2016). Sampling in research. In *Mixed methods research for improved scientific study* (pp. 107-121). IGI Global.

Muthelo, L. (2022). *Strategies to enhance compliance of health and safety standards at the selected mining industries in Limpopo Province, South Africa: occupational health nurse's perspective* (Doctoral dissertation, University of Limpopo).

Mwangi, P. T. (2017). *Assessment of the level of compliance with occupational safety and health act 2007 in public TVET institutions in Nairobi County, Kenya* (Doctoral dissertation, COHES, JKUAT).

Myers, J. L., Well, A. D., & Lorch, R. F. (2013). *Research design and statistical analysis*. Routledge.

Ncube, F., & Kanda, A. (2018). Current status and the future of occupational safety and health legislation in low-and middle-income countries. *Safety and health at work*, 9(4), 365-371.

Ndegwa, P. W., Guyo, W., & Orwa, G. (2014). The Influence of Management Support in the Implementation of Occupational Safety and Health Programmes in the Manufacturing Sector in Kenya. *International Journal of Academic Research in Business and Social Sciences*, 4(9), 490 - 506.

Ngaruiya, F. W., Ogendi, G. M., & Mokua, M. A. (2019). Occupational health risks and hazards among the fisherfolk in Kampi Samaki, Lake Baringo, Kenya. *Environmental Health Insights*, 13, 1 - 11.

Ngwama, J. C. (2016). Framework for occupational health and safety in Nigeria: the implication for the trade union movement. *Journal of Economics and Sustainable Development*, 7(11), 98-109.

Nikulin, A., & Nikulina, A. Y. (2017). Assessment of occupational health and safety effectiveness at a mining company. *Ecology, Environment and Conservation*, 23 (1), 351 - 355.

Ogetii, J. B. (2019). *An Assessment of Occupational Health and Safety Practices at Construction Sites in Nairobi City Region, Kenya* (Unpublished Masters Project, University of Nairobi).

Ojiem, D. O. (2012). *Occupational health and safety management practices among the electronic media houses in Kisumu County, Kenya* (Unpublished Masters Project, University of Nairobi).

Okoye, P. U., Ezeokonkwo, J. U., & Ezeokoli, F. O. (2016). Building construction workers' health and safety knowledge and compliance on site. *Journal of Safety Engineering*, 5 (1), 17 - 26.

Oluoch, E. O. (2015). *Effect of occupational safety and health programmes on employee performance at Kenya power company limited* (Master's Thesis, University of Nairobi).

Oluoch, I., Njogu, P., & Ndeda, J. O. (2007). Effects of Occupational Safety and Health Hazards' Exposure on Work Environment in the Water Service Industry within Kisumu County-Kenya. *occupational Safety and Health*, 1 (1), 46 - 51

Otzen, T., & Manterola, C. (2017). Sampling techniques on a population study. *International Journal of Morphology*, 35 (1), 227 - 232.

Park, J., Park, J. S., Han, B., & Kim, Y. (2017). Vulnerability of employees in businesses with fewer than five workers (micro-enterprises) to occupational safety and health problems. *American Journal of Industrial Medicine*, 60 (12), 1056 - 1065.

Popping, R. (2015). Analyzing open-ended questions by means of text analysis procedures. *Bulletin of Sociological Methodology/Bulletin de Méthodologie Sociologique*, 128 (1), 23 - 39.

Puah, L. N., Ong, L. D., & Chong, W. Y. (2016). The effects of perceived organizational support, perceived supervisor support and perceived co-worker support on safety and health compliance. *International journal of occupational safety and ergonomics*, 22 (3), 333 - 339.

Rad, K. G. (2013). Application of domino theory to justify and prevent accident occurrence in construction sites. *IOSR J. Mech. Civ. Eng. IOSR-JMCE*, 6, 72 - 76.

Rahiman, M. A., & Mahat, N. A. A. (2018). The influence of domino theories in preventing construction accidents. 3rd Undergraduate Seminar on Built Environment and Technology 2018 (USBET2018) UiTM Perak Branch

Reese, C. D. (2018). *Occupational health and safety management: a practical approach*. CRC press.

Salahuddin, M., & Alam, K. (2016). Information and Communication Technology, electricity consumption and economic growth in OECD countries: A panel data analysis. *International Journal of Electrical Power & Energy Systems*, 76, 185 - 193.

Seker, S., & Zavadskas, E. K. (2017). Application of fuzzy DEMATEL method for analyzing occupational risks on construction sites. *Sustainability*, 9 (11), 1 - 19.

Sharma, B. (2018). Processing of data and analysis. *Biostatistics and Epidemiology International Journal*, 1 (1), 3 - 5.

Sovacool, B. K., Andersen, R., Sorensen, S., Sorensen, K., Tienda, V., Vainorius, A., & Bjørn-Thygesen, F. (2016). Balancing safety with sustainability: assessing the risk of accidents for modern low-carbon energy systems. *Journal of cleaner production*, 112, 3952 - 3965.

Stave, G. M., & Wald, P. H. (2016). *Physical and biological hazards of the workplace*. John Wiley & Sons.

Tan, S., Hon, C. Y., Young, I., & Sekercioglu, F. (2022). An analysis of health and safety audits of aquatic facilities in Ontario: 2002–2020. *Environmental health review*, 65 (1), 11 - 16.

Tilli, T. (2021). Mechanical hazards at the interfaces of a paper making machine and the responsibility of identifying hazards (Unpublished Degree Project, LAB University of Applied Sciences).

Varpio, L., Paradis, E., Uijtdehaage, S., & Young, M. (2020). The distinctions between theory, theoretical framework, and conceptual framework. *Academic Medicine*, 95(7), 989 - 994.

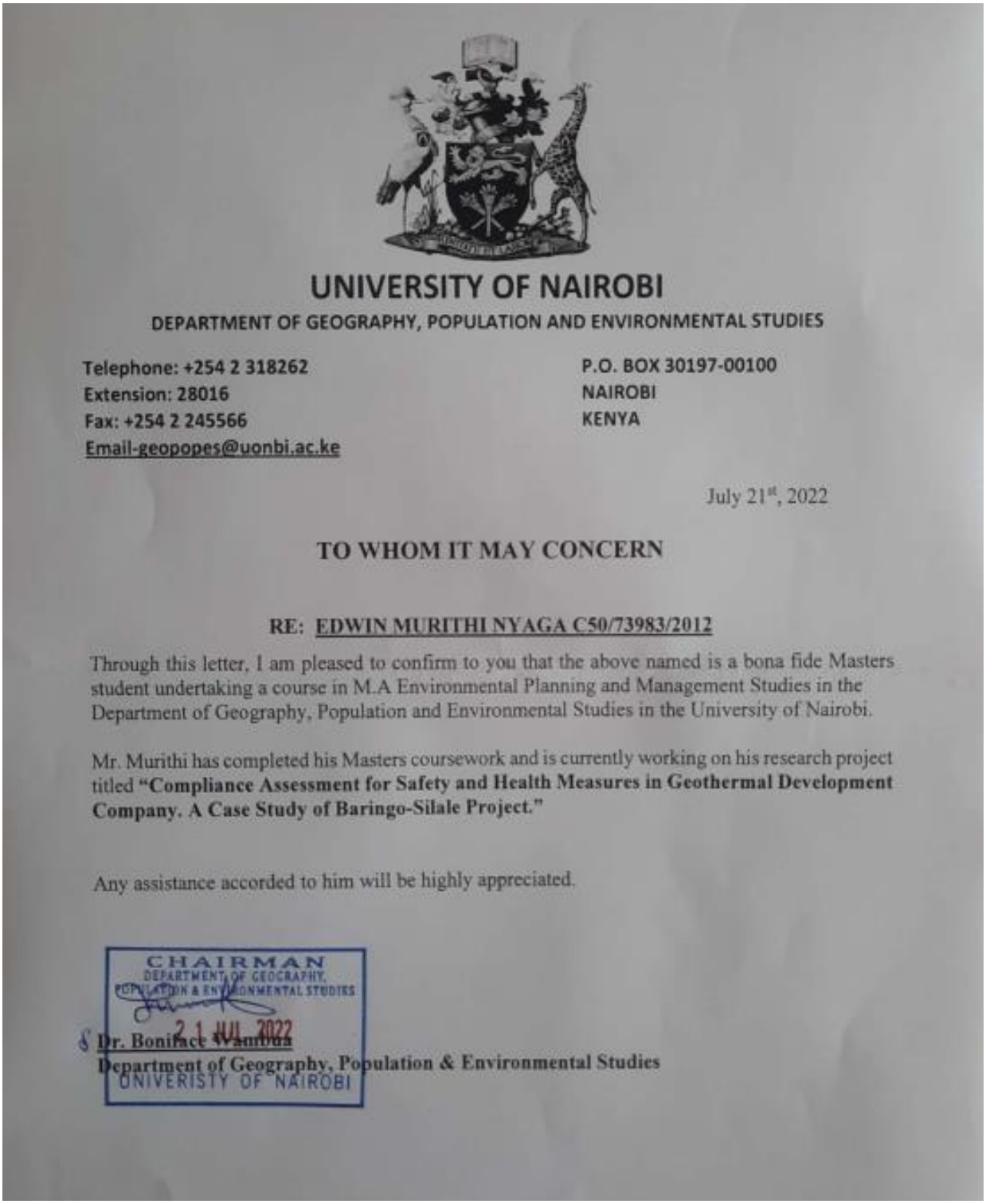
Vidadili, N., Suleymanov, E., Bulut, C., & Mahmudlu, C. (2017). Transition to renewable energy and sustainable energy development in Azerbaijan. *Renewable and Sustainable Energy Reviews*, 80, 1153 - 1161.

Wong, T. K. M., Man, S. S., & Chan, A. H. S. (2020). Critical factors for the use or non-use of personal protective equipment amongst construction workers. *Safety science*, 126, 104 - 663.

Yamamoto, M., & Morooka, C. K. (2019). Feedback control system for blow-out preventer positioning. *Applied Ocean Research*, 82, 362 - 369.

APPENDICES

Appendix I: Introduction Letter



UNIVERSITY OF NAIROBI

DEPARTMENT OF GEOGRAPHY, POPULATION AND ENVIRONMENTAL STUDIES

Telephone: +254 2 318262
Extension: 28016
Fax: +254 2 245566
Email-geopopes@uonbi.ac.ke

P.O. BOX 30197-00100
NAIROBI
KENYA

July 21st, 2022

TO WHOM IT MAY CONCERN

RE: EDWIN MURITHI NYAGA C50/73983/2012

Through this letter, I am pleased to confirm to you that the above named is a bona fide Masters student undertaking a course in M.A Environmental Planning and Management Studies in the Department of Geography, Population and Environmental Studies in the University of Nairobi.

Mr. Murithi has completed his Masters coursework and is currently working on his research project titled **"Compliance Assessment for Safety and Health Measures in Geothermal Development Company. A Case Study of Baringo-Silale Project."**

Any assistance accorded to him will be highly appreciated.

CHAIRMAN
DEPARTMENT OF GEOGRAPHY,
POPULATION & ENVIRONMENTAL STUDIES
21 JUL 2022

Dr. Boniface Wambua
Department of Geography, Population & Environmental Studies
UNIVERISTY OF NAIROBI

Appendix II: Research Questionnaire

This questionnaire is to collect data for purely academic purposes. All information will be treated with strict confidentiality. Do not put any name or identification on this questionnaire. Answer all questions as indicated by either filling in the blank or ticking the option that applies.

Section A: Background Information

1) Please indicate your gender:
   Male [ ]
   Female [ ]

2) Please indicate your highest academic qualifications
   Certificate [ ]
   Diploma [ ]
   Degree [ ]
   Postgraduate [ ]

3) For how long have you been working at Baringo-Silali geothermal drilling sites?
   Less than 2 years [ ]
   2 to 6 years [ ]
   6 to 10 years [ ]
   Above 10 years [ ]

4) What is your age bracket?
   18-29 years [ ]
   30-39 years [ ]
   40-50 years [ ]
   More than 50 years [ ]

Section B: Workplace Hazards

5) Are you aware of any existing workplace hazards at GDC's Baringo-Silali geothermal drilling sites?
   Yes [ ]
   No [ ]

If yes, please list them

_ _

_ _

_ _

_ _

6) Which of the following hazards are you exposed to while working at GDC's Baringo-Silali geothermal drilling sites?

	Yes	**No**
Geothermal drilling machines with sharp edges		
Geothermal drilling machines with and hot surfaces		
Exposed machine propellers		
Exposure to poisonous gases such as hydrogen sulfide		
Exposure to hot steam		
Work-related stress		
Poor supervisor support		
Longer working hours in geothermal site operations		
Lack of personal protective equipment		
Uncontrolled flow of fluids from a wellhead		
Excessive sound from rock blasting, rock crushers, sound from engine drillers and dumping trucks		
Excessive dust from drilling operations		
Poor working conditions		

7) In which ways do you think workplace hazards have affected employees at GDC's Baringo-Silali geothermal drilling sites?

_ _

_ _

_ _

_ _

Section C: Safety and Health Measures

8) Are there health and safety policies in place at Baringo-Silali geothermal drilling sites?

Yes [ ]

No [ ]

9) How are health and safety policies communicated to the staff?

_ _

_ _

_ _

10) How effective health and safety policies in reducing work place injuries at Baringo-Silali geothermal drilling sites?

_ _

_ _

_ _

11) Is there a health and safety committee at Baringo-Silali geothermal drilling sites?

Yes [ ]

No [ ]

12) Have you ever had any training on Safety and Health at Baringo-Silali geothermal drilling sites?

Yes [ ]

No [ ]

If yes, in which areas have you been trained on?

_ _

_ _

_ _

13) Are the workers at Baringo-Silali geothermal drilling sites provided with Personal Protective Equipments while at work?

Yes [ ]

No [ ]

14) Are personal and protective equipments put in proper use by the staff?

Yes [ ]

No [ ]

15) Does the Baringo-Silali geothermal drilling sites conduct health and safety audits?

Yes [ ]

No [ ]

If yes, please explain how is it conducted?

_ _

_ _

_ _

16) Is there health and safety surveillance at Baringo-Silali geothermal drilling sites?

Yes [ ]

No [ ]

If yes, please explain how is it conducted?

_ _

_ _

_ _

17) Does the Baringo-Silali geothermal drilling sites have fully equipped First Aid Kits appropriately located at strategic places?

Yes [ ]

No [ ]

18) Is there noise mapping conducted at Baringo-Silali geothermal drilling sites?

Yes [ ]

No [ ]

Section D: Level of Compliance with Safety and Health Measures

19) In your opinion, do you think Baringo-Silali geothermal drilling sites have complied with all safety and health measures?

Yes [ ]

No [ ]

20) Please rate the compliance with the following safety and health measures at Baringo-Silali geothermal drilling sites

	Compliant	**Non-Compliant**
Safety and health awareness Training		
Worker's Health Surveillance		
Health and safety policies formulated		
Health and safety audits conducted		
Established safety committee		
Provision of personal protective equipment		

21) According to your opinion, do you think the company is fully compliant to the safety and health Regulations?

_ _

_ _

_ _

22) What recommendations can you make so as to improve the compliance of Safety and Health measures?

_ _

_ _

_ _

Appendix III: Observation Guide

This instrument will be used to help the researcher in observing key areas of Safety and Health concerns at the Company.

1) Presence of health and safety policy.
2) Proper use of personal protective equipments.
3) Presence of safety and health precautions at strategic places e.g. Kitchen, Stair cases, Workshops and drilling sites.
4) Display of First Aid Kits.
5) Presence of fire extinguishers and a fire assembling point.
6) The condition of the floor, ventilation, fire exits, housekeeping at various workplaces.

Appendix IV: Research Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 103647

Date of Issue: 28/July/2022

RESEARCH LICENSE

This is to Certify that Mr.. Edwin Murithi Nyaga of University of Nairobi, has been licensed to conduct research in Baringo on the topic: compliance assessment for safety and health measures in Geothermal Development Company for the period ending : 28/July/2023.

License No: NACOSTI/P/22/19301

103647

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

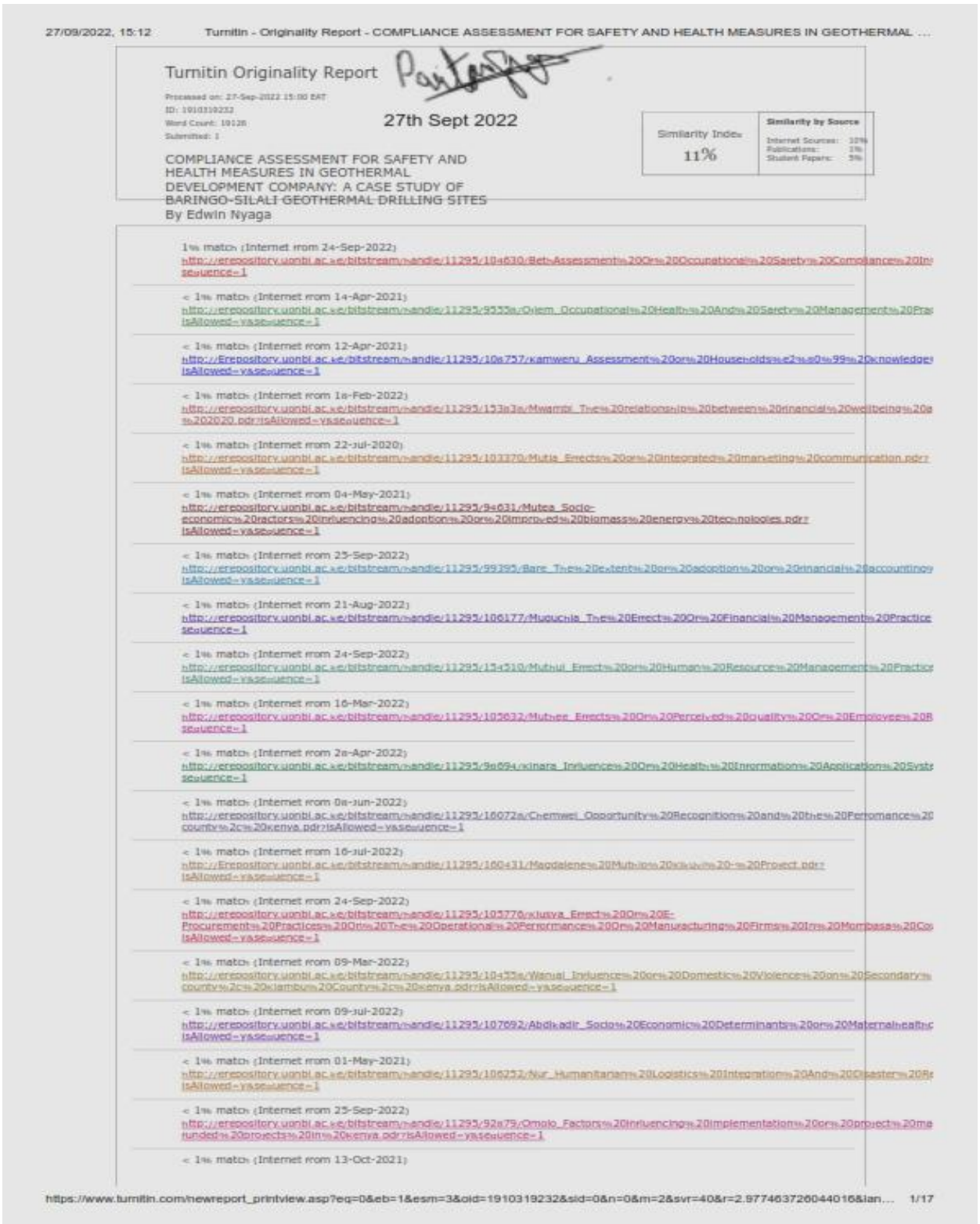
Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

Appendix V: List of Site Photos


GDC
NDOVU 1

Appendix VI: Originality Test



27/09/2022, 15:12 Turnitin - Originality Report - COMPLIANCE ASSESSMENT FOR SAFETY AND HEALTH MEASURES IN GEOTHERMAL ...

Turnitin Originality Report

Processed on: 27-Sep-2022 15:00 EAT
ID: 1910319232
Word Count: 19126
Submitted: 1

27th Sept 2022

Similarity Index 11%

Similarity by Source
Internet Sources: 10%
Publications: 1%
Student Papers: 5%

COMPLIANCE ASSESSMENT FOR SAFETY AND HEALTH MEASURES IN GEOTHERMAL DEVELOPMENT COMPANY: A CASE STUDY OF BARINGO-SILALI GEOTHERMAL DRILLING SITES
By Edwin Nyaga

1% match (Internet from 24-Sep-2022)
http://erepository.uonbi.ac.ke/bitstream/handle/11295/104630/Bet...Assessment%20On%20Occupational%20Safety%20Compliance%20In...sequence=1

< 1% match (Internet from 14-Apr-2021)
http://erepository.uonbi.ac.ke/bitstream/handle/11295/9555a/Oyiem_Occupational%20Health%20And%20Safety%20Management%20Pra...isAllowed=y&sequence=1

< 1% match (Internet from 12-Apr-2021)
http://Erepository.uonbi.ac.ke/bitstream/handle/11295/10a757/Kamweru_Assessment%20on%20Household%e2%s0%99s%20knowledge...isAllowed=y&sequence=1

< 1% match (Internet from 1a-Feb-2022)
http://erepository.uonbi.ac.ke/bitstream/handle/11295/153a3a/Mwambi_The%20relationship%20between%20financial%20wellbeing%20a...%202020.pdf?isAllowed=y&sequence=1

< 1% match (Internet from 22-Jul-2020)
http://erepository.uonbi.ac.ke/bitstream/handle/11295/103370/Mutia_Effects%20of%20integrated%20marketing%20communication.pdf?...isAllowed=y&sequence=1

< 1% match (Internet from 04-May-2021)
http://erepository.uonbi.ac.ke/bitstream/handle/11295/94631/Mutea_Socio-economic%20factors%20influencing%20adoption%20of%20improved%20biomass%20energy%20technologies.pdf?...isAllowed=y&sequence=1

< 1% match (Internet from 25-Sep-2022)
http://erepository.uonbi.ac.ke/bitstream/handle/11295/99395/Bare_The%20extent%20of%20adoption%20of%20financial%20accounting...isAllowed=y&sequence=1

< 1% match (Internet from 21-Aug-2022)
http://erepository.uonbi.ac.ke/bitstream/handle/11295/106177/Muguchia_The%20Effect%20Of%20Financial%20Management%20Practice...sequence=1

< 1% match (Internet from 24-Sep-2022)
http://erepository.uonbi.ac.ke/bitstream/handle/11295/15d510/Muthui_Effects%20of%20Human%20Resource%20Management%20Practice...isAllowed=y&sequence=1

< 1% match (Internet from 16-Mar-2022)
http://erepository.uonbi.ac.ke/bitstream/handle/11295/105632/Muthee_Effects%20On%20Perceived%20quality%20On%20Employees%20R...sequence=1

< 1% match (Internet from 2e-Apr-2022)
http://erepository.uonbi.ac.ke/bitstream/handle/11295/9e894/Kinara_Influence%20On%20Health%20Information%20Applications%20Syste...sequence=1

< 1% match (Internet from 0e-Jun-2022)
http://erepository.uonbi.ac.ke/bitstream/handle/11295/16072a/Cherwei_Opportunity%20Recognition%20and%20the%20Performance%20...county%2c%20Kenya.pdf?isAllowed=y&sequence=1

< 1% match (Internet from 16-Jul-2022)
http://Erepository.uonbi.ac.ke/bitstream/handle/11295/160431/Magdalene%20Muthoni%20Kiguru%20-%20Project.pdf?...isAllowed=y&sequence=1

< 1% match (Internet from 24-Sep-2022)
http://erepository.uonbi.ac.ke/bitstream/handle/11295/105776/Kiusya_Effect%20On%20E-Procurement%20Practices%20On%20The%20Operational%20Performance%20On%20Manufacturing%20Firms%20In%20Mombasa%20Co...isAllowed=y&sequence=1

< 1% match (Internet from 09-Mar-2022)
http://erepository.uonbi.ac.ke/bitstream/handle/11295/10d55a/Wanuai_Influences%20on%20Domestic%20Violence%20on%20Secondary%...county%2c%20Kiambu%20County%2c%20Kenya.pdf?isAllowed=y&sequence=1

< 1% match (Internet from 09-Jul-2022)
http://erepository.uonbi.ac.ke/bitstream/handle/11295/107692/Abdikadir_Socio%20Economic%20Determinants%20on%20Maternal%20Health...isAllowed=y&sequence=1

< 1% match (Internet from 01-May-2021)
http://erepository.uonbi.ac.ke/bitstream/handle/11295/106252/Nur_Humanitarian%20Logistics%20Integration%20And%20Disaster%20Re...isAllowed=y&sequence=1

< 1% match (Internet from 25-Sep-2022)
http://erepository.uonbi.ac.ke/bitstream/handle/11295/92a79/Omolo_Factors%20Influencing%20Implementation%20of%20Project%20Me...funded%20Projects%20in%20Kenya.pdf?isAllowed=y&sequence=1

< 1% match (Internet from 13-Oct-2021)

https://www.turnitin.com/newreport_printview.asp?eq=0&eb=1&esm=3&oid=1910319232&sid=0&n=0&m=2&svr=40&r=2.977463726044016&lan... 1/17