



**AN ANALYSIS OF HEALTH AND SAFETY COMMUNICATION AND ITS IMPACT ON
INCIDENT OCCURRENCE AT ESKOM: EASTERN CAPE OPERATING UNIT.**

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**An analysis of health and safety communication and its impact on incident occurrence
at Eskom: Eastern Cape Operating Unit.**

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DECLARATION

I, Nomsa Qwemeshe, hereby assert that this research report is my own work. It is submitted for the degree of Master of Health Sciences in Environmental Health at the Central University of Technology, Free State. This research project has not been submitted for any other degree or examination at this or any other university.

Signature of candidate

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ABSTRACT

This research focused on the various techniques used to communicate workplace health and safety messages. It further fixated on the impact and barriers of inefficient health and safety communication on Eskom: Eastern Cape Operating Unit's health and safety performance; as well as the common workplace health and safety injuries and incidents and the leading causes to the injuries and incidents. The current study followed a quantitative research approach, in which relevant data on health and safety incidents from 2015 to 2019 was collected from Systems, Applications and Products in data processing of Environmental Health and Safety (SAP EH&S). Furthermore, a survey was conducted through the distribution of a questionnaire to managers, supervisors, engineers, and operators. Task observations were also conducted while operators were performing their work. A total of 614 incidents were analysed where the results revealed motor vehicle accidents and hand injuries as the most prominent types of incidents occurring at Eskom: Eastern Cape Operating Unit. The results further showed that 86.5% of the incidents were motor vehicle accident occurred in the Mthatha Sector. Unsafe worker behaviour, such as non-adherence to the wearing of person protective equipment (PPE) and negligence were found as the most common causes of incidents. The results of the questionnaire distributed to 294 participants showed that participants agree that non-adherence to rules was the most common unsafe behaviour that led to the occurrence of incidents. Further, 50% of the participants agreed that the health and safety message communicated were unclear in their transmission. There is sufficient evidence indicating that communication strategies in the workplace need to be strengthened to ensure the reduction of potential hazards pertaining to health and safety performance and incident occurrence. There is a surge of workplace health and safety incidents due to unsafe worker behaviour, despite legislative interventions. Moreover, inadequate communication methods and language barriers have a negative impact on Eskom: Eastern Cape Operating Unit's health and safety performance. Therefore, there is an urgent need for improved health and safety communication methods, using innovative systems.

DEDICATION

To God who gives me strength. To my late mother, Amanda Nyumba, whose memories continue to guide me in my ways. A special feeling of gratitude goes to my loving husband, whose support knows no boundaries. To my children, Sonke and Mithwa, thank you for being my cheer leaders. Lastly, I dedicate this dissertation to all who believe in empowerment through education.

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Abbreviations

Acronyms/ Abbreviations	Definition
Dx	Distribution Division.
SHERQ	Safety, Health, Environment, Risk and Quality.
SHEQ	Safety, Health, Environment and Quality.
BIPM	Business Integration and Performance Management.
AC	Asset Creation.
M&O	Maintenance and Operations.
CNC	Customer Network Centre.
PPM	Power Plant Maintenance.
ECOUC	Eastern Cape Operation Unit.
OHS Act	Occupational Health and Safety Act, 1993 (OHS Act, 1993).
ISO	International Organization of Standardization (SANS ISO 45001:2018).
OHSMS	Occupational Health and Safety Management System ISO 45001:2018.
PTO	Planned Task Observation.

Clarification of basic terms and concepts

Terms and concepts	Definition
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Incident	Unplanned, undesired event that adversely affects the completion of a task, ranging from near misses to fatality.
Accident	Unintentional events, usually resulting in damage or injury.
Compliance obligation	Lawful requirements that an organization must fulfil with and other requirements that an organization may choose to comply with.
The company	Eskom.
The Constitution	The Constitution of the Republic of South Africa, 1996 (Act 108 of 1996).

CHAPTER 1: INTRODUCTION

1.1. Background

Communication is one of the most crucial elements in the effective management of a workplace health and safety system (ISO 45001). It can be used to improve workplace health and safety performance (Skeepers & Mbohwa, 2015; Anibire *et al.* 2018). Likewise, Oswald *et al.* (2019), suggest that health and safety is critical in project management, thereby rendering health and safety communication as an important aspect in health and safety of a project.

Generally, Occupational Health and Safety compliance obligates the company to communicate health and safety matters to its workers. Health and safety communication is done through various methods in the company such as emails, telephone, posters, health, and safety signage, as well as face to face interaction. However, health and safety communication remain a challenge difficult to achieve in the workplace (Oswald *et al.* 2019). Not only is this a challenge in the northern hemisphere, the entire African continent experiences serious challenges in terms of risk perception and communication of health and safety communication matters (Dodoo & Hugman, 2012). This is often since the communication methods used are not always understood by workers due to various reasons; including the level of literacy, attitude, language used, health and safety terminology, and mode of communication used. Abdullah *et al.* (2009), argues that people tend to engage in safe or unsafe behaviours in accordance with their different interpretations or perceptions of what can lead to incidents. Literature reveals that the “unsafe behaviours of construction workers are often the immediate causes of construction accidents” (Jiang, Fang & Zhang, 2015). This further demonstrates that human factors contribute to most of the health and safety incidents. It becomes crucial for the worker to understand the message conveyed through the health and safety messages, to promote positive worker behaviour and attitude towards health and safety at the workplace, as well as preventing the occurrence of health and safety incidents. However, Oswald *et al.* (2019), argued that language amongst multinational workers creates and remains a barrier in health and safety communication. This can lead to a perceived negative attitude towards health and safety.

Globally, there are various methods of communication used by employers to convey information pertaining to workers’ health and safety at the workplace (Silk, 2003). The different methods include policies, procedures, performance statistics, hazard reports, incident reports, posters, workplace inductions, risk assessments, training and are essential in improving the safety culture (Vecchio-Saus, 2007). According to Robert (2004), the use of safety signs is

most preferred by construction workers. Occupational health and safety signage is described as “system components used for delivering prohibition, mandatory as well as warning and guidance messages to workers to promote appropriate and responsible behaviour” (Chan & Ng, 2012). Researchers promote the use of safety signs to improve workplace safety and safety awareness (King *et al.* 2021; Ajayi *et al.* 2021). Similarly, Scott & Goncalves (2021), assert that effective safety communication at the workplace can be achieved using safety signs.

The methods of signage used in occupational health and safety are prohibitory signs, mandatory signs, information signs and warning signs (Darabont, Antonov & Bejinariu, 2017; ISO 45001:2018). Sherratt, Farrell & Noble (2013), argue that safety signs are the safety voice in the workplace. However, incorrect interpretation can result in increased workplace incidents and injuries (Abdullah *et al.* 2009; Chan & Chan, 2011).

There are other useful channels of communication used by employers to improve safety communication and performance, including safety awareness. Schulte *et al.* (2018), state that the promotion of safety awareness is one of the communication vehicles that can be used to promote safety in the workplace. Likewise, Acquil (2012), demonstrates enhanced safety performance through the adoption of safety awareness training, and education. Recent studies also reveal that safety awareness informs workers about workplace safety hazards (Landis & Valdes, 2021), and improved safety programs (Luri & Rinawati, 2019). In a study conducted in India, Samanta and Gochhayat (2021), also found that safety awareness increased and perfected the levels of workplace safety. Subsequently, weakened safety awareness causes increased safety incidents (Dannoun & Nouban, 2021). Beniya *et al.* (2021), also asserts that inadequate safety awareness negatively affects safety implementation at the workplace. Thus, poor safety awareness can lead to disastrous safety performance and increased safety-related incidents.

Toolbox talks are considered advantageous when communicating matters relating to health and safety. A toolbox talk is essentially an informal group discussion or safety briefing focusing on a particular safety issue. Workers can basically understand health and safety issues as work progresses during these toolbox talks (Ganah & John, 2015). Toolbox talks are also beneficial for the workplace in that they create a platform for the planning of work and discussion of health and safety topics relating to the planned work (Jeschke *et al.* 2017). Information sharing on workplace hazards is usually among the topics discussed during toolbox talks (Babu & Devi, 2020). In some countries in Sub-Saharan Africa, toolbox talk meetings are still upheld as one of the twelve best platforms to communicate matters relating to health and safety (Okorie &

Emuze, 2019). In South Africa, managers conduct toolbox talk meetings to converse with workers on matters relating to health and safety (Haupt, Agumba & Pretorius, 2014). Essentially, toolbox talk meetings can be viewed as an important platform to promote health and safety communication, and they are effective in encouraging face to face channelling of safety information between the employer and workers (Ean, 2010). Therefore, it can be concluded that face-to-face communication is the preferred method of communication in the workplace.

Globally, there is an enormous amount of literature on various methods of health and safety communication to promote safety in the workplace. However, very little is mentioned about the use of media to communicate health and safety matters. Jacob, Mathiasen & Powell (2010), found that safety messages sent through media positively impacted on changing human behaviour. On the other hand, the use of technology, particularly emails, in communicating health and safety matters sometimes contributes to the semantic barriers to communication (Lunenburg, 2010) and this can lead to poor organizational health and safety performance.

1.2. Problem statement

The International Labor Organization (ILO) statistics show that 2.3 million people, globally, die because of occupational health and safety incidents. In Africa, studies show that the approach of policy makers must be such that it considers the perceptions of laymen to effectively communicate hazards and risks in the workplace (Dodoo & Hugman, 2012).

Garibi et al. (2016), adds that “the role of human in accidents is undeniable and it is the most prominent factor in occurring accidents”. Ganah and John (2015), suggest that communication is a two-way process that relies on cooperation between a sender and a receiver, and its success rests on both the sender and the receiver. Failure in the role of the sender or the receiver can create a communication barrier. The communication barriers can lead to incident occurrence. Leonard, Graham and Bonacum (2004), show that failure to effectively communicate health and safety related matters can inadvertently result in harm. When words are not structured and communicated effectively, they distort the meaning and intent of a message, thus forming a communication barrier (Lunenburg, 2010). Various scholars suggest that the lack of health and safety communication can result in communication breakdown (Gamil & Rahman, 2017; Lin & Jeng, 2017). Similarly, Haron et al. (2019), posit that a health and safety communication barrier is often brought about by lack of communication between the employer and workers. Although health and safety communication is crucial for the enhancement of workplace safety

performance, its success of effective health and safety messages between the employer and the workers at the workplace, rests on the way the message is transmitted.

Language can cause a barrier to effective communication. The company has employed workers originating from different countries, who speak different languages. The health and safety communication in the company is often written in English, this makes it difficult for the non-English speaking workers to demonstrate understanding of these messages when they are not translated. This could potentially miss the message carried, exposing the workers to risk. The International Labor Organization (ILO) 2004, points out that language differences are one of the common communication barriers. Similarly, Oswald et al. (2019), emphasized that language differences cause a barrier to effective communication in the workplace. Its effect can have a negative impact on organizational performance (Ne'Matulla *et al.* 2021). Makayev et al. (2021), suggests that workers need to be able to understand all communication in the workplace. Therefore, the employer must use language(s) that will be understood by the receiver; also, workers must understand the language used by the employer to communicate health and safety matters to avoid creating a gap that can lead to poor safety performance. Workers who possess a positive attitude towards workplace health and safety are less likely to cause health and safety incidents (Garibi *et al.* 2016). Similarly, the poor attitude of workers towards occupational health and safety is one of the most prominent factors that can result in the occurrence of health and safety incidents (Irumba, 2014). Therefore, it becomes crucial for the company to establish whether health and safety communication negatively or positively impacts the occurrence of incidents at the workplace.

1.3. Motivation and justification

The company has workers, who, daily are inundated with health and safety messages. The messages carry information on hazard awareness, as well as control measures that must be implemented to avoid health and safety incidents. The employer expects the health and safety messages to be understood by all workers. However, the highly diversified and multi cultured workforce poses a challenge in the transmission and interpretation of the health and safety messages. For this reason, there is uncertainty on what impact the health and safety communication has on the occurrence of health and safety incidents. However, worldwide, employers are encouraged to make efforts to ensure that workers understand their rights and obligations relating to health and safety law, and to further encourage the reporting of hazards as an important aspect in occupational health and safety (Tutt *et al.* 2011).

According to section 8 of the Occupational Health and Safety Act 85 of 1993, (South Africa, 1993), the company has a responsibility to create a work environment that is healthy and without detrimental effects to the safety and welfare of workers at work (South Africa, 1993). Thus, the company must communicate to the workers any hazards and risks they may be exposed to, and the controls put in place to prevent and minimize the occurrence of occupational health and safety incidents. There are various methods of communication which have been found to positively impact the behaviour of workers, with the aim of reducing health and safety incidents. For example, the transmission of messages through media presented the possibility of effectively changing dangerous human behaviours (Jacob, Mathiasen & Powell, 2010). Likewise, peer education programs contribute positively to behavioural change and the reinforcement of messages communicated through the peer education program is important for future behavioural change (Richter *et al.* 2012). Educating workers through training is important and in line with the requirements of the health and safety standards (Darabont, Antonov & Bejinariu, 2017; ISO 45001). Training increases knowledge on health and safety matters (Tetemke *et al.* 2014). Essentially, empowerment through training can further improve the workers' behaviour in terms of workplace health and safety and encourage a safety culture amongst workers.

This research will be beneficial to the company as it seeks to demonstrate whether occupational health and safety communication positively or negatively impacts the occurrence of incidents within the company. The study was conducted using the quantitative research method. The quantitative research methodology interrogated the company's health and safety incident statistics and records, coupled with reports from observations conducted on the workers, as well as questionnaires distributed amongst managers, supervisors, and operators. An analysis of the results of this study yielded an understanding of how the health and safety communication methods used in the company impact on the occurrence of health and safety incidents in the company.

1.4. Hypothesis

The current health and safety communication methods at Eskom are effective in reducing health and safety incidents.

1.5. Research aims and objectives

The aim of the study was to evaluate the effectiveness of the health and safety communication methods employed by the Eskom Eastern Cape Operating Unit.

The researcher posed in-depth questions aimed at assessing the impact of health and safety communication on incident occurrence in the workplace. The questions posed were as follows:

- To what extent does the company meet its legal obligations in relation to health and safety communication to its workers?
- How effective are the communication methods used in relation to how the workers perceive them?
- What type of health and safety incidents have occurred at the workplace?

To achieve the main aim of the study, the objectives of the research were:

- To determine the effectiveness of communication methods used.
- To investigate the relationship between the health and safety communication methods used and the occurrence of occupational health and safety incidents; and
- To recommend alternative health and safety communication methods.

1.6. Research achievements and contribution

This study assessed the current health and safety communication methods used and how they are received by the workers, as well as their impact on the occurrence of health and safety incidents. The findings of this study contribute to the current literature available on the health and safety communication and further improve on the health and safety practices in the workplace.

1.7. Dissertation structure

The research work in this study was conducted at Eskom Distribution, Eastern Cape Operating Unit in South Africa. The research focused on the analysis of health and safety communication and its impact on health and safety incidents.

This dissertation consists of 6 chapters as outlined below:

Chapter 1- Introduction: This chapter details the research background, the research hypothesis, and the problem statement.

Chapter 2 - Literature Review: This chapter includes a literature review on health and safety incidents, health, and safety communication methods, as well as barriers to effective health and safety communication.

Chapter 3 - Research Methodology and Design: The chapter outlines the research design and methods used in this study, sampling, data collection and data analysis.

Chapter 4 – Results: This chapter provides a presentation of results and analysis of the data collected.

Chapter 5 – Discussion: This chapter synthesizes and interprets the meaning of the key points of the results.

Chapter 6 - Conclusion and Recommendations: This chapter includes a summary and conclusion of the findings based on the research questions and hypothesis. Recommendations for mitigating the problem(s) identified in this study are also discussed in this chapter.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

This chapter discusses current and historic literature on workplace health and safety incidents, various health and safety communication methods and their barriers. It further elucidates the trajectory of research trends in health and safety communication in relation to workplace incidents.

Generally, communication is the centrepiece of any relationship between two parties, particularly the workplace relationship between employer, and worker. It has further advanced to being an important and sensitive aspect in the field of workplace health and safety, as it involves the workers' lives and workplace health and safety performance (Kim *et al.* 2019), such that it contributes to the reduction of worker injuries (Chen, McCabe & Hyatt, 2017). Similarly, Geordy *et al.* (2021), suggest that enhanced safety communication effectively impacts on the reduction of safety incidents. According to Sanni-Anibire *et al.* (2018), safety communication between supervisors and workers improves workplace health and safety. Health and safety communication is encompassed within the management of a workplace health and safety system (ISO 45001), and health and safety communication can be a means to manage and promote workplace health and safety (Oswald *et al.* 2019; Adebisi & Rasheed, 2021; Ghahramani, 2017). Therefore, a sound health and safety communication relationship in the workplace environment must be maintained to ensure and maintain a good safety performance in the workplace.

Health and safety communication has been articulated as an effective and efficient tool employed in risk analysis and achieving risk reduction (Chen, McCabe & Hyatt, 2017; Kim *et al.* 2019). Grace *et al.* 2010, express the view that the incorporation of risk communication in industry effectively reduces risk and further suggest that it improves industrial safety. Against this background, it can be deduced that the reduction of safety risk at a workplace depends on the effectiveness of communication of the hazards present at the workplace. According to Ghahramani and Salminen (2019), health and safety communication is a necessity in industries. Essentially, industries must heed the call to communicate with their workers on health and safety matters for the betterment of workplace health and safety.

2.2. The importance of communication in health and safety systems

The occupational health and safety management standard has placed significant emphasis on the requirement for the company to communicate with its workers, to ensure a successful health

and safety management system (ISO 45001). Workplace health and safety systems are set out during the planning and implementation phase, and communication is one of the specific tools required (Fargnoli, De Minicis & Di Gravio, 2011; Chen, McCabe & Hyatt, 2017; Kim *et al.* 2019). Tutt *et al.* (2011), add that employers are encouraged to ensure that workers understand their rights and obligations relating to health and safety laws; as well as report workplace safety hazards as an important aspect in the success of an occupational health and safety system. Thus, employers become obligated to inform workers of the rights and responsibilities in relation to workplace health and safety. Dai *et al.* (2021), believe that health and safety communication play a fundamental role in identifying safety hazards in the workplace. Therefore, precise, and clear consultation and communication of matters concerning workplace health and safety, including communication of workplace hazards and safety risk discussion is essential in ensuring an effective implementation and maintenance of a health and safety management system.

Clear risk communication is a cardinal principle of good governance and effective risk management (Dodoo & Hugman, 2012; Grace *et al.* 2010). The effects of good hazard and risk communication reduces risk and ensures a good maintenance of the safety system. Such has proved to be beneficial to the value systems of health and safety management in the construction industry (Kheni, Gibb & Dainty, 2010; Acakpovi & Dзамikumah, 2016). Similarly, industry in the Sub-Saharan Africa validate that the communication of safety risk works towards achieving a good management of the industrial safety system (Racovita *et al.* 2013; Delia & Roesel, 2014). There are broad discussions on the interrogation of the relationship between the communication of health and safety matters and its impact and involvement in obtaining and managing a successful health and safety management system. In South Africa, Moyo *et al.* (2015), endorses the view that effective health and safety communication is one of the most fundamental elements in ensuring a successful health and safety system. Some researchers believe that the enhancement of effective communication boosts safety performance in the workplace (Burgener, 2020; Vignoli *et al.* 2021). Therefore, it can be deduced that successful management of a safety system can be yielded if communication of workplace hazards and risk is effectively implemented.

Various studies have shown that ineffective communication is a factor that can have adverse effects on the success of workplace health and safety systems (Kheni, Gibb & Dainty, 2010; Acakpovi & Dзамikumah, 2016; Phoya 2012; Phoya & Eliufoo, 2016). Essentially, when communication of health- and safety-related matters is not effectively conducted, there is

bound to be a failure in workplace health and safety. Likewise, other scholars are convinced that ineffective health and safety communication yields poor management of organizational health and safety systems (Agbede *et al.* 2016; ISO 45001; Skeepers & Mbohwa, 2015). The ISO 45001 management system advocates for effective safety communication to attain its effectiveness (García-Gómez *et al.* 2020). Similarly, the lack of knowledge on the workplace safety hazard and risk management methods, workers are bound experience safety incidents which can potentially yield to poor safety performance and management of the health and safety system.

2.3. The influence of communication on health and safety performance

Many industries across the world have weighed the impact of effective communication on health and safety performance. A prime example is a study conducted in the European countries, where the discussions identified factors of safety climate and safety communication as facilitators of good health and safety performance (Parker, Axtell & Turner, 2001; Cigularov, Chen & Rosecranes, 2010; Kim *et al.* 2019; Chen, McCabe & Hyatt, 2017; Guo, Yiu, & González, 2016). Keffane and Delhomme (2013), placed emphasis on the association between safety communication and safety performance. In a recent study by Geordy *et al.* (2021), it was concluded that the communication of hazards is essential in enhancing workplace safety performance. Additionally, the enhancement of communication mechanisms contributes effectively to the safety performance of the organization (He *et al.* 2021; Zainol *et al.* 2020; Desa *et al.* 2013). Effective health and safety communication reduces the risks and improves the wellbeing of the workers while at work, through prevention of injuries (Keffane & Delhomme, 2013; Desa *et al.* 2013; Kim *et al.* 2019; Chen, McCabe & Hyatt, 2017; Guo, Yiu, & González, 2016). The argument is stretched further by Skeepers and Mbohwa (2015), who suggest that safety performance can be enhanced by a simple improvement on safety practices, such as health and safety communication.

Safety practices include communication through safety awareness programmes. According to Dos Santos *et al.* (2014), safety awareness plays a key role in enhancing a constructive safety culture in the workplace, thereby contributing to positive safety behaviour among workers. Similarly, Landis and Valdes (2021), found that safety awareness communication promotes the understanding of workplace hazards, and further improves health and safety standards (Luri & Rinawati, 2019). Fundamentally, when workers become aware of their environment and its hazards and other workplace safety matters, incidents can be reduced, thereby resulting to good safety performance. A study conducted in India showed that health and safety communication

improved health and safety standards in the country (Samanta & Gochhayat, 2021). Studies conducted by various scholars have shown that when the health and safety performance of a workplace improves, a reduction in health- and safety-related incidents is evident and vice versa (Kim *et al.* 2019; Chen, McCabe & Hyatt, 2017). Similarly, Skeepers and Mbowha (2015), suggest that when good communication is well- entrenched in the safety management system within the workplace, huge improvements can be achieved in the health and safety performance in an industry.

Ineffective communication can have an adverse impact on performance. There are various factors contributing to ineffective safety performance at the workplace. Some studies suggest that ineffective communication due to differences in culture leads to poor safety performance (Acakpovi & Dзамikumah, 2016; Phoya & Eliufoo, 2016). For example, effective communication can be affected in a construction workplace where workers of different ethnic groups are interacting, thus causing a reduction in safety performance (Ismail, Doostdar & Harun, 2012; Chan *et al.* 2014). Essentially, when the employer fails to communicate with the workers in ways that are common to all ethnic groups of the workers, the effectiveness of the communication can be compromised. The low level of education of workers can hinder full understanding of the safety messages. Some research asserts that communication amongst workers with a low level of literacy can lead to poor health and safety performance in a workplace, as they might not fully comprehend safety messages (Sanni-Anibire *et al.* 2018). Therefore, it is crucial that the safety messages are precise and simple enough for easy understanding by workers at all levels of the workplace to avoid misinterpretation of the messages, which can lead to the occurrence of incidents. In Ghana, a research study suggest that insufficient communication of health and safety programmes was one of the factors which negatively contributed to the firms' health and safety programmes (Ismail, Doostdar & Harun, 2012). Fundamentally, the employer is propelled to develop safety communication programmes that take cognizance of the worker's ethnic and cultural differences to ensure successful and effective communication of safety matters in the workplace.

The effect of communication on the occurrence of health and safety incidents within the workplace is considered as a key strategy in preventing illnesses and disabilities. It plays a fundamental part in the health and safety of workers (Dalvie, Rother & London, 2014; Ghahramani, 2017). Workplace safety incidents can be reduced by effective safety communication (Bergener, 2020). Therefore, the more effective safety communication is, the fewer the safety incidents (Chan *et al.* 2014; Ghahramani, 2017). For example, one of the main

components of managing traffic safety is communication as it contributes to the reduction of road crashes (Keffane & Delhomme, 2013; Desa *et al.* 2013). Workers who are knowledgeable about health and safety are less likely to cause incidents (Nasab *et al.* 2009). On the other hand, unsafe actions by workers influence the frequency and severity of safety incidents (HSE, 2020; Hallowell, 2010). Aliabadi *et al.* (2020), contend that human errors cause more severe safety incidents.

2.4. Behaviour and attitude on incident occurrence

Workplace health and safety incidents are caused by an unsafe act committed by workers. Monazzam and Soltanzadeh (2009), found that there is a significant relationship between the attitude of workers and workplace incidents. The findings of Sanni-Anibire *et al.* (2018), show the significant relationship between the workers' attitude and behaviour towards workplace safety and safety incidents. Workers who deliberately fail to adhere to safety rules and procedures cause incidents, and such compromises workplace safety (Opoku, Stephani & Quentin, 2017; Sanni-Anibire *et al.* 2018; Puplampu & Quartey, 2012). According to Kim, Lee and Seong (2017), a worker's positivity and adherence to the company's safety culture results in less frequent involvement in safety incidents. Thus, it can be surmised that unsafe actions are a consequence of the worker's negative attitude and behaviour towards workplace health and safety.

Nasab *et al.* (2009), argue that when workers possess the right attitude, knowledge and behaviour towards health and safety, they are more likely to cause fewer incidents. According to Mohamed, Ali and Tam (2009) unsafe behaviour by workers has been directly linked to health and safety incidents in the workplace. Ajayi *et al.* (2021), suggest that the enhancement of behavioural safety management amongst construction workers can mitigate risky behaviour and workplace accidents, particularly fatalities. Therefore, it can be deduced that workers who experience a high number of incidents exhibit negative behaviours and attitudes towards health and safety in the workplace, consequently, it becomes crucial to encourage and promote a positive safety worker behaviour to achieve a reduction of incidents. Positive safety behaviour is behaviour that supports good health and safety practices and activities in the workplace (Mahmood *et al.* 2010). This means that incidents can be reduced if workers behave in a manner that is aligned to the workplace safety practices. Shin *et al.* (2014), assert that the occurrence of health and safety incidents in construction is due to unsafe acts caused by workers' behaviour which deviates from the normal accepted safety procedures. In essence, various worker behaviours practiced in the workplace create a culture that influences workplace health and

safety. Unsafe worker behaviours result to a negative safety culture, while safe worker behaviour yield a positive safety culture in the workplace, or visa versa.

Burns et al. (2006), assert that safety culture has been linked to organizational incidents. Norms, practices and the general health and safety culture in the workplace is one of the factors which have an enormous influence on the workers' attitude and behaviour in relation to the health and safety performance in the company (Choudhry, Fang & Mohamed, 2007; Phipps & Ashcroft, 2012), thereby directly impacting on the occurrence of incidents, as well as the performance of health and safety in the workplace (Zin & Ismail, 2012). The interaction between workers' attitude and behaviour creates the safety culture in a workplace. This culture can either be negative or positive depending on the worker's attitude and behaviour towards workplace health and safety. Latief et al. (2019), state that the dynamic interaction between stakeholders' (1) attitudes and beliefs, (2) their behaviour, and (3) the environment creates the workplace safety culture (Lofquist et al. 2011). Mosly and Makki (2020), suggest that safety education and awareness campaigns are the best way to improve workplace safety culture.

According to Zin and Ismail (2012), human behaviour influences the occurrence of health- and safety-related incidents in the workplace. Clarke (2010) and Nascimento et al. (2017), argue that the psychological safety climate and safety incidents are the results of worker safety behaviour and general health. Ajayi et al. (2021), suggest that an enhancement in safe behaviour can lead to reduced incidents. As legislated in section 14 of the Occupational Health and Safety Act 85 of 1993, workers are mandated to operate in a safe manner so as not to cause harm to themselves (South Africa, 1993). Furthermore, Skeepers and Mbohwa (2015), believe that workers' safe behaviour can prevent the occurrence of safety incidents at the workplace. It is against this background that it can be deduced that there is a human psychological element behind the occurrence of workplace safety incidents.

There are various methods that can be used to promote safe behaviour amongst workers. For example, Rauh et al. (2021), recommends the use of mixed reality devices for promoting safe worker behaviour. Uzuntarla et al. (2020), believes that safe behaviour can be achieved through amplified safety awareness. Consequently, reduced safety awareness leads to workplace fatalities (Dannoun & Nouban, 2021). According to Opoku, Stephani and Quentin (2017), effective communication through various communication forms, can be achieved if the sender and the receiver have a positive attitude and share a common language. However, there are many factors that create barriers to effective communication (Crico, 2015). Table 1 shows different barriers to effective communication.

Table 1: Barriers to effective communication

Communication Barrier	References
<p>Lack of confidence amongst rural and unskilled workers.</p> <p>Language barrier amongst multinational workers.</p> <p>Accent in language used amongst multinational workers.</p> <p>Lack of knowledge of risk.</p> <p>Lack of empathy, self-image, and selective listening</p>	<p>Oswald et al. 2019; Vecchio-Saduse, 2007; Phonya & Eliufoo, 2016</p>
<p>Power conflicts.</p> <p>Lack of trust between sender and receiver.</p> <p>Poor working environments</p> <p>Work environmental disturbances, such as noise.</p>	<p>Health and Safety Executives (HSE), 2020</p> <p>Okorie et al. 2019</p>
<p>Burden exerted by extended family on the workers pose a challenge to health and safety communication.</p> <p>Ignorance of the employer.</p> <p>Low competency levels of the workers.</p> <p>Government's commitment to improving health and safety within workplaces.</p> <p>Coaching workers on their health and safety right.</p>	<p>Kheni et al. 2010</p> <p>Kanchana et al. 2015</p> <p>Latief et al. 2019</p> <p>Lofquist et al. 2011</p>
<p>Different levels of literacy amongst workers.</p>	<p>Okorie et al. 2019</p>
<p>Absence of a shared language between employer and workers.</p> <p>Workplace stress.</p> <p>Superior's and colleagues' attitude towards site workers.</p> <p>Misinterpretation of health and safety message and poor communication skills amongst workers.</p>	<p>Olanrewuji et al. 2017</p>

2.5. Challenges to effective communication

The word communication originates from a Latin word *communico*, meaning the sharing of information (Bust *et al.* 2008). In the workplace, the sharing of safety information can be between the employer and the workers or amongst workers. Section 8 of the Occupational Health and Safety Act 85 of 1993 advocates for the sharing of information concerning workplace hazards between the employer and workers (South Africa, 1993). Similarly, ISO 45001, provides guidance on the importance of health and safety communication in the workplace. However, the communication of health and safety messages in the workplace can be a very complex factor (Opoku, Stephani & Quentin, 2017; Cicero, 2015). Oswald *et al.* (2019), state that the construction industry is riddled with health and safety communication challenges. Doodoo and Hugman (2012), argue that construction industries in the Sub-Saharan continent are constantly challenged with achieving effective communication. There are detrimental consequences, such as injuries and diseases, if effective safety communication is not achieved (Marquez & Farrington, 2013). According to Okorie *et al.* (2019), meaningful communication can achieve trust and harmony between the employer and workers.

A two-way open communication channel between the sender and the receiver is of utmost importance as it closes the gap for ineffective communication (Gahan & John 2015; Phonya & Eliufoo; 2016; Sanni- Anibire *et al.* 2018). Ineffective health and safety communication was one amongst many other challenges facing small to medium sized enterprises in construction (Mashwama, Aigbovboa and Thwala, 2019). The effects of ineffective communication can cause misinterpretation of the safety message and potentially yielding to a rise in safety incidents in the workplace, as well as a poor safety performance. Additionally, it causes project delays and failure (Alameri *et al.* 2021; Subramaniam *et al.* 2020).

2.6. Type of communication methods

There are many different mediums which can be used to share health and safety messages and information. Health and safety communication can have many different approaches and forms, including policies and procedures, performance statistics, hazard and incident reports, workplace inductions, risk assessments, and training (Vecchio-Sadus, 2007; Tutt *et al.* 2012; Ganah & John, 2015; Delia & Roesel, 2014; Phonya & Eliufoo, 2018). However, the interpretation and execution of such messages rest on the worker's perception of risk management, safety rules and procedures (Mohamed & Tam, 2009). When the employer communicates safety messages in the workplace, there is an expectation on the workers to

respond to the communication measures imposed by the employer, to prevent incidents. The response can be measured and assessed based on how workers react to the communication methods used for health and safety matters.

2.6.1. Health and safety signs and posters

The communication of health and safety matters through safety signage has been regulated (Scott & Goncalves, 2021) and is described as “a system component used for delivering prohibition, mandatory, warning and guidance messages to mining workers to promote appropriate and responsible behaviour in the mine area” (Chan & Ng, 2012). Other scholars have interrogated the different methods of communicating health and safety matters, particularly the communication of risk. The display of safety signs and posters has been shown, in numerous studies, to be one of the most used communication mediums to communicate risks in the workplace (Phonya 2012; Phonya & Eliufoo, 2016; Sanni-Anibire, 2018).

Even though, Tutt et al. (2012), found that the use of interpreted signs and posters was more effective in communicating matters relating to health and safety at a construction site, in comparison to using talking signs. Studies in Sub Saharan Africa contend that the use posters as a means of communicating health and safety is thought to present possible misrepresentations as the workplace designs may not have considered the workers’ characteristics (Phonya & Eliufoo, 2018; Oswald *et al.* 2019; Olanrewuji *et al.* 2017). Therefore, the lack of consideration of a common language shared between workers in the design of safety posters and signs, results in ineffective health and safety communication. The design of the posters must be such that they contain a common language and simplest message for the workers of all levels in the workplace to understand.

Communication of health and safety messages to and amongst low education level workers is a common challenge in the small and medium construction industries (Chen, McCabe & Hyatt, 2017; Becerik-Gerber & Siddiqui, 2014). Some scholars suggest the use of posters and signs as the most effective method to communicate health and safety matters with a group of low education level workers (Olanrewuji *et al.* 2017; Kheni *et al.* 2010; Vitharana *et al.* 2015), as it is a simpler, more readable, and eye-catching method to bring about safety awareness to workers to prevent the occurrence of incidents in the workplace (Phonya, 2012). For example, many industries in the developing countries consider the use of health and safety signs and posters as best practice to communicate with workers with low levels of education and thus prevent the occurrence of incidents and improve health and safety performance in the

workplace (Phonya, 2012; Delia & Roesel, 2014). Studies conducted in South Africa have argued that the use of posters to communicate food safety has been enhanced to promote a positive health and safety culture in the workplace (Griffith, Livesey & Clayton, 2010; Griffith, Jackson & Leus, 2017). Therefore, the posters used must not be clustered but rather designed to be simple and eye-catching.

2.6.2. Face to face interactions

There are various methods of face-to-face interactions which can be applied at the workplace. These include induction, toolbox talks, as well as health and safety meetings (Phonya, 2012; Kim *et al.* 2019; Haupt, Agumba & Pretorius, 2014; Santos *et al.* 2013; Vitharana *et al.* 2015). When used at regularly, they help to reduce hazards (Babu & Devi, 2020), thereby improving workplace performance. It has been argued that workers who are exposed to health and safety induction in their workplaces are better informed and the workplace maintains a good and sound health and safety performance (Squelch, 2001). It is through induction that workers are informed of workplace hazards and risk control measures to prevent incident occurrence, thereby improving workplace safety performance. Additionally, communication through training and awareness, including induction, is a more suitable mode of communicating health and safety matters with construction workers (Sanni-Anibire *et al.* 2018). Similar findings were made in Sub Saharan Africa, where it was shown that occupational health and safety communication through training, awareness and education is fundamental in ensuring health and safety at the workplace, thereby impacting positively on the reduction of incidents at the workplace (Puplampu & Quartey, 2012).

Face to face interactions also take place in other forms such as health and safety meetings and toolbox talks between the employer and the workers. Toolbox talks are still upheld as one of the best platforms to communicate safety matters (Okorie *et al.* 2019), as they are used to impart health and safety knowledge and awareness to the workers. This was demonstrated at various construction workplaces in Sub-Saharan Africa, where the key findings of the studies showed that managers conduct toolbox talks as a method of communication with workers on matters relating to health and safety to bring about health and safety awareness which, in turn, will lead to the reduction on incidents and impact positively on the health and safety performance of the workplace (Haupt, Agumba & Pretorius, 2014; Santos *et al.* 2013). Essentially, the adoption of toolbox talks, health and safety meetings, training and awareness are simple and effective methods of communicating health and safety matters with construction workers.

The challenge with face-to-face interactions is that they can be ineffective without the intervention of an interpreter, the language and terminology used may not be well understood by low-level workers (Tutt *et al.* 2012; Phonya & Eliufoo, 2018; Oswald *et al.* 2019; Phonya, 2012). An interpreter is often used to present and assist workers during safety induction before the commencement of work (Kheni *et al.* 2010). The involvement of an interpreter during face-to-face interactions ensures that where workers differ in language.

Safety induction is one of the methods of ensuring that workers of different skill levels are orientated into the company's expectations regarding safety issues. According to Samosamo, Marais and Joubert (2014), safety induction is an effective tool to transmit health and safety information and messages in the workplace. It is an example of awareness programmes which can be employed to bring awareness on workplace safety hazards amongst workers. In the construction industry, health and safety induction expands the safety knowledge of the construction workers (Teck *et al.* 2015; Al-Shabbani *et al.* 2020). Singh *et al.* (2021), suggest that health and safety induction should be compulsory for all workers at the start of their employment. This will ensure that workers are aware of the workplace health and safety hazards and control measures at initial employment stage. Workers agree that the knowledge shared during safety induction can assist to reduce incidents (Samosamo *et al.* 2014). Even though the use of face-to-face interactions, particularly health and safety induction and training, may be widely used they are not completely effective (Kim *et al.* 2017) as their effectiveness rests on the workers' skill level to possibly influence their responsiveness to health and safety communication in the workplace (Kheni *et al.* 2010; Olanrewuji *et al.* 2017).

2.6.3. Media

Media is another mode of communication which can be used to transmit health and safety messages. The use of email has served as an advantage to organisations worldwide, such that people at different geographical areas are able to communicate across time and space (Whittaker & Snider, 1996). Additionally, the use of email was found to be more effective in assisting and ensuring protection of workers who prefer confidentiality about their personal health issues, as some workplaces tended to share this information through workplace emails (Marquez & Farrington, 2013). Section 19 of the Protection of Personal Information Act stipulates that responsible person need to ensure confidentiality of personal information of others that is in their possession (South Africa, 2013). The use of emails presented semantic barriers to effective health and safety communication (Lunenburg, 2010). The one-way

communication channel creates an opportunity for misinterpretation of the content of the message and further discourages physical interaction of workers in the company.

Nevertheless, Jacob, Mathiasen and Powell (2010) found that the introduction of new media for the communication of food safety messages improved human behaviour towards food safety. According to Tutt et al. (2012), the use of media, particularly visual media, has been the most pioneering and effective method for transmitting health and safety messages between managers and workers in the workplace. Skinners and Rampersad (2014), posit that media are the most effective and widely spread channel of communication. Therefore, the use of visual and non-visual media, as well as emails can still be used to communicate matters of workplace health and safety, regardless of its challenges.

2.7. Types of hazards in construction sites

Workers in the construction industry are exposed to many hazards. Various studies have found that workers are exposed to mechanical, chemical, ergonomic, and biological hazards (Hanna *et al.* 2017; ISO 45001; RRC, 2017). Mechanical hazards occur during the use of manual or powered equipment, plant tools or machinery and may result in physical injury. Hamid and Singh (2003), state that the “physical injuries are often caused by equipment used such as scaffolds, power access equipment, ladders, plant and machinery for excavation and processes such as manual handling, and roof work”. According to Vitharana et al. (2015), mechanical hazards such as noise, vibration, and extreme temperatures can also result in physical injury. For example, over exposure to excessive noise leads to noise induced hearing loss (Pitt, 2006).

Chemical hazards are created by exposure to chemicals at the workplace, and chemical exposure in the workplace can cause acute or chronic health effects (Vitharana *et al.* 2015). As found by Pendlebury et al. (2006), examples of chemical hazards mostly present in the construction industry include asbestos, welding fumes, solvents, spray paints, cutting oil mists and hexavalent chromium. In workplaces, exposure to asbestos dust can emanate from broken asbestos roof sheets. According to Satapathy (2021), cement and asbestos dust are chemical hazards which cause skin reaction among workers. Vitharana et al. (2015), explain that chronic health effects from exposure to small amounts these chemicals develop slowly over a prolonged period. For example, when workers are exposed to small amounts of silica dust, they may not immediately show symptoms of silicosis. However, the symptoms may develop years after exposure. Symptoms of acute health effects may become visible within a short time after exposure to large amounts of the chemical hazard. For example, workers who manually handle

chemicals may experience skin irritations immediately when the chemical spills on their bodies.

Another type of hazard found in construction workplaces are ergonomic hazards (Hanna *et al.* 2017). Ergonomic hazards are workplace physical factors that can cause musculoskeletal injuries. In a study conducted by Attar (2014), musculoskeletal disorders were found to be a common problem and back pains were most common amongst health workers because of the long working hours. Incorrect body posture can also result in musculoskeletal disorders. Putri *et al.* (2020), concur that working in awkward bodily positions can result in musculoskeletal disorders; and extensive working hours and lack of sleep were amongst the factors which contributed to musculoskeletal disorders.

Hanna *et al.* (2017), found that biological hazards were common hazards which affected construction workers. Biological hazards are classified as biological substances which threaten the health of workers in the workplace. Russi (2017), conducted a study which focused on various biological hazards and their impact to the health and workers, such as Human-Immuno Virus (HIV), hepatitis B virus, hepatitis C virus, tuberculosis, and other infectious diseases, which can be contracted via direct contact, air-borne transmissions, and faecal-oral transmission. For example, workers infected with Covid-19 may infect other workers if good hygiene practices are not adhered to. Rodríguez-Lázaro *et al.* (2012), support the view that virus and bacteria can be spread in an environment from person-to-person via food, water, and skin contact. Therefore, the employer must prevent the spread of biological hazards in the workplace.

The construction industry is a dynamic industry, where most health and safety incidents occur. According to Hamid *et al.* (2019) and Vatharana *et al.* (2015) incidents are caused by unsafe acts and conditions. The leading causes of fatalities in a construction site in Malaysia were identified as unsafe methods, nature of the work and unsafe workplace conditions, where the incidents that occur at construction workplaces result in injuries among many construction workers (Hamid *et al.* 2019; RRC, 2017; Atusingwize *et al.* 2019; Hanna, Seid & Lamessa, 2017). The findings of the studies have shown that the construction industry has, over the years, experienced an increased number of worker fatalities caused by various factors.

Some research studies have found that worker fatalities and falls from heights incidents are the most frequent incidents that occur at construction workplaces (Hamid *et al.* 2019; Almen *et al.* 2012; Vatharana *et al.* 2015; Meng *et al.* 2018). Al-kotb (2017), found that workers were often

fatally injured because of material falling from the buildings under construction causing broken bones and fractures. Therefore, working from heights exposes workers to possible risk of fatality and/ or severe injury.

Construction environments and activities often involve working in confined spaces and conducting repeat activities, such as manual lifting of material. The repeated bodily action over extended periods contribute to adverse ergonomic factors, causing strain to the body and resulting in ergonomic challenges (Kanchana *et al.* 2015; Hanna *et al.* 2017; Dong *et al.* 2015). Therefore, exposure to repetitive bodily action should be limited.

2.8. Unsafe practices on the hazards

Generally, most injuries are caused by workers' practices around the hazards present at the workplace. Workers who are uninformed about workplace hazards and the controls thereof, fail to act in a safe manner in the work environment. According to Kanchana *et al.* (2015), most fatalities and injuries to the workers resulted from unsafe practices by the workers. In construction sites, the unsafe acts result mostly from lack of health and safety awareness, as well as non-adherence to the wearing of personal protective equipment (PPE), (Vitharana *et al.* 2015; Al-kotb, 2017; Hanna *et al.* 2017; Kim, Lee & Seong, 2017). Kifle *et al.* (2014), compared workers who wore PPE and those who did not in Ethiopia. The findings of his study revealed that those who disregarded the wearing of PPE were more likely to be injured compared to those who did adhere to the requirements of wearing PPE. This background of literature shows that unsafe acts of workers exposed the workers to the risk of sustaining injury. The use of alcohol and drugs has also shown to be the root of unsafe behaviour amongst workers (Hanna *et al.* 2017; Dong *et al.* 2015; Kifle *et al.* 2014). Essentially, worker behaviour influences the occurrence of incidents. According to Amponsah-Tawaih & Adu (2016), safety communication can influence a safe worker behaviour so workers can comply with safety rules, procedures, and practices, thus bringing about an improvement in the health and safety system. Table 2 shows the type of hazards, risk exposure and control measures for the risks identified. Apart from worker behaviour causing incidents, the workplace also presents hazards which can cause injuries to workers. A hazard is any source of harm to workers. Generally, the workplace contains hazards and hazardous conditions which can give rise to injuries to workers (Almen *et al.* 2012). In a study conducted at a building construction site, it was highlighted that material overload had not been considered in the architectural and design phases of the project and that safety was given less priority than aspects such as quality, time, and finances of the project

(Almen *et al.* 2012). This constituted a major failure in safety practice on the part of the client during consultation before commencement of the project.

Table 2: Hazards, Risk Exposure and Control Measures

Hazard	Risk Exposure	Control measure	Reference
Mechanical Hazards	Falls and fatalities from working at heights, Bone fractures from falling material and objects	Avoid working at heights activities, Use lifting equipment, Implementation of active safety management and awareness programs, First Aid, PPE	RRC, 2017; South Africa, 1993; Zhang et al. 2015; Vitharana et al. 2015; Tadesse et al. 2016; Kanchana et al. 2015; Atusingwize et al. 2019; Dong et al. 2015; Al-kotb., 2017; Hanna et al. 2017; Almen et al. 2012; Hamid & Singh, 2003
Ergonomics Hazards	Structural damage from material overload, Electric shock, Manual handling of material, Back pains, musculoskeletal disorders	Awareness programs Change of design Reduced working time, increased sleeping time	Kanchana et al. 2015; Almen et al. 2012; RRC, 2017; Atusingwize et al. 2019; Hanna et al. 2017, 2017; Dong et al. 2015; Attar, 2014; Putri et al. 2020
Chemical Hazards	Respiratory disorders from inhalation of dust, fumes, gases, vapours and mist, dermatitis from chemical irritants	Substitution of chemical agent, Medical surveillance, Awareness programs, PPE	RRC, 2017; Vitharana et al. 2015; Al-kotb, 2017; South Africa, 1993; ISO 45001; Reinhold et al. 2019; Kanchana et al. 2015; Kamrin, 2014; South Africa, 1993; Hanna et al. 2017; Kifle et al. 2014
Biological Hazards	Cancer from inhalation of fibres Infections and diseases from exposure to fungi, blue-green algae, bacteria, and viruses	Training and awareness programs, PPE, hygiene practices	ISO 45001; RRC, 2017; World Health Organization, 2019; Reinhold et al. 2019; Russi, 2017; Rodríguez-Lázaro et al. 2012
Physical Hazards	Cancer, sunburn, anemia, and birth defects from exposure to ionizing and non-ionizing radiation, Stress from exposure to working extensive hours and workload, fatigue, psychological disorders from	Implementation of active safety, management and awareness programs, PPE	Vitharana et al. 2015; Tadesse et al. 2016 Kanchana et al. 2015; South Africa, 1993; Kheni et al. 2010; Kanchana et al. 2015; Atusingwize et al. 2019; Ndejjo et al. 2015; Vitharana et al. 2015; Pitts (2006); Kifle et al. 2014

Hazard	Risk Exposure	Control measure	Reference
s	working away from family. Noise induced hearing loss from exposure to excessive noise. Whole body vibration from exposure to vibration.		

2.9. The Occupational Health and Safety Act, Act 85 of 1993

The Occupational Health and Safety Act 85 of 1993 (OHS Act) is the main legislation governing all workplaces in South Africa. Its existence is intended to safeguard the workers while ensuring the safety of plant and machinery in the workplace (South Africa, 1993). As various scholars have demonstrated, workplace safety is dynamic and challenging to achieve (Chen, McCabe & Hyatt, 2017; Guo, Yiu, & González, 2016; Acakpovi & Dзамikumah, 2016; Moyo *et al.* 2015). Part of obtaining and maintaining a good health and safety system involves the management of incidents. The Occupational Health and Safety Act 85 of 1993, provides guidance in terms of incident management.

2.9.1. Section 8 of the Occupational Health and Safety Act 85 of 1993: Duties of the employer

Industries still experience a challenge in preventing the occurrence of incidents in the workplace, as evidenced by the occupational injuries and illness claims registered with the compensation fund (South Africa, 1993). According to the Occupational Health and Safety Act 85 of 1993, the employer is required to establish control measures for all the risks associated with its activities. A qualitative survey conducted at an academic hospital in Johannesburg (Foromo *et al.* 2016), uncovered 93.3% non-implementation of the requirements of the Occupational Health and Safety Act 85 of 1993. This finding shows serious adverse implications on the workers' safety.

One of the basic principles underpinning the Occupational Health and Safety Act 85 of 1993 is for the employer to create and maintain a safe working environment for its workers by identifying hazards and implementing controls to prevent the occurrence of incidents. According to the Occupational Health and Safety Act 85 of 1993, the employer is required to identify hazards which may result in incidents. The intention behind the establishment and implementation of the control measures is to avoid, substitute, treat, tolerate, or control the identified risk. As supported by ISO 45001 and Katsuro *et al.* (2010), the employer needs to create a safe working environment and identify hazard and administer controls to preserve the lives of the workers. Foromo *et al.* (2016), argued that at the academic hospital in Johannesburg little was done by the employer to ensure a safe working environment or even raise awareness on the identified safety measures to be implemented to comply with the Occupational Health and Safety Act 85 of 1993. Seleke and Odalete (2013), also supported the contention that the

employer is responsible for ensuring a safe environment for persons outside their employment who may be affected by their activities.

According to the Occupational Health and Safety Act 85 of 1993, the employer must communicate with the workers about the control measures to mitigate the identified risks and hazard, to prevent incident occurrence. Hu et al. (1998), suggest that emergency escape routes should be kept free of obstructions. Safety signs for the escape routes should also be conspicuously displayed. In workplaces where there is a risk of fire, the employer must communicate the fire risk assessment as well as the fire safety plan, detailing the exit routes in the event of a fire. It is crucial for the emergency exit routes to not be locked, such that the workers are provided with easy access to them to avoid being trapped inside a burning premise.

The Occupational Health and Safety Act 85 of 1993, stipulates that the employer must report health and safety injuries to the Inspector and occupational diseases to the Chief Inspector. It is also required for the worker to report incidents to the employer or the health and safety representative before the end of shift, to enable the employer to report to the Inspector and/or Chief Inspector. However, the reporting of incidents by the workers and employer is not always adhered to. In the study conducted by Foromo et al. (2016), they reported that incidents, near misses and unsafe conditions were rarely reported to the employer. They also found that occupational injuries and diseases were rarely reported to the Compensation Commissioner by the employer. The occupational injuries which must be reported to the Compensation Commissioner include incidents where a worker has been injured and booked off work for periods longer than 14 days, or where a worker has been fatally injured, is unconscious, has lost a limb or has sustained a fracture of the skull.

According to the Occupational Health and Safety Act 85 of 1993, non-compliance with this requirement may result in the employer incurring a fine or being subjected to imprisonment. It is recommended that the employer should report incidents to the Compensation Commissioner, as well as encourage workers to report incidents to avoid incurring the financial burden brought about by noncompliance and to avoid tarnishing the employer's public image and social trust brought about by imprisonment. Information from Department of Labour in the Eastern Cape indicates that according to the Department of Labour's records of the total incident reported in the 2012/13 financial year, in the Eastern Cape, the manufacturing sector accounted for 42% of the injuries, 20% of community injuries, 11% of injuries in the agricultural sector, 8% of injuries in electricity, gas and water supply sustained; and lastly the 7 % of injuries in the construction industry. The statistics further revealed that of these reported incidents, 21% of

injuries reported were related to back pain; 13% associated with cuts and lacerations; 11% were related to fingertip amputations; 8% were related to amputations; 6% were associated with bruises; and a total of 6 fatalities were reported in the first and second quarter of the year (Department of Labour, 2013). This record of statistics presents concerning results in that the construction industry is reluctant to report workplace health and safety incidents.

The efforts employed by the Eastern Cape Department of Labour in enforcing the reporting of incidents by the employer and ensuring compliance with workplace health and safety is clearly articulated by the Provincial Head of Operations in the Eastern Cape Department of Labour office, Bheki Gama (2013), “Safety should underpin the operations of any business. Employers and employees must endeavor to make sure that the Health and Safety Act is implemented in the workplace as loss of life is priceless” (Department of Labour, 2013). The Occupational Health and Safety Act 85 of 1993, further requires for the employer to investigate all incidents occurring at the workplace. The incidents include near-misses, injuries, and occupational diseases. The investigation of incidents is conducted to establish the root cause of an incident, thereby employing control measures to prevent possible recurrence. Statistics on the investigation and completion of incident management in the Eastern Cape are reflected in the Department of Labour’s records, which indicate that in 2012; approximately 56% of reported incidents were investigated and their causes were analysed by the Department of Labour (Department of Labour, 2013). It can be concluded that there is room for improvement in terms of the investigation of incidents. In addition, when employees fail to comply with reporting of incidents (Foromo *et al.* 2016), this hinders the investigation process and leaves room for such incidents to be repeated, which, in turn has a negative impact on the lives of workers. Katsuro *et al.* (2010), state that when incidents are not reported, they remain unknown to the employer and so their cause remains either unmanaged or mismanaged, thus creating an opportunity for repeat occurrence. Therefore, employers are advised to encourage workers to report incidents so that the investigation of incidents can assist the employer to implement measures to prevent re-occurrence.

2.9.2. Section 14 of the Occupational Health and Safety Act 85 of 1993: Duties of the employee

The Occupational Health and Safety Act 85 of 1993, compels workers to take responsibility for their own safety, as well as that of any other person who may be adversely affected by their actions. However, it has been demonstrated that workers fail to comply with this legislative requirement. According to Foromo *et al.* (2016), workers do not carry out their legal obligation

to take care of their own safety and that of others. Unsafe actions by workers cause workplace incidents. Non-adherence to PPE results in incident occurrence and increases the frequency and severity of injuries. This is supported by various studies conducted at construction sites where workers who were found not adhering to the wearing of PPE sustained serious injuries and fatalities (Al-kotb, 2017; Hanna *et al.* 2017; Kanchana *et al.* 2015). Hallowell (2010), argues that workers' unsafe actions contribute to the frequency and severity of injuries.

In Foromo *et al.* (2016)'s study, they found that workers did not adhere to safety procedures or rules. This means that the workers did not execute lawful orders laid down by the employer in the interest of health and safety. This behaviour raises concerns as it leaves room for incident occurrence and endangers workers' lives. Ignorance about safety procedures and rules leads to workers incurring financial fines and/ or possible imprisonment, as per the Occupational Health and Safety Act 85 of 1993. Workers are therefore encouraged to comply with the requirements of the Occupational Health and Safety Act 85 of 1993 to avoid the penalties.

CHAPTER 3: METHODOLOGY

3.1. Introduction

This chapter discusses the research approach by detailing the methodology that was employed during the project. A quantitative research method was used and clarified below. This section further clarifies several factors which were used to ensure data integrity during collection, analysis, and its accuracy.

3.2. Research design

A research design is a “logic plan for getting from here to there, where here may be defined as the initial set of questions to be answered, and there is more set of conclusions (answers) about these questions” (Yin, 2009). It is applied by the researcher, for realistic and accurate response to questions or statements (Kumar, 2014). The research design leads the researcher on the methods of gathering, evaluating, and understanding the findings of the study. In this study, a quantitative research methodology was applied. This method of study includes the interrogation of Eskom Eastern Cape Operating Unit’s (ECOUC) health and safety incident statistics and records, coupled with observation reports from observations conducted on the sampled population. Additionally, the study involves the distribution of a questionnaire by the researcher with the sampled population. The design of this study details a plan of execution of the selected research method, enabling the collection of data, its analysis, interpretation, and presentation. These will be executed with the aim of providing an expressive contribution to the research project. The results from the analysis of the data collected will yield an understanding of how health and safety communication impacts on the occurrence of incidents in Eskom ECOUC.

3.3. Study area

Eskom ECOUC is divided into four main departments, i.e., Asset Creation (AC), Maintenance & Operations (M&O), Safety, Health, Environment and Quality (SHEQ) and Business Integration and Performance Management (BIPM). These departments are located across the Distribution Division (Dx) in the Eastern Cape Operating Unit (ECOUC). See Figure 1.

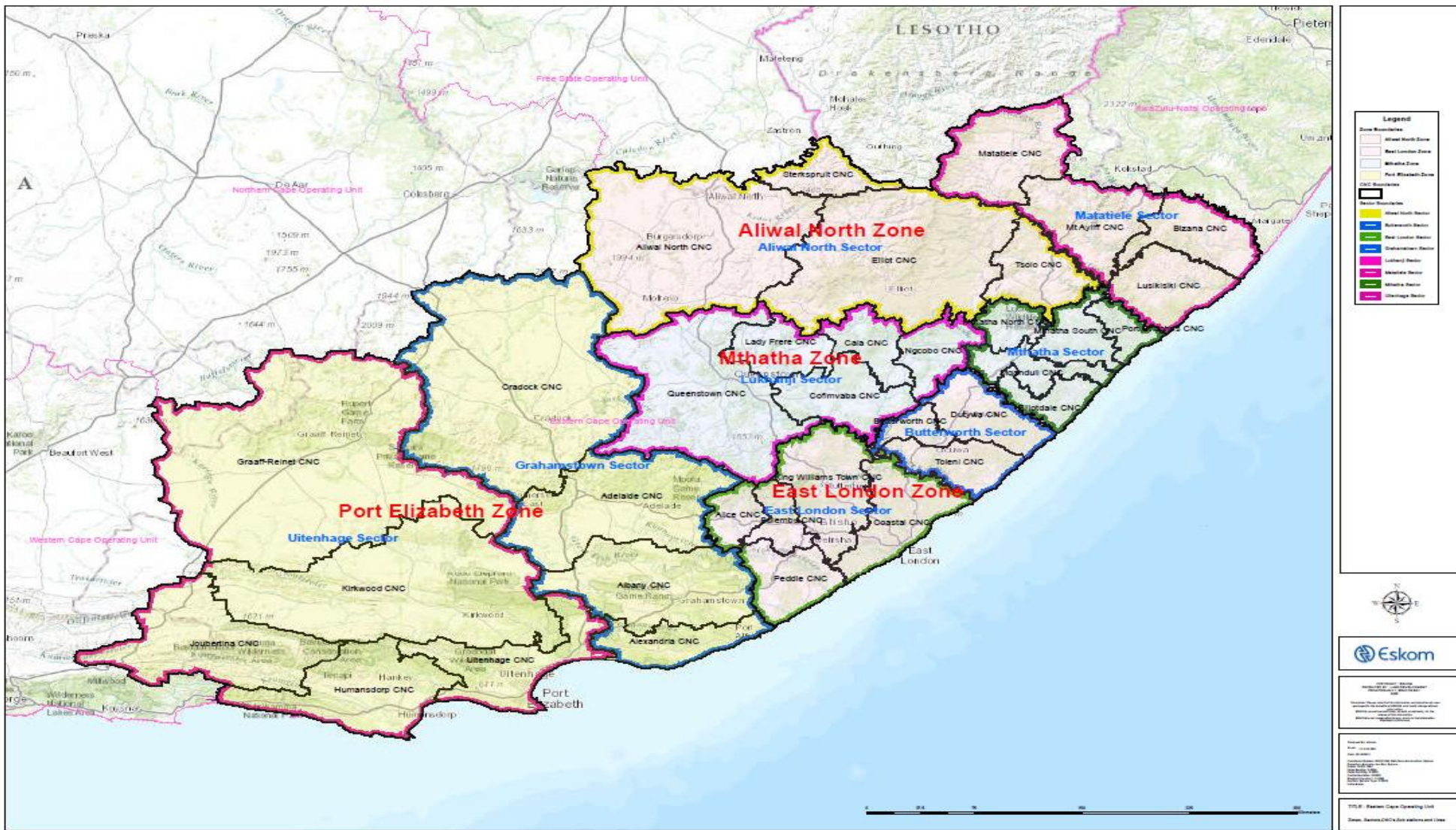


Figure 1: Distribution Division in the Eastern Cape Operating Unit (Geographic Information Technology, Company)

3.4. Research population

3.4.1. Sampling process

Sampling involves the gathering of data from several units that represent a research project's population (Vijayalakshmi & Sivapragasam, 2019; Creswell *et al.* 2007; Leedy & Ormrod, 2018). Similarly, Stratton (2021), suggests that when a population is large, sampling is applied to represent the target population. Therefore, the quality of the research findings and results depends on the type of research strategy used (Kipfer, 2021). In this research, a stratified random sampling approach was applied. The total sample population of 510 (N). The strata were divided between 10 managers, 42 supervisors, 8 engineers and 450 operators were selected across the various sectors in the Eastern Cape Operating Unit (ECOUC). The size of the sample from the population was 294 participants who responded to the questionnaire. The application of the stratified random sampling gives the best representation of the population (Murphy, 2019). It is extensively applied for processing estimate interrogations (Nguyen, 2021). Similarly, Zaman (2021), suggests that the stratified random sampling technique ensures accuracy of the estimation. Liu and Pontius (2021), advises that stratified random sampling is more effective than simple random sampling.

The focus of this study was on the M&O environment because of (1) its nature of business; (2) its rate of incident occurrence as per the SAP EH&S Incident Management database. For the purposes of this research project, the selected departments within M&O are Customer Network Centres (CNC), Power Plant Maintenance (PPM) and Energy Protection (EP). These departments are scattered across eight sectors, namely: East London Sector, Butterworth Sector, Uitenhage Sector, Grahamstown Sector, Lukhanji Sector, Aliwal North Sector, Matatiele Sector and Mthatha Sector. Amongst the sectors, there are a total of 36 CNCs, 4 PPM departments and 3 EP departments.

Participants were selected from a total population of 510 (N) participants was selected, which included 10 managers, 42 senior supervisors, 8 engineers, and 450 operators across the sectors in Eskom ECOUC and a sample of 294 (n) responded to various sections of the questionnaire. The key to achieving realistic and accurate results is to sample a large size examining the objectives of the research, if there is similarity in activity. The targeted candidates were deemed to be most knowledgeable and experienced respondents in their departments. In the absence of a senior supervisor on site, a full delegation of authority was given to the technician or work coordinator, such a person would as also be part of the sample. Essentially, this sample provides

95% confidence interval of the sample size to confirm the success of the research. According to Morey et al. (2016), the confidence interval (CI) is a “guide to which parameter values are plausible or reasonable”. The tolerance interval is the amount of error which can be tolerated (Sample Size Calculation, 2020). Goodman et al. (2020), state that “The confidence levels provide a first-order method for internal quality assessment to determine the physical extent of where and to what degree model output is considered valid”. A research study with a low confidence level is of less valid compared to one with a higher confidence level (Caldecott, 2020). In this study, it is presumed that the confidence coefficient provided 95% plausibility of the population.

3.4.2. Inclusion criteria

The M&O department performs the core function of the ECOU. Most health and safety incidents within the company emanate from the M&O department. Therefore, the department with a large volume of health and safety incidents was selected for this study. The M&O department consists of eight sectors, namely: East London Sector, Butterworth Sector, Uitenhage Sector, Grahamstown Sector, Lukhanji Sector, Aliwal North Sector, Matatiele Sector and Mthatha Sector. Amongst the sectors, there is a total of 36 Customer Network Centres (CNCs), 4 Power Plant Maintenance departments (PPM) and 3 Energy Protection departments (EP). See Table 3. As part of the sampled populations, workers within the eight sectors in M&O were selected as participants in the task observations conducted and survey. These workers This worker selection included only operators as they are the ones mostly involved in safety incidents, as well as that they are working in the field where the safety communication methods and controls are expected to be practiced.

Table 3: M&O sectors

Sector (s)	East London	Butterworth	Uitenhage	Matatiele	Lukhanji	Aliwal North	Mthatha	Grahamstown	Total
CNC	4	3	5	6	4	5	5	4	36
PPM	1		1			1	1		4

EP	1		1		1		3
Total number of areas							43

3.4.3. Exclusion criteria

The Safety, Health, Environment and Quality department (SHEQ); as well as the Asset Creation department (AC); and the Business Integration and Performance Management department (BIPM) were excluded because they serve as support structures for the M&O department and experience a negligible number of incidents. The workers in the SHEQ, AC and BIPM departments were excluded in this study as they are rarely involved in safety incidents.

3.5. Data collection methods

Data collection refers to first-hand gathering of primary data through site visits and the gathering of secondary data through the withdrawal of data from a data system (Kumar, 2014). This approach involves gathering and evaluating information from various sources to form an accurate view of an area of interest (Rouse, 2016). In this research, the Systems, Applications and Products in data processing of Environmental Health and Safety (SAP EH&S) incident management system were used to collect quantitative data on health and safety incidents which have occurred within the selected departments of the Eskom ECOU. It is intended to manage all environmental, health and safety incidents from the time of occurrence to the processing of the incident, to the action of corrective measures, until the incident is completely managed and closed out. Abele et al. (2006), state that the SAP EH&S incident management system is used for continuous tracking of a health and safety incident from the time of capture to the time of close out of the incident. This system is used to capture, store, and draw reports and information on the health and safety incidents (Butler & McGovern, 2012). This software is fundamental in assisting with the analysis of occupational health and safety incidents and safety performance across the eight sectors, PPM and EP of the Eskom ECOU from 01 January 2015 until 31 December 2019. The reason for this timeframe was to enable the researcher to quantify the collected health and safety incident statistics. Additionally, many serious incidents occurred in Eskom ECOU within this timeframe, where workers were severely injured. Therefore, an assessment carried out within this timeframe to establish whether there is a positive or negative

link between incident occurrence and the effectiveness of communication to prevent injury and/or incidents is justified.

A set of questions which included open-ended, closed-ended and statements were distributed to the participants to enable the researcher to collect data without any influence on the participants. The research questionnaire evaluated the respondents' views on the workplace health and safety matters. Eltiti et al. (2007), explain that a questionnaire is designed to evaluate the degree of agreement of the participant with the said statement. The researcher distributes the questionnaire to the respondents for them to respond to the research questions (Jenn, 2020). Researchers also use questionnaires to collect data from respondents at different geographic areas (Questionnaire design sample, 2021). In completing a questionnaire, the respondent is afforded the opportunity to comment on specific topics (Allen & Seaman, 2007). In this research, the questionnaire consisted of open-ended questions, closed questions, and statements, as set out in Appendix 4. In an open-ended question, the respondent is not exposed to predetermined responses, whereas, in a closed-ended question the respondent is subjected to a predetermined response. The sampled population received the questionnaire and formed part of the respondents in the survey.

The questionnaires were distributed to managers, supervisors, and engineers via email, as this method is cheaper, simple to manage and not time consuming. The questionnaire was hand-delivered by the researcher to the operators as they have no access to email. During the completion of the questionnaire, the respondents were assisted by the researcher without undue influence on their responses. The questionnaire consisted of open-ended questions, closed questions, and statements. The statements in the questionnaire used the Likert scale method as it involved a series of statements to which the participants could select a rating (Ivanov *et al.* 2018). The Likert scale measures the participants' opinions by providing them with a statement and requesting them to rate the degree of agreement or disagreement with the statement (Barua, 2013). In this research, a 5-point Likert scale was applied. The 5-point Likert scale is easier to understand and makes the questionnaire quick for the respondents to complete (Newson, 2021).

Another instrument used to collect data was task observations on workers while performing work. The task observations were conducted by the researcher at various sites. Task observations are classified as primary research methods aimed at collecting first-hand data for the studied subject, rather than obtaining data from secondary research found in books, databases, or journals (Driscoll, 2011; Kielhofner & Mallinson, 1995). Direct task observations are important as they allow the observer to measure the competency on the persons observed

and create an opportunity for the observed persons to learn from any identified incompetency (De Jonge *et al.* 2020). Ste-Marie *et al.* (2020), affirms the effectiveness of task observations in providing evidence-based information. The intent of the task observations was to gather evidence on whether workers perform their functions in accordance with task manual and safety procedures. Site visits were conducted by the researcher, with at the sampled department in M&O. The observations were conducted on operators, as their response to the methods of communication has a direct impact on the occurrence of incidents in the company. The observation checklist used during site visits is attached as Appendix 3.

3.6. Pilot study

Generally, a pilot study involves testing the research methods to be applied on a larger population sample on a small sample. Doody and Doody (2015), suggest that a pilot study affords the researcher an opportunity to improve on the necessary skills before commencing with the large-scale research. Fundamentally, the purpose of a pilot study is to test the viability of the approach intended to be used on a larger scale (Porta *et al.* 2008). Williams-Mcbean (2019), emphasizes the importance of a pilot study in refining research protocols and anticipating possible challenges before conducting research. When well designed, a pilot study can assist to identify and overcome challenges to ensure a successful design (Fairhurst *et al.* 2019). Therefore, a pilot study is an important phase of the research project, but its intent should not be confused with the hypothesis testing study. Leon, Davis & Kramer (2011), argue that the results of the pilot study “can inform feasibility and identify modifications needed in the design of a larger, ensuing hypothesis testing study”. In this research, a pilot study was conducted to test the reliability by collecting data, using the research questionnaire, from a small number of participants, prior to the implementation of the actual research to test the data collection tools. According to Leon, Davis & Kraemer (2011), the pilot study is a mandatory initial step in examining the intended research method.

Determining the appropriate sample size is essential in illustrating accurate conclusions from the findings of the research (Memon *et al.* 2020). The use of an incorrect sample size can mislead the findings and lead to approval of untrue results (Charan *et al.* 2021). Similarly, Stevenston (2021), suggest that it provides approximate minimum values for observations which must be conducted during the research study. Whitehead *et al.* (2016), recommends that a sample size should be calculated at optimal solutions when the standardized effect of the main population sample is known. However, this is not always known. For this reason, 5% of the total number of operators was considered for the pilot study. In this research study, the

questionnaire was piloted to 24 respondents to test the reliability of the how the respondents understood and interpreted the questions of the survey using. Since the questionnaire is new, it was critical for it to be tested for feasibility.

When the pilot study was conducted, clear understanding of the questions was determined. Thabane et al. (2010) and Leon et al. (2011), the results of the pilot study will be incorporated into the main study if there is no change in the methodology. There were no changes made to the methodology collection of data. As such, the results of the pilot study were incooperated into the total sample of the study.

3.7. Study variables

Two variables were recognized for this research project namely,

- Health and safety communication as the independent variable (X)
- Health and safety incidents as the dependent variables (Y)

A variable is a general phenomenon that is likely to vary or change. According to Flannelly, Flannelly & Jonkawski (2014), a variable is a rational assembling of attributes whose characteristics are common, to describe an object. Helmenstine (2020), suggests that a variable “can be controlled, changed or measured in an experiment”. The common attributes can include age, beliefs and/or environment. The variable can be independent (X) or dependent (Y).

Generally, a dependent variable is where the effect of any other variable is absorbed. Tate et al. (2019), describes a dependent variable as an “outcome variable”, in that it yields to the actions of one or more other variables or that it is the outcome of “any outcome variable associated with some measure, such as a survey”. Furthermore, the dependent variable considers and measures the independent variable (Welman, Kruger & Mitchell, 2005). In this study, the variables were identified by that the independent variable (X), which is the health and safety communication at the workplace caused a change in the occurrence of health and safety incidents at the company, this being the depended variable (Y). The questionnaire and the task observations were used assess the methods of health and safety communication at the workplace, their implementation in the company, as well as their understanding by the workers. The health and safety incidents were used to assess the types and cause of the incidents at the workplace. Fundamentally, the relationship and dependence between two variables is a crucial factor of determination for this study. The effect will be rejected if there is no evidence of dependence and relationship between the two variables. However, the effect will be accepted

if there is evidence of a relationship or dependence between the two variables, whether it is positive or negative.

3.8. Data analysis

According to Spiggle (1994), data analysis involves seven operations, namely: “categorization, abstraction, comparison, dimensionalization, integration, iteration, and refutation”. It involves the review of previous data to make predictions for the future (Islam, 2020). Furthermore, the analysis of data helps to clarify the correlation between variables (Loftus, 2022). The fundamental reason for data analysis is to evaluate the association between the dependent variable (Y) = health and safety incidents and the independent variable (X) = health and safety communications. O’Connor and Gibson (2003), suggest that effective data analysis is assisted by the representation of collected data, provided that its focus allows for the viewing of facts in an area and is arranged systematically to answer the research questions and objectives. The data collected for analysis can be sourced from various places, such as internet, old records associated with the data to be analysed (Durgevic, 2020). The data analysed for this study was collected from SAP EH&S, task observations and questionnaire. The analysis of this data clarified the connection between documented procedures and processes versus the practical on-site evidence.

Quantitative data analysis involves the numeric coding of similar data. The incident occurrence data was collected from the SAP EH&S Incident Management System. The SAP EH&S incident management system is a computerized software used in the life cycle of environmental, health and safety incidents. In this system, health and safety related incidents are captured, stored, and withdrawn. This record of data is from the specific time of incident occurrence, the time and date of capture and process, including the management of implementation of corrective measures, until the incident is completely managed and closed out (Abele *et al.* 2006; Butler & McGovern, 2012). The SAP EH&S incident management software assisted in analysing health and safety incident data from 2015 until 2019. The selected dates enabled the researcher to quantify the health and safety incident statistics. This data was presented in graphs and pie charts. The graphs and pie charts were used to illustrate the findings of the research, from the data collected from the EH&S incident management system, questionnaires, and task observations.

The data collected was programmed and analysed using the Statistical Analysis Software 14.2 (SAS). The Shapiro-Wilk test was performed to investigate the distribution of continuous data. During the analysis of data, if the $p < 0.05$, there was a significant difference between the proportions. If the $p >$ or $=$ to 0.05 there was no significant difference between the proportions.

3.9. Reliability and validity

Reliability is the extent to which the measured results can be depended on for accuracy. Mohajan (2017), argued that reliability is concerned with the confidence that one has on the data obtained with a measuring tool. Bernard (2017), suggests that reliability is demonstrated when one obtains consistent results using a measuring apparatus more than once. According to Heale and Twycross (2015), reliability refers to the “consistence of measure”. Similarly, reliability indicates consistency in the measured values attained through repeated measuring under the same circumstances (Sürücü & Maslakci, 2020). Consistent and reliable data was collected using a questionnaire. Additionally, the observations based on workers’ behaviour provided reliable data on how workers respond to health and safety communication. The consistent reporting and capturing of incidents onto the SAP EH&S system showed reliability of the incident data. In this study, consistent and stable results were obtained from the pilot study, which indicated no need was required to amend the questionnaire after the pilot study. As such, the results produced during the pilot study were reliable enough to include in the main study.

Validity refers to how sound and factual the research study is. Heale and Twycross (2015), suggests validity as “a concept is accurately measured in a quantitative study”. Likewise, Moharaj (2017), argues that validity relates to the instrument used for measurement and its accuracy in measuring. The precise interpretation of the data analysed determines the validity of the data (Sürücü & Maslakci, 2020). In this study, there were 294 questionnaires completed by the managers, supervisors, engineers, and operators. The value and validity of the reached a level that was acceptable and enabling the research to draw conclusion. The responses from the questionnaire and task observations were categorized into the various research concept, upon which analyses provided a clear view of the responses and the concepts. The task observations and responses from the participants were categorized into the following concepts, the type of incidents; the methods of safety communication; and the understanding of the safety messages by the workers. The participants responded to all questions on the questionnaire. These questions were set out to respond to the research objectives.

3.10. Ethical considerations

Ethics clearance was received from the Health Sciences Research Ethics Committee at the Central University of Technology. The ethical clearance number is UFS-HSD2020/1714/2302. Written permission was granted by the company (Appendix 1) prior to the commencement of the study.

Prior to participating in the task observations and answering the questionnaire, participants were provided with an informed consent form which stipulated what the research study was about and its intent, potential risks, and benefits of the study, as well as their right to withdraw from the study at any time. The conclusion and recommendations of this study served to assist and provide guidance to the company in improving its health and safety communication methods to reduce incidents.

3.11. Conclusions

In this chapter, the research design and methodology were presented to clarify the research approach. In this research study, a quantitative research method was used, and data was collected and analysed. Thereafter, the data was programmed and analysed using SAS. The research population, data reliability and validity were explained. The ethics clearance was received from the Health Sciences Research Ethics Committee at the Central University of Technology and approval was sought and obtained from the Eskom ECOU. Consent was also sought from the participants who took part in the study. The findings of the study will be presented in the next chapter.

CHAPTER 4: RESULTS

4.1. Introduction

This chapter focuses on the description of the workplace incidents from the data collected through SAP Environmental, Health and Safety (EH&S) Incident Management System, the responses of the participants to the questionnaire and the researcher’s observations while the workers were carrying out their tasks. The findings are analysed in relation to the objectives of the research.

4.2. Demographics

Figure 2 shows the areas where the questionnaire was distributed, with Mthatha sector being the highest in the percentage of participants in the survey (17%). East London sector took the second position, at 13.6%, on the percentage of respondents to the survey. The Matatiele and Uitenhage sectors were at equal percentages (12%) each. There lowest percentage of respondents presented was from Energy Protection (4.1%).

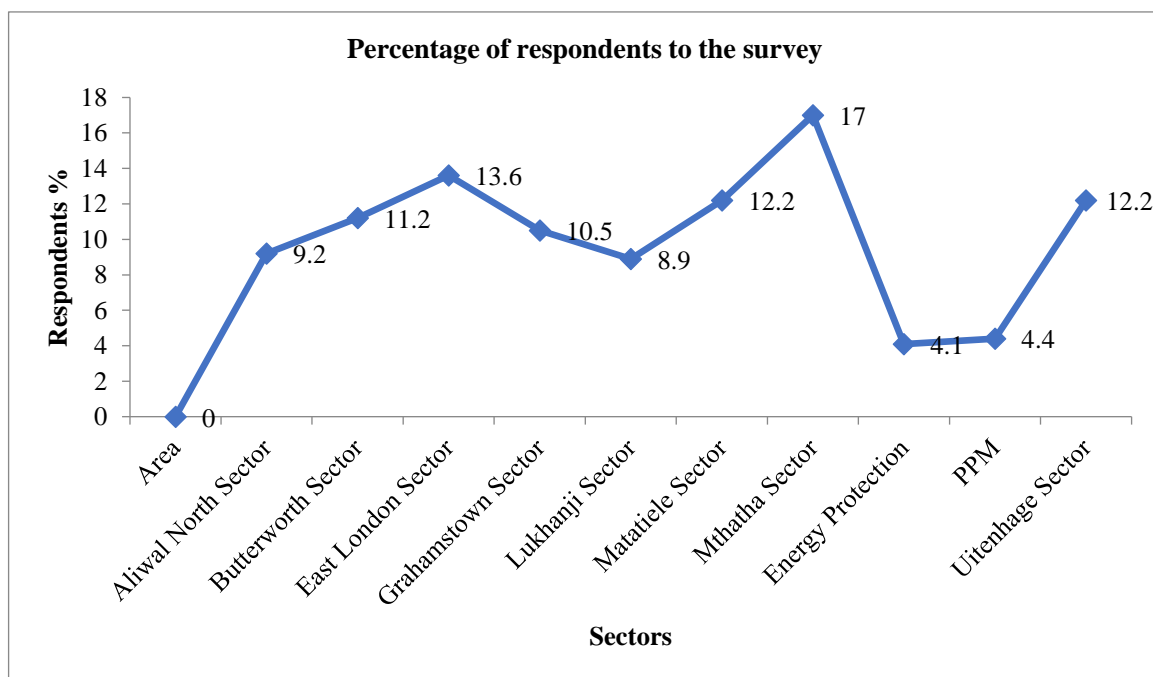


Figure 2: Percentage of respondents to the survey in various sectors

As shown in Figure 3 operators accounted for a significant percentage of participants (90.5%) while supervisors and managers accounted for 6.1% and 3.4%, respectively.

In terms of the Shapiro-Wilk test for normality, the distribution of the years worked and ages of workers in the departments do not follow a normal distribution ($W = 0.887, p < 0.0001$ and $W = 0.95, p < 0.001$, respectively). Consequently, the mean and standard deviation are reported.

As shown in Table 4, the workers’ average years of experience was 11 years. Table 5 shows that the average age of the workers was 39 years.

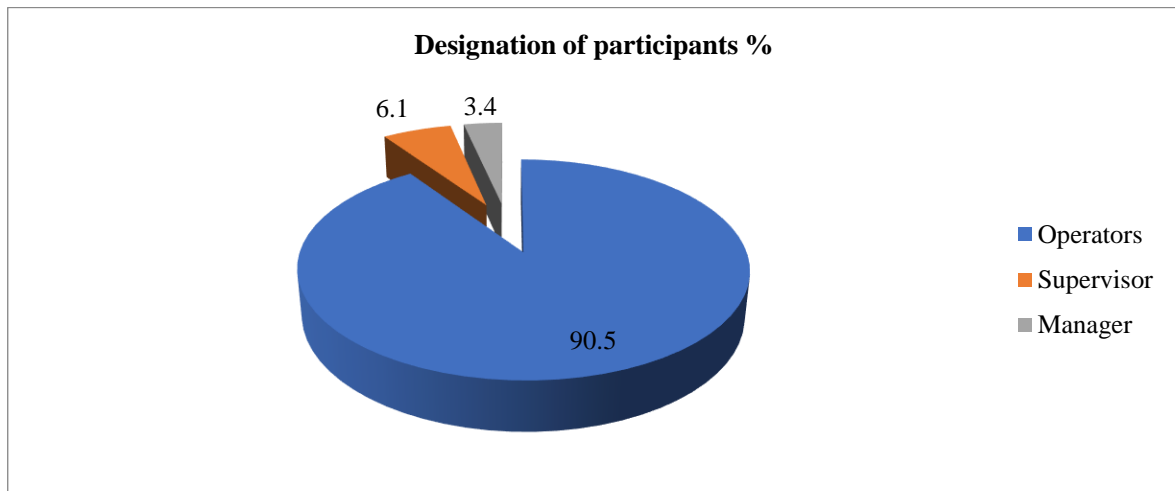


Figure 3: Designation of participants

Table 4: Worker’s average experience and age

	Years of work experience					
	N	Median	Lower Quartile	Upper Quartile	Minimum	Maximum
Workers average years	294	11.00	8.00	17.00	1.00	43.00
Average age	293	39.00	34.00	47.00	18.00	65.00

4.3. Health and safety incidents data

As shown in Figure 4 there are four dominant sectors regarding health and safety incidents, i.e., Lukhanji, Mthatha, Aliwal North and the Matatiele Sector. The Lukhanji (24.8%) and Mthatha Sector (18.1%) have contributed significantly to the frequency of health and safety incidents over a five-year period. The lowest scoring sectors were Grahamstown (6.5%) and Uitenhage (5.0%) Sectors, while the departments with the lowest scores were Power Plant Maintenance Transformers department (1.1%), Power Plant Maintenance department Auxillaries (0.3%) and Energy Protection (0.2%). The percentages of incident occurrence in East London Sector and Butterworth Sector were quite similar at 8.3% and 9%, respectively.

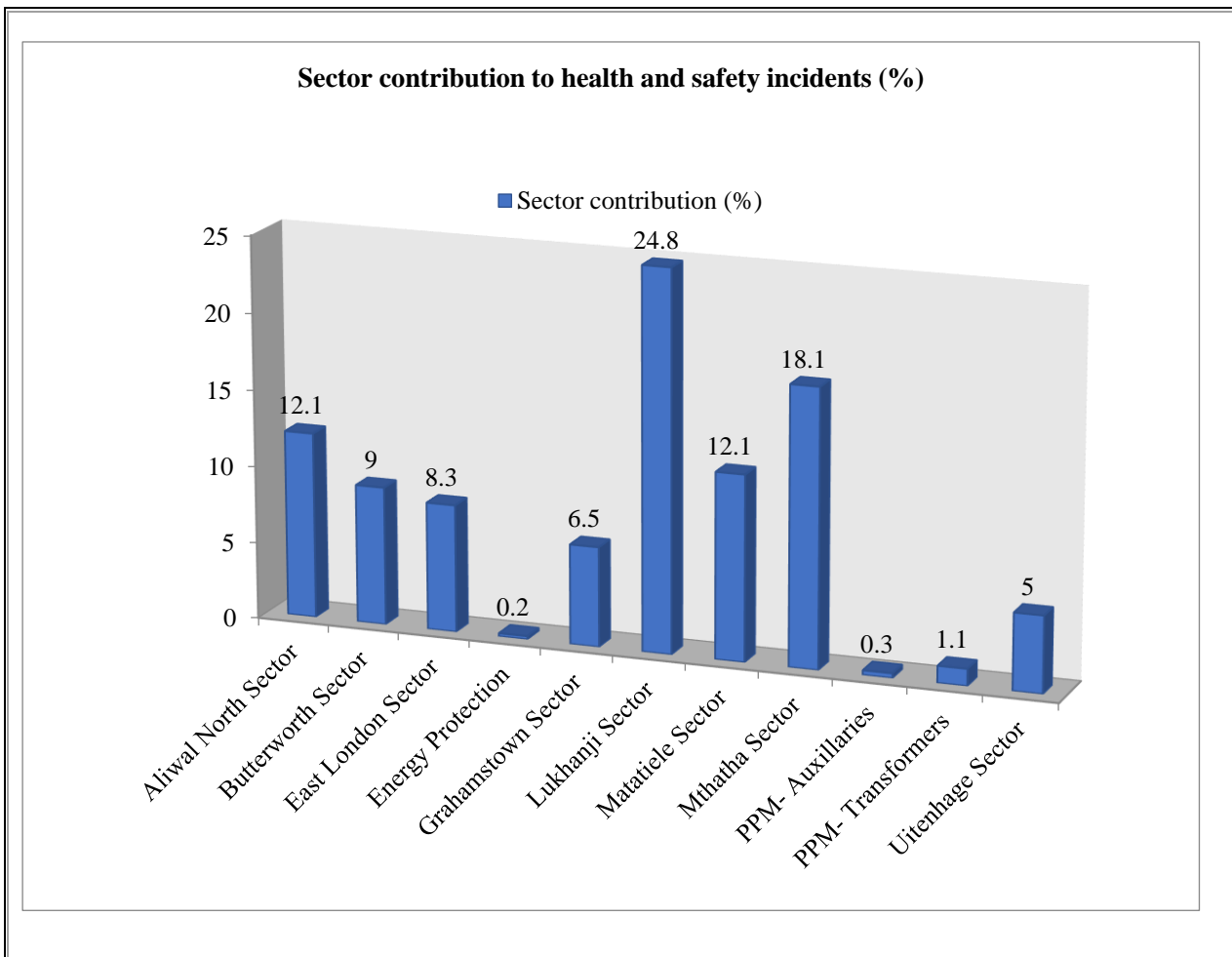


Figure 4: Frequency of health and safety incidents in the Eastern Cape Operating Unit

Figure 5 shows that most motor vehicle incidents occur in the Mthatha Sector (86.5%), Aliwal North Sector (83.8%), Lukhanji Sector (82.9%) and Matatiele Sector (79.7%). The hand injuries are reported to be the highest type of injuries in the ECOU, with PPM Transformers leading at 28.6%.

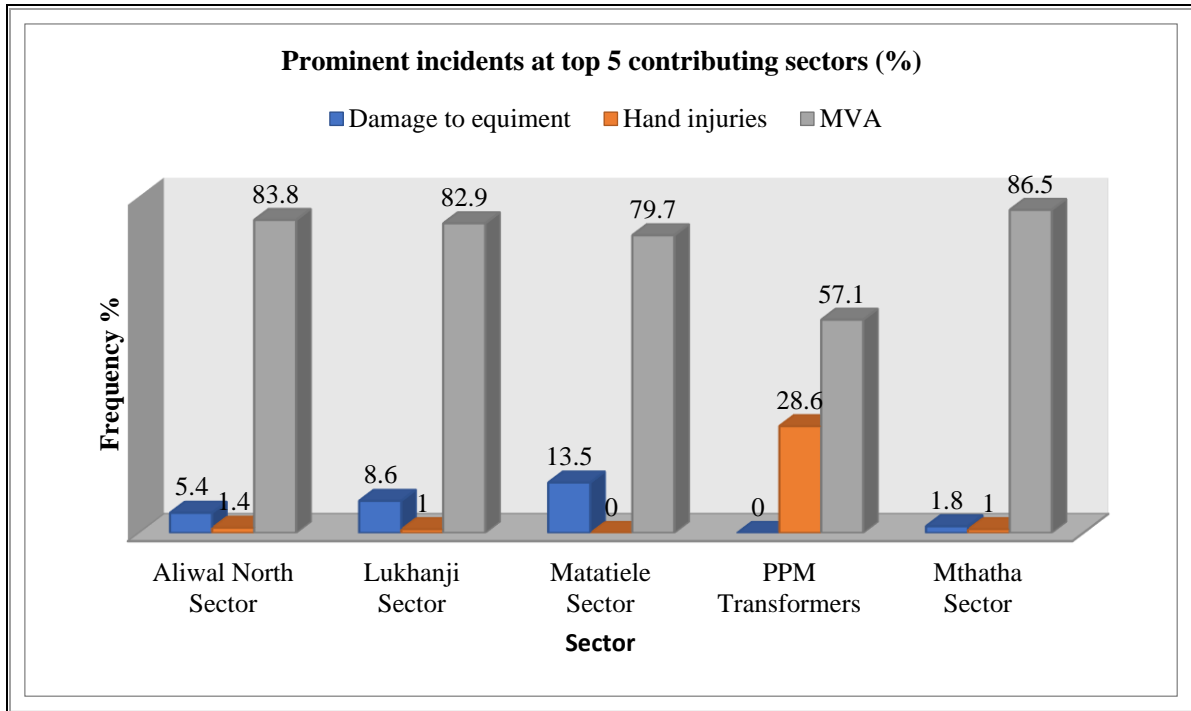


Figure 5: Prominent incidents at top 5 contributing sectors

Figure 6 shows that hand injuries due to unsafe issues inherent in the equipment and workers deviating from procedures had an insignificant contribution to the occurrence of hand injuries (0.2%). The major contributor to hand injuries emanated from workers not wearing personal protective equipment (1.1%). Figure 7 shows that the highest cause of damage to equipment incidents was the negligence of workers (3.3 %), followed by unsafe equipment (2.1%). Deviation from procedure and workers ignoring the rules, accounted for small percentages of damage to equipment incidents (0.8% and 0.7%, respectively). Figure 8 shows that 65.2% of all motor vehicle incidents resulted from the negligence of drivers. In contrast, it is reported that only 2.4% motor vehicle accidents occurred due to safety issues inherent in the vehicle.

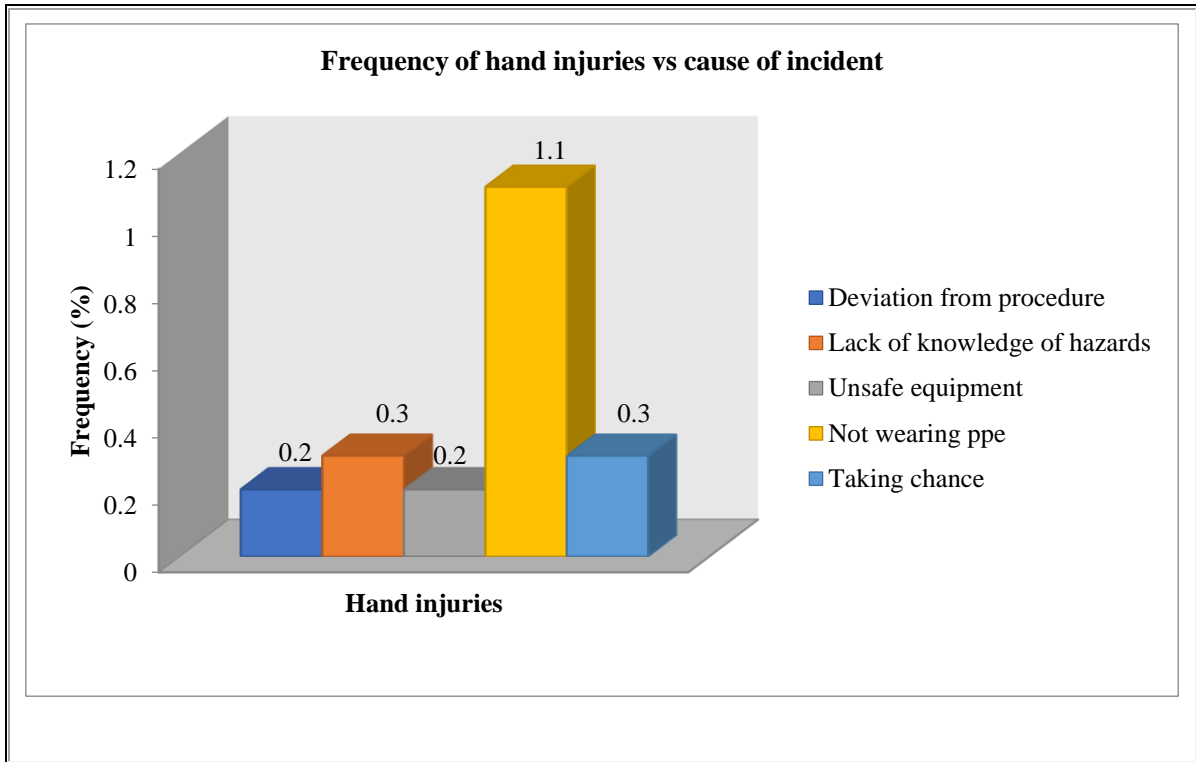


Figure 6: Frequency of hand injuries vs incident cause

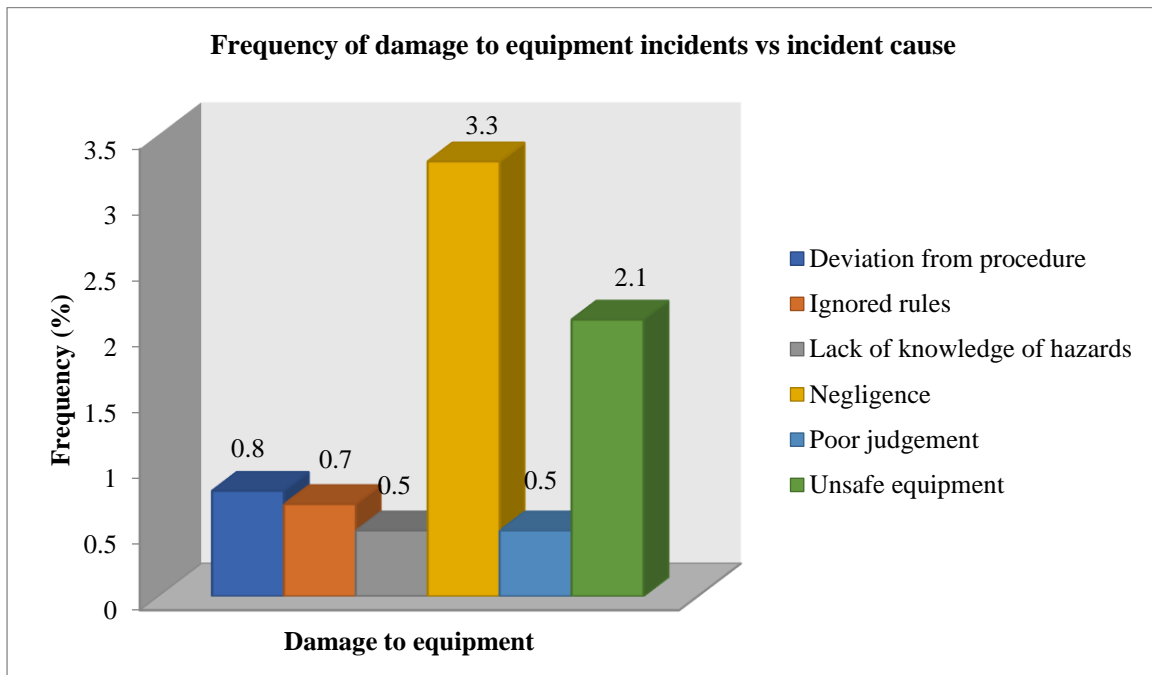


Figure 7: Frequency of damage to equipment incidents vs incident cause

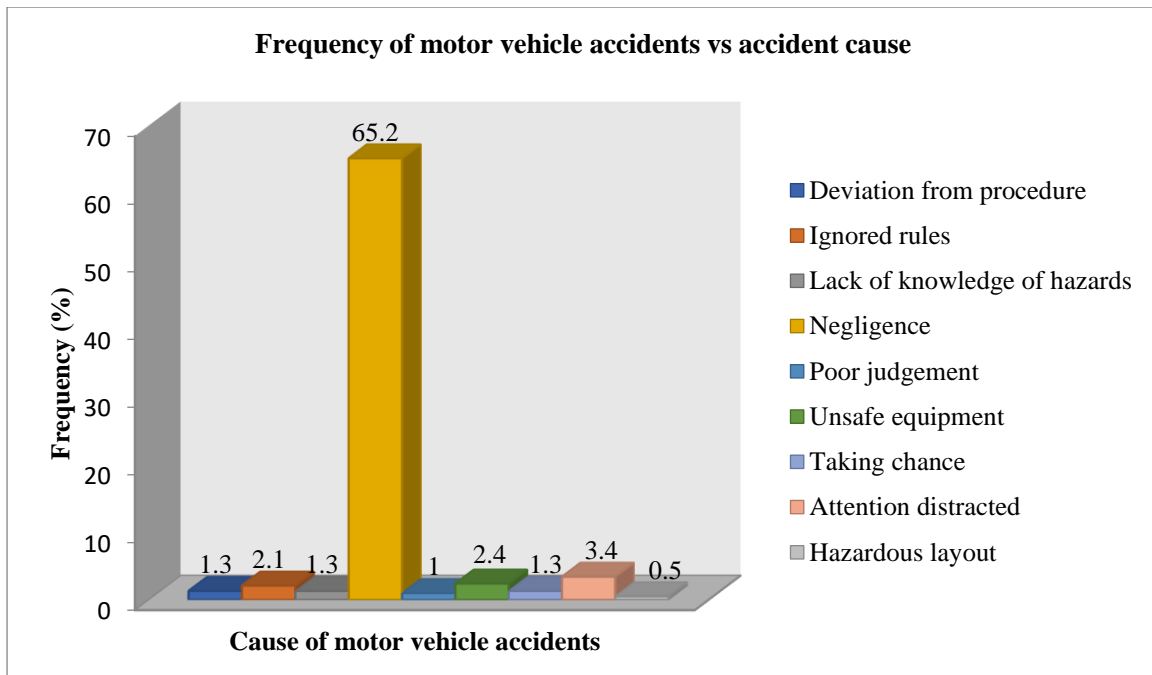


Figure 8: Frequency of motor vehicle accidents vs incident cause

Figures 9 a-b present the frequency of specific causes of incidents at sectors. Figure 9a shows that the more prevalent cause of incidents in the Aliwal North Sector is negligence (78.4%). Non-wearing of personal protective equipment (1.4%) accounted for a low percentage of health and safety incidents in this sector. The leading cause of incidents in the Matatiele Sector, as shown in figure 8b, is negligence (58.1%). This cause is followed by distraction on the worker's attention at 8.1%. A relatively low percentage for incidents inherent from unsafe equipment was reported at 4.1%. Figure 8c shows that in the Mthatha Sector, the negligence of workers was reported as the predominant cause of incidents (73.9%)., Unsafe equipment was reported as the second most common cause of incidents in the Mthatha Sector (7.2%). Health and safety incidents resulting from workers taking chances accounted for an insignificant percentage (0.9%).

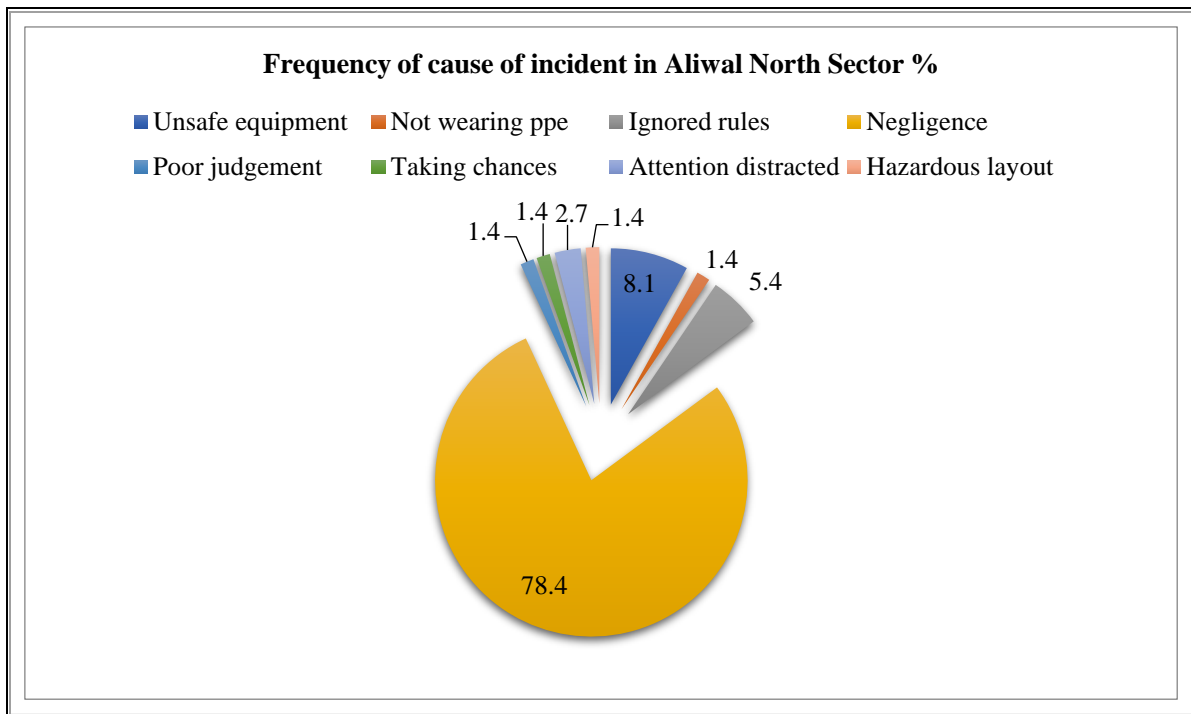


Figure 9: Frequency of cause of incidents Aliwal North Sector

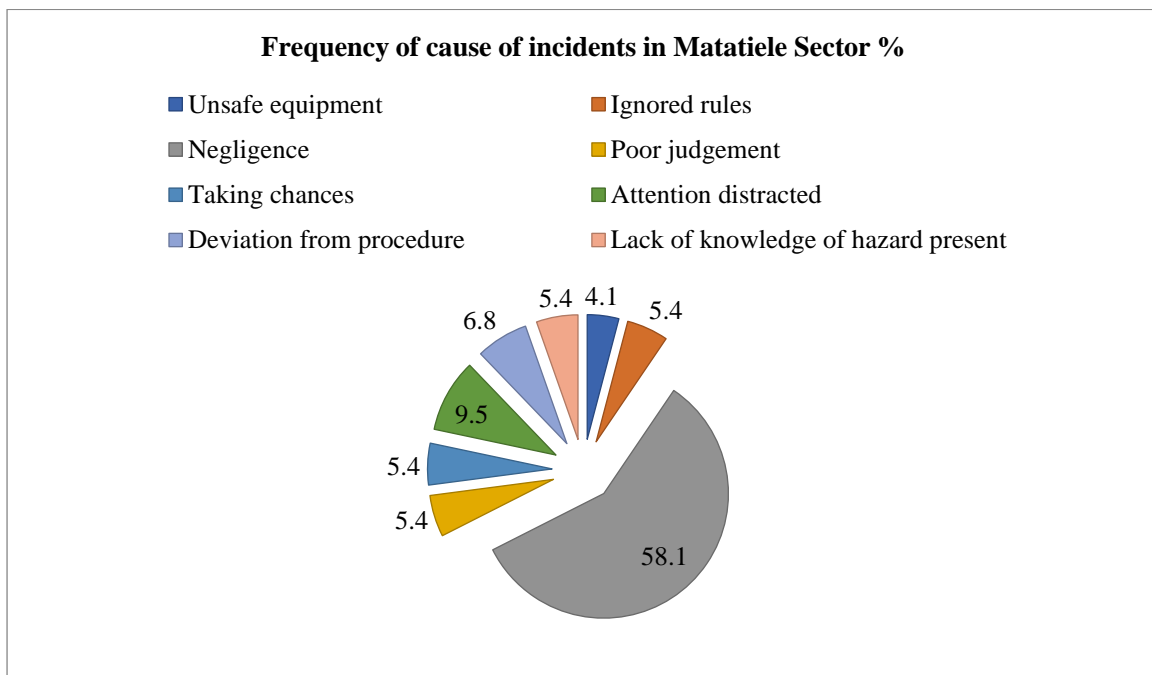


Figure 9 a.: Frequency of cause of incidents in Matatiele Sector

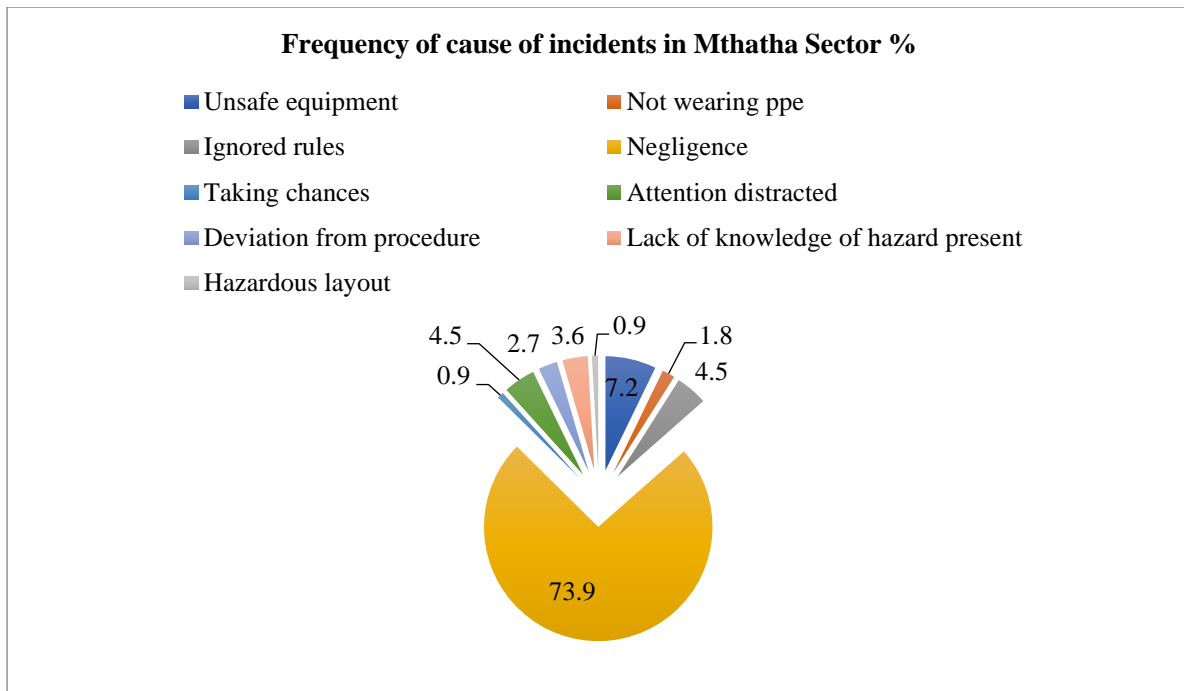


Figure 9 b: Frequency of cause of incidents in Mthatha Sector

Figure 10 shows a comparison of the four sectors in terms of negligence, which is the most frequent cause of health and safety incidents. Similar percentages were reported for Aliwal North and Lukhanji sector at 78%, followed by the Mthatha Sector at 74%. The Matatiele sector reported the lowest percentage of negligence as a cause of incidents at 58%.

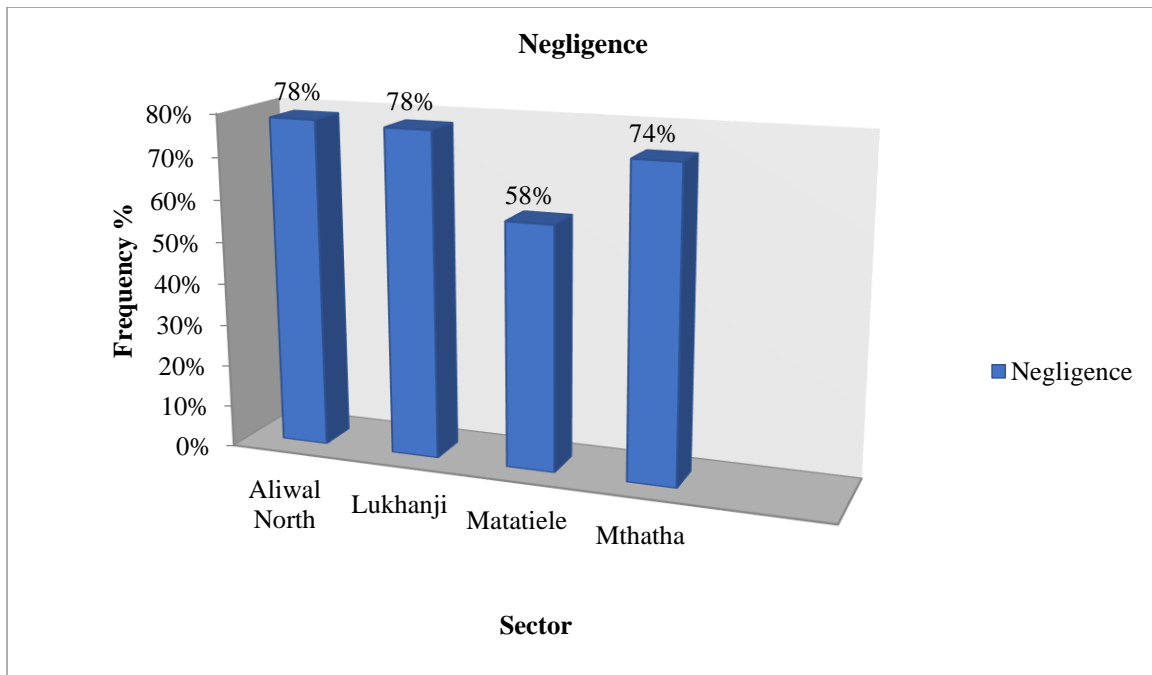


Figure 10.: Negligence at sectors

Table 5 illustrates that motor vehicle accidents were the most prominent type of incidents to occur over a five-year period, with a total of 482 accidents. Nonetheless, the motor vehicle accidents were reported to have decreased from 87.8% in 2015 to 68.3% in 2019. In 2018 and 2019, there was an increase in equipment damaged, from 1.9% in 2017 to 19.1% in 2019. Over a five-year period (2015 – 2019) a total number of 614 health and safety incidents were reported, with 2017 and 2018 having the least number of health and safety incidents (94 and 104, respectively).

Table 5: Incident type over 5 years (2015-2019)

Table of the type of incident by year						
Type of Incident	Year					
	2015	2016	2017	2018	2019	Total
Back injuries	0 (0.0 %)	0 (0.0 %)	2 (1.9 %)	0 (0.0 %)	0 (0.0 %)	2
Damage to equipment	5 (3.8 %)	6 (3.8 %)	2 (1.9 %)	11 (11.7 %)	24 (19.1 %)	48
Electrical contact	1 (0.8 %)	3 (1.9 %)	4 (3.9 %)	1 (1.1%)	2 (1.6 %)	11
Eye injuries	2 (1.5 %)	2 (1.3 %)	2 (1.9 %)	3 (3.2 %)	1 (0.8 %)	10
Fall from same level	1 (0.8 %)	1 (0.6 %)	1 (1.0 %)	1 (1.1%)	3 (2.4 %)	7
Hand injuries	3 (2.3 %)	5 (3.1 %)	0 (0.0%)	3 (3.2 %)	2 (1.6 %)	13
Insect/animal bite	1 (0.8 %)	4 (2.5 %)	3 (2.9 %)	4 (4.3 %)	1 (0.8 %)	13
Motor vehicle accidents	115 (87.8 %)	129 (81.1 %)	84 (80 %)	68 (72.3%)	86 (68.3 %)	482
Near miss	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	1 (0.8%)	1
Operating error	3 (2.3 %)	7 (4.4%)	3 (2.9%)	2 (2.1 %)	1 (0.8%)	16
Slip trip and fall	0 (0.0 %)	1 (0.6%)	2 (1.9%)	1 (1.1 %)	4 (3.2 %)	8
Struck by a moving object	0 (0.0 %)	1 (0.6 %)	1 (1.0 %)	0 (0.0 %)	1 (0.8%)	3
Total	131	159	104	94	126	614

Figure 11 shows that the frequency of motor vehicle accidents declined from 87.8% in 2015 to 68.3% in 2019. In contrast, damage to equipment incidents showed a significant spike from 2.3% in 2015 to 19.1% in 2019. A sudden surge in hand injury incidents was reported between 2017 and 2018. The incidents increased from 0% in 2017 to 3.2% in 2018. In the five-year period, animal and insect bite incidents were reported to be most prevalent in 2018 (4.3%). The frequency of operating error incidents decreased from 4.4% in 2016 to 0.8% in 2019.

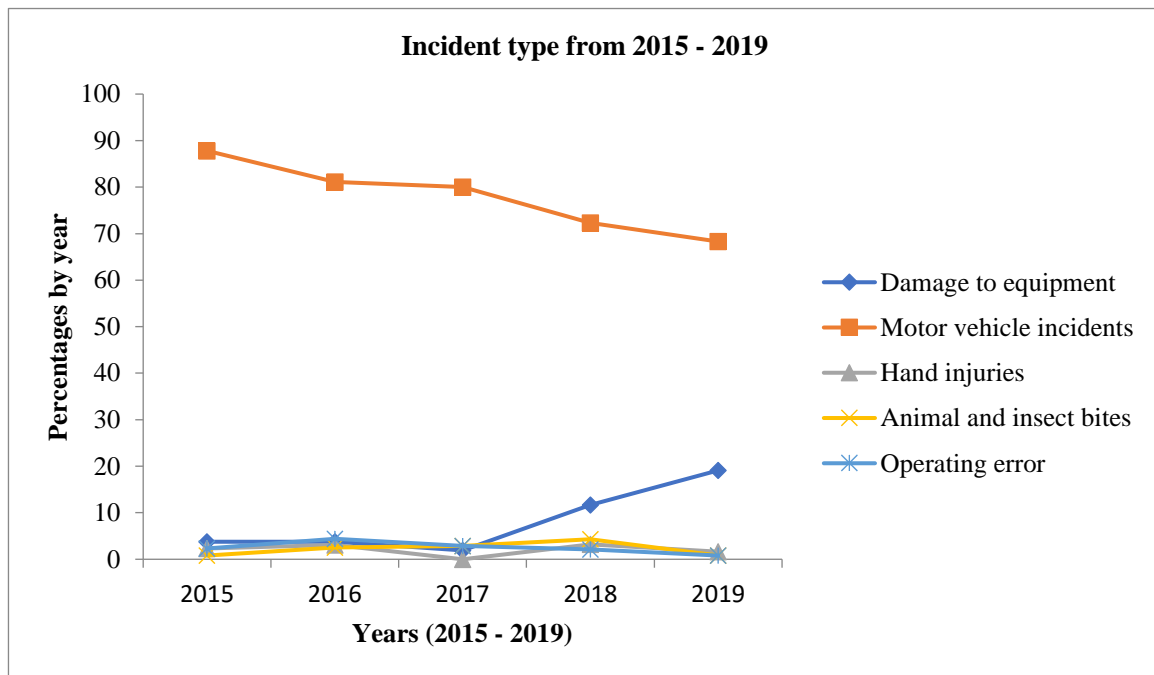


Figure 11: Incident types from 2015 – 2019

4.4. Results on observations

Figure 12 shows that an equal percentage (10%) of planned task observations were conducted at various sectors within the Eastern Cape Operating Unit, i.e., Aliwal North, East London, Grahamstown, Lukhanji, Matatiele, Mthatha and Uitenhage sectors, as well as in different departments, namely Energy Protection and Power Plant Maintenance departments and at an unknown department.

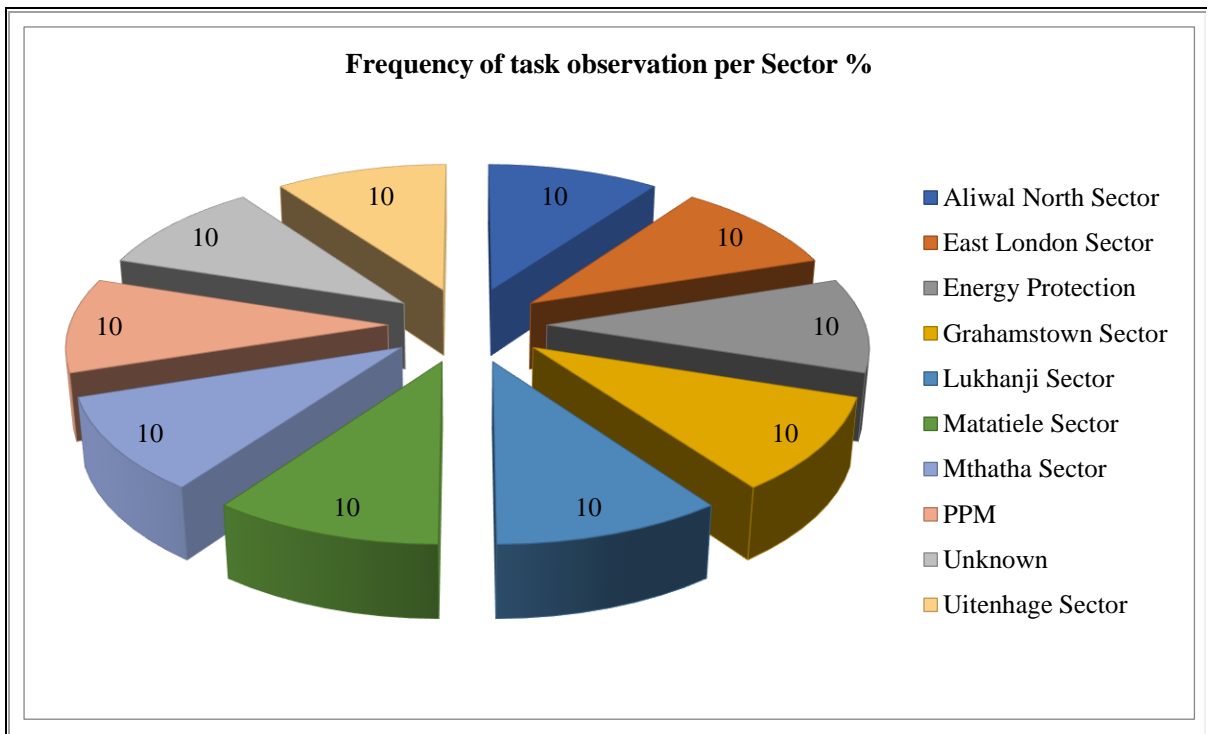


Figure 12: Frequency of task observation conducted

Figure 13 shows that many of the task observations conducted were on technical observations (40%). Workers designated as Senior Technical Officers accounted for 30% of the task observations conducted. The Principal Technical Officers accounted for 20% of the task observations conducted. Unidentified designations of workers were reported as the least percentage (10%) of task observations conducted.

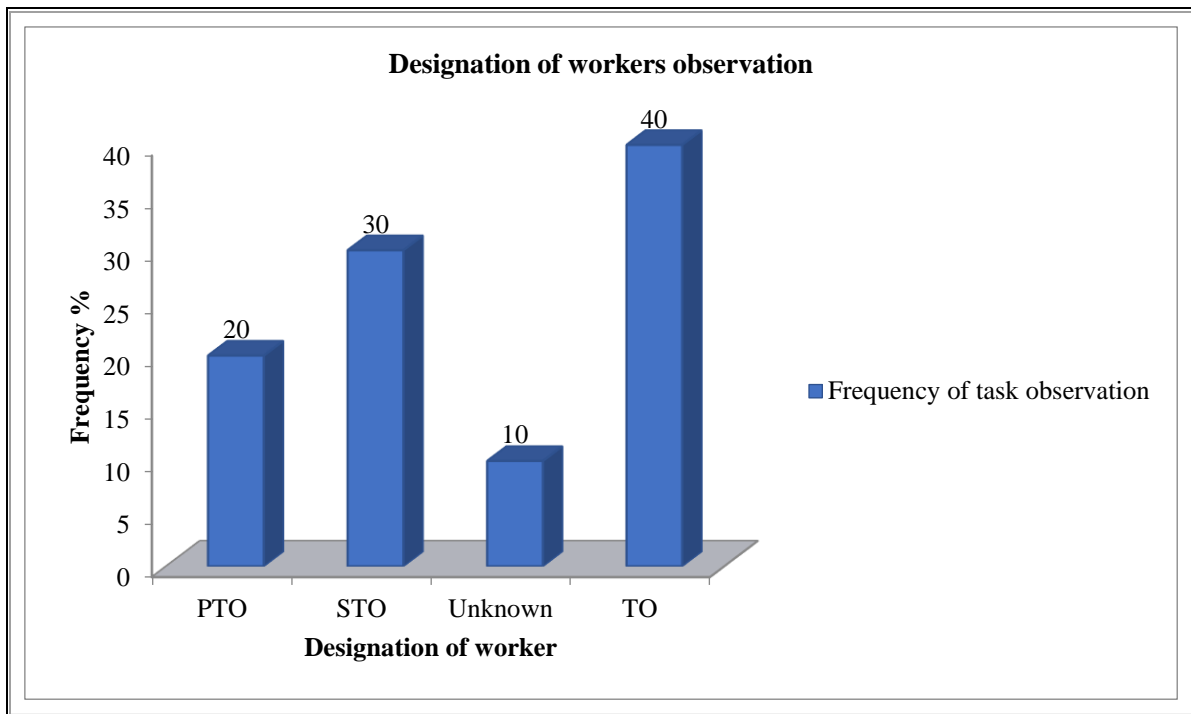


Figure 13: Designation of worker observed

Figure 14 below shows that the most predominant task observation conducted was on workers working at heights (20%). An equal percentage (10%) of task observation was reported for various tasks performed by the workers, i.e., driving, operating, removing breaker, replacing mosdorfer fuse carriers, medium voltage operating, replacing pole standing on the bucket, replacing fuse, and repositioning of pole.

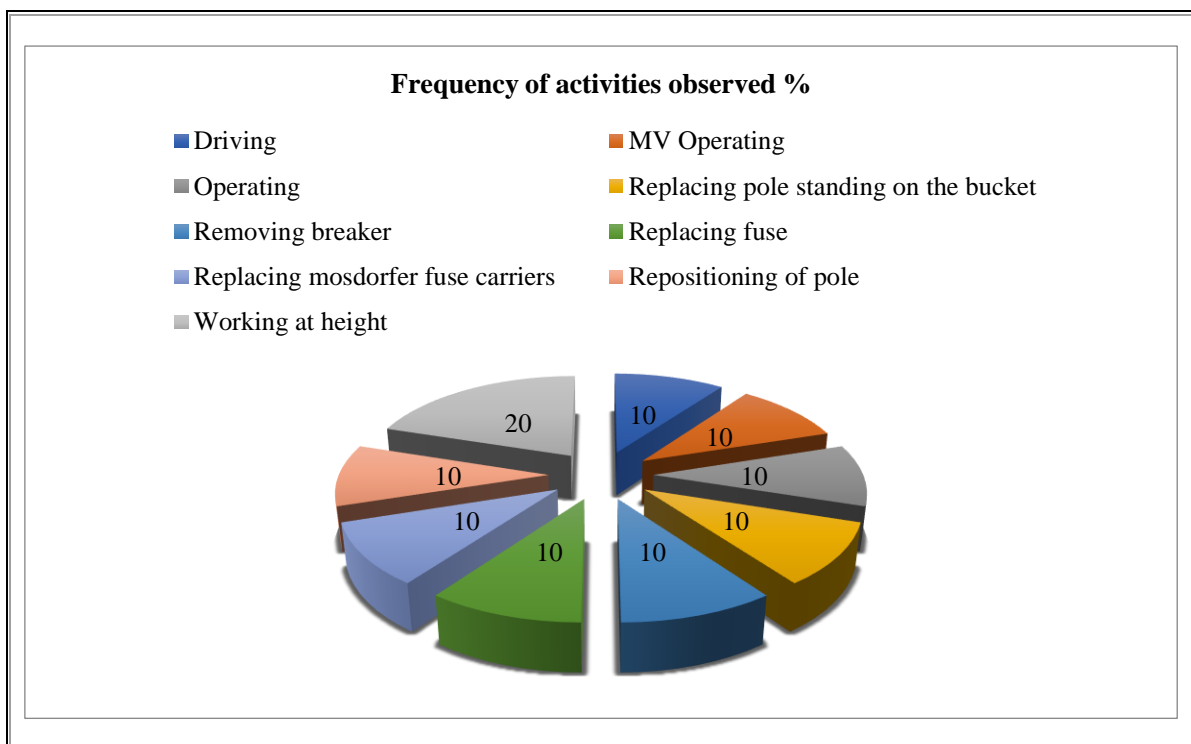


Figure 14: Frequency of activities observed

Figure 15 shows work performed above ground level. This type of work is classified as working at heights.



Figure 15: Worker performing a task while working at heights

Figure 16 shows the type of Fall Arrest System (FAS) used by workers when conducting work at heights.



Figure 16: Fall Arrest System

Table 6 shows that most workers are aware of the personal protective equipment required in the workplace (90%). Fewer workers reported that they were not aware of the required personal protective equipment required in the workplace (10%). Even though 90% of workers reported that they were aware of the personal protective equipment, 60% of workers reported that they did not wear the required personal protective equipment. In most instances, the personal protective equipment worn by workers was found to be in a suitable condition (60%).

Table 6: Observations on the wearing of personal protective equipment

Personal Protective Equipment	Yes	No	N/A
Is the worker aware of the required PPE?	9 (90%)	1 (10%)	0(0%)
Is all PPE worn?	3 (30%)	6 (60%)	1 (10%)
Is PPE in a suitable condition?	6 (60%)	1 (10%)	2 (20%)

Figure 17 shows the different types of personal protective equipment (PPE) worn by workers when performing various tasks. Hard hats, flame-retardant trousers, shirt and jacket, gloves and surgical masks are the type of PPE worn before a worker undertakes the task of replacing a fuse.



Figure 17: Suitable condition of ppe worn by workers before replacing a fuse

Table 7 shows that 70% of the workers observed, faced the risk of electrocution. 50% of the workers observed also faced the risk of falling. The risk of inhalation of hazardous chemical substances was reported as non-existent (0%). A risk involving workers being struck by objects presented at 40%. Similarly, 40% of the workers reported that they were exposed to extreme temperatures, while (20%) of workers were exposed to repetitive bodily motion.

Table 7: Observation on the position of workers

Position of workers	Yes		No	N/A
Could the worker fall?	5 (50%)		0 (0%)	5 (50%)
Could the worker be struck by an object?	4 (40%)		3 (30%)	3 (30%)
Could the worker be caught in between objects?	3 (30%)		2 (20%)	5 (50%)
Could the worker make contact with electrical current?	7 (70%)		1 (10%)	2 (20%)
Is the worker exposed to extreme temperatures?	4 (40%)		3 (30%)	3 (30%)
Could the worker inhale hazardous chemicals?	0 (0%)		6 (60%)	4 (40%)

Is the worker exposed to repetitive bodily motion?	2 (20%)		5 (50%)	3 (30%)
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Table 8 shows that the correct tools were mostly used for the work performed (70%) and the tools were used correctly (60%). The condition of the tools was also reported as good with no tools reported as defective, 70% and 0%, respectively. When workers were observed using Fall Arrest System (FAS), 50% of the Fall Arrest System was reported as being in a good condition. The use of ladders was more prominent (30%) than the use of climbing irons (10%). However, it was also observed that 80% of the workers observed did not use climbing irons in their tasks. Surprisingly, while workers were observed working on the ladder, only 30% could maintain a 3-point contact.

Table 8: Observation on the use of tools/ equipment

Use of tools/ equipment	Yes	No	N/A
Are correct tools for the job used?	7 (70%)	1 (10%)	2 (20%)
Are tools used correctly?	6 (60%)	2 (20%)	2 (20%)
Are tools in a good condition?	7 (70%)	0 (0%)	3 (30%)
Is the fall arrest system (FAS) worn correctly?	2 (20%)	3 (30%)	5 (50%)
Is FAS in a safe condition?	5 (50%)	0 (0%)	5 (50%)
Is there a FAS rescue kit available?	5 (50%)	0 (0%)	5 (50%)
Are climbing irons used?	1 (10%)	1 (10%)	8 (80%)
Are the climbing irons used correctly?	1 (10%)	0 (0%)	9 (90%)
Is the ladder safe to use?	3 (30%)	0 (0%)	7 (70%)
Is the ladder secured correctly?	3 (30%)	0 (0%)	8 (70%)
Does the worker maintain 3-point contact when climbing up/down the ladder?	3 (30%)	0 (0%)	7 (70%)

As shown in Table 9 safe work procedures are available for tasks performed by workers (80%). Even though the safe work procedures were reported as being available, 40% of workers reported that they were not aware of them. Most workers (70%) did not adhere to the step-by-step guide of safe work procedures. A similar percentage (60%) of the workers reported that they did not understand the contents of the safe work procedures.

Table 9: Observation on the use of Safe Work Procedures (SWP)

Safety procedures	Yes	No	N/A
Is there a safe working procedure (SWP) for the work being carried out?	8 (80%)	2 (20%)	0 (0%)

Is SWP known by workers?	6 (60%)	4 (40%)	0 (0%)
Is the SWP adequate/ practical?	6 (60%)	4 (40%)	0 (0%)
Is the SWP followed?	3 (30%)	7 (70%)	0 (0%)
Is the SWP understood?	4 (40%)	6 (60%)	0 (0%)

Table 10 indicates that the workplace was clean (50%) and relatively free of slip and trip hazards (60%). On the other hand, most workers reported that they were aware of the housekeeping standards (80%), but many of them did not fully understand the housekeeping standards (60%). The lack of display of safety signs at the various sites at the workplace was concerning (40%). When trenches were excavated, barricading of the trenches was not done (0%).

Table 10: Workplace orderliness/ housekeeping

Orderliness/ housekeeping	Yes	No	N/A
Is the work area free from slip & trip hazards?	6 (60%)	2 (20%)	2 (20%)
Is the work area in a clean condition?	5 (50%)	3 (30%)	2 (20%)
Are there adequate safety signs in place?	1 (10%)	4 (40%)	5 (50%)
Are trenches/ excavations barricaded?	0 (0%)	1 (10%)	9 (90%)
Are housekeeping standards known?	8 (80%)	0 (0%)	2 (20%)
Are housekeeping practices followed?	3 (30%)	3 (30%)	4 (40%)
Are housekeeping procedures understood?	6 (60%)	0 (0%)	4 (40%)

Figure 18 shows similar percentages for avoiding discomfort and forgetting to follow safety practices as major reasons for workers to behave in an unsafe manner regarding workplace health and safety (70% and 60%, respectively). Additionally, time pressure on the workers was reported as reason for unsafe worker behaviour (60%). The third most concerning reasons for unsafe behaviour were unclear responsibilities, unavailability of safe work procedures and the tasks not practical to implement (40%). The score for lack of worker training as a reason for unsafe worker behaviour was insignificant (10%).

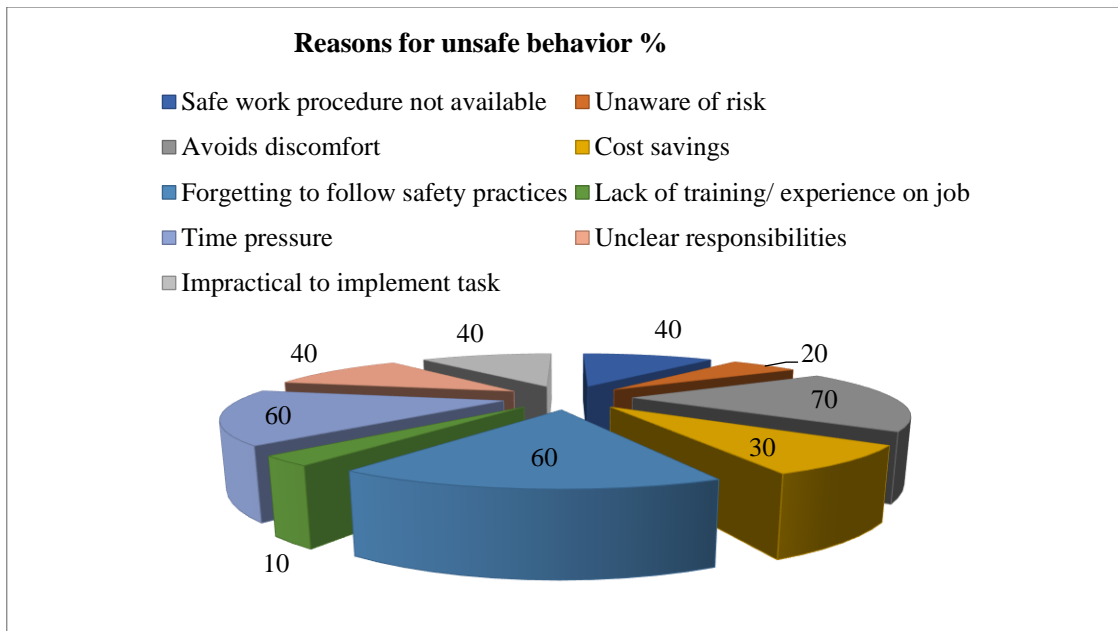


Figure 18: Reasons for unsafe behaviour

4.5. Results on questionnaire

As shown in Figure 19 there are various methods used for health and safety communication, i.e., meetings, posters and signs, verbal communication, email, presentations, telephonic and media. All these methods report similar percentages for their use, 100% frequency for verbal communication, posters and signs, emails, meetings, presentation and 96% for telephonic and media use.

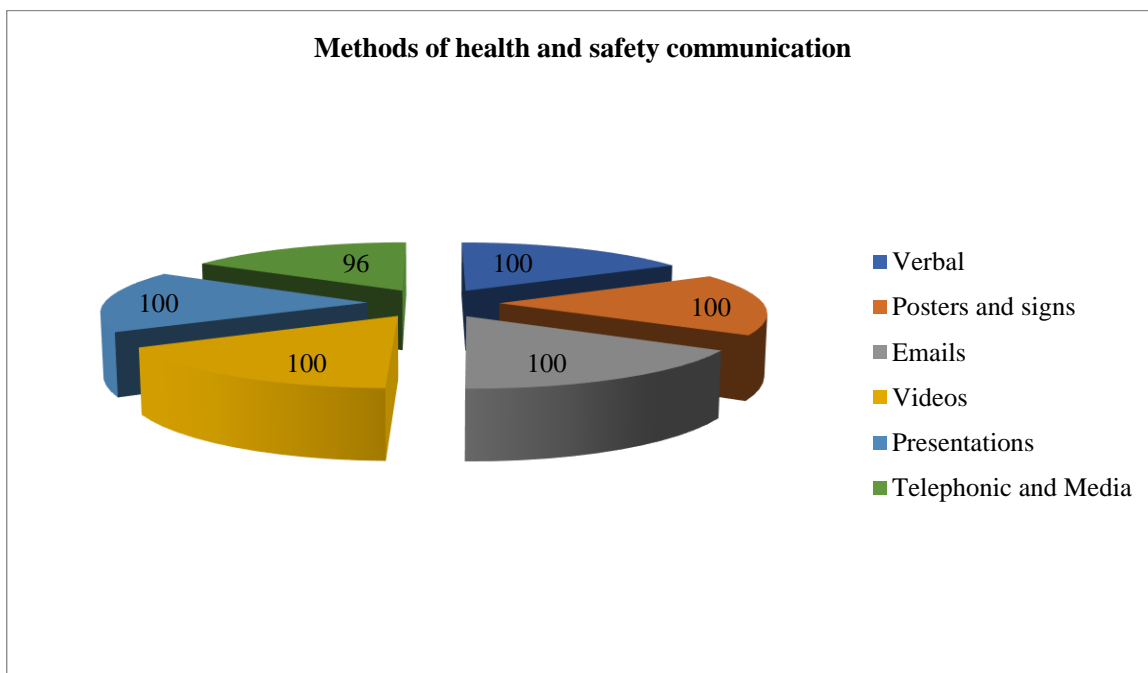


Figure 19: Methods of health and safety communication

Table 11 illustrates that the main role of managers and supervisors is to communicate health and safety to all workers (14.3%). The second dominant roles for supervisors and managers in terms of health and safety communication are discussion of case studies and the safety meetings report (7.1%). Other roles account for a low percentage of the supervisors' and managers' communication responsibilities (3.6%).

Table 11: Supervisor and manager role in health and safety communication

Role	
Communicate health and safety to all	1 (3.6 %)
Communicate safety incidents	1 (3.6 %)
Communicate the safety message to all staff	1 (3.6 %)
Communicate to workers and encourage workers execute the safety message	1 (3.6 %)
Communicate with staff: pass messages to my staff	1 (3.6 %)
Communicate with staff: receiving, sending the message	1 (3.6 %)
Communication of health and safety to employees	1 (3.6 %)
Discuss case studies	2 (7.1 %)
Discuss safety incidents with staff and the policy	1 (3.6 %)
Discuss safety issues with workers and manage safety filing systems	1 (3.6 %)
Discuss safety with staff	4 (14.3 %)
Ensure all employees hear the safety message	1 (3.6)
Ensure employees understand the safety message across the sector	1 (3.6)
Ensure health and safety communication reaches all in the sector	1 (3.6 %)
Ensure all employees hear the safety message	1 (3.6 %)
Implement the safety message	1 (3.6)
Implement the safety message and communicate to all	1 (3.6)

Make employees aware of safety through everyday safety communication and engagement with supervisors	1 (3.6)
Make safety meetings to talk about safety	2 (7.1)
Member of safety meeting	1 (3.6)
Share health and safety messages with staff and colleagues	1 (3.6)
Share incident reports and case studies with staff	1 (3.6)
Share safety incident reports	1 (3.6)
Share safety messages	1 (3.6)

As shown in Figure 20, ignorance of rules is the main contributing factor to health and safety incidents (100%). This was followed by the lack of understanding of the rules (7.1%). Unclear health and safety communication, as well as workers taking chances (3.6%) accounted for the lowest contribution to incident occurrence.

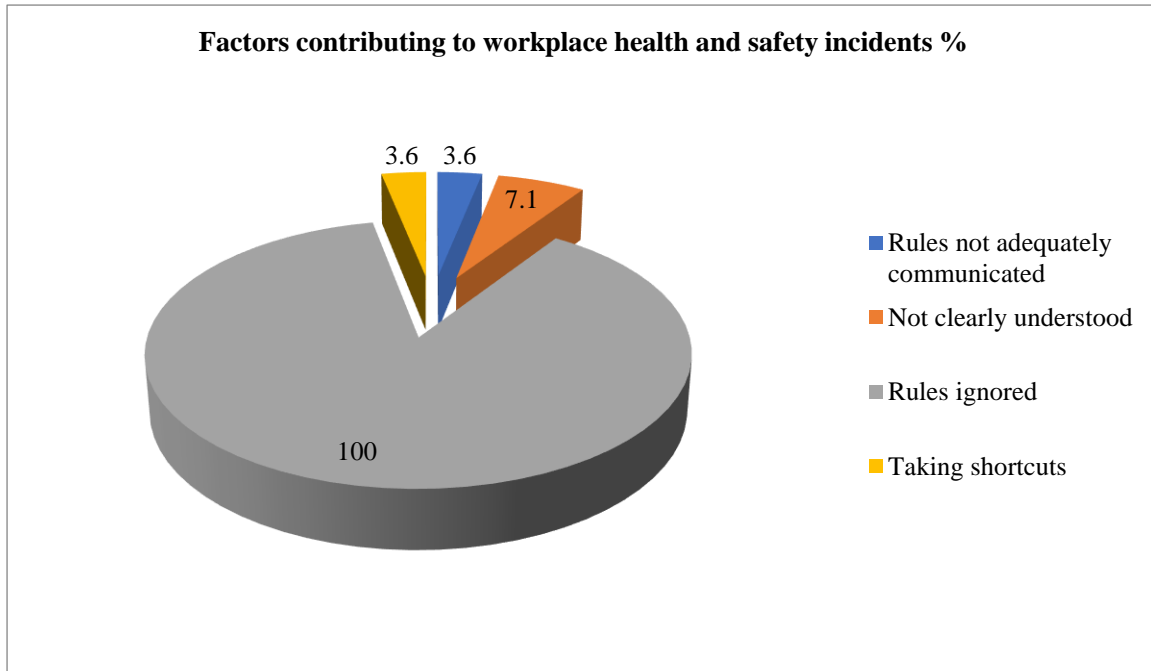


Figure 20: Factors contributing to workplace health and safety incidents

Figure 21 shows that health and safety communication does occur in departments (98.5%). An insignificant percentage reported that some departments did not accommodate discussions on health and safety (1.5%). Figure 21a shows that in most instances the communication is unclear to workers (50%). Some workers reported that they were unsure if they understood health and safety communication (31.3%). As seen in Figure 2b, verbal communication is the most frequently used method for health and safety communication (91.9%), followed by posters, email, and signs (41.6%, 39.3% and 38.6% respectively). The use of mobile phones was the least used to communicate matters of health and safety (20.6%).

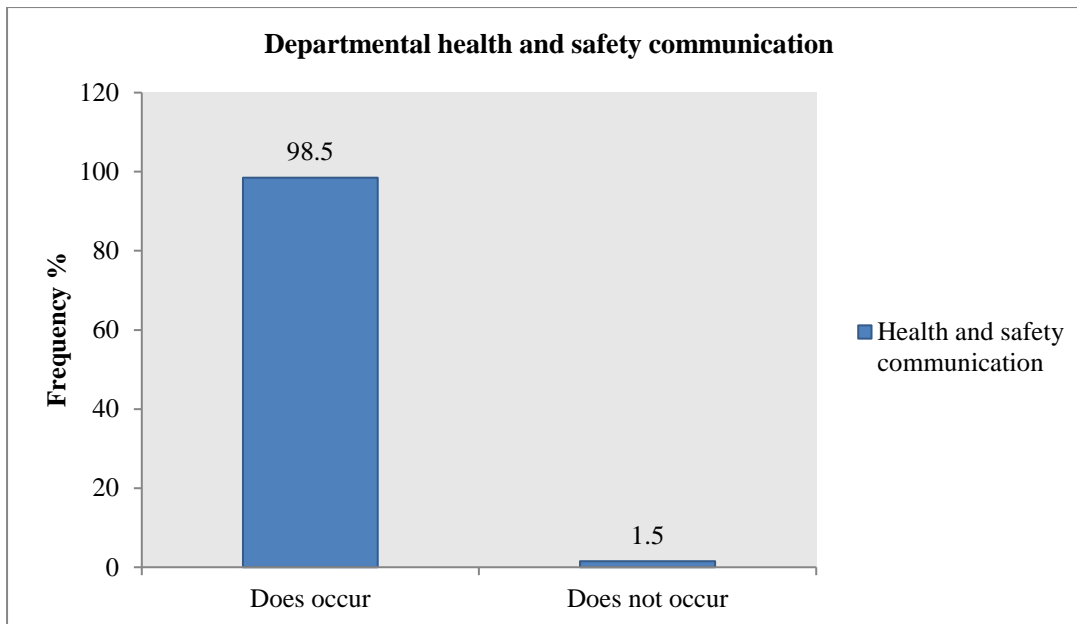


Figure 21: Occurrence of departmental health and safety communication

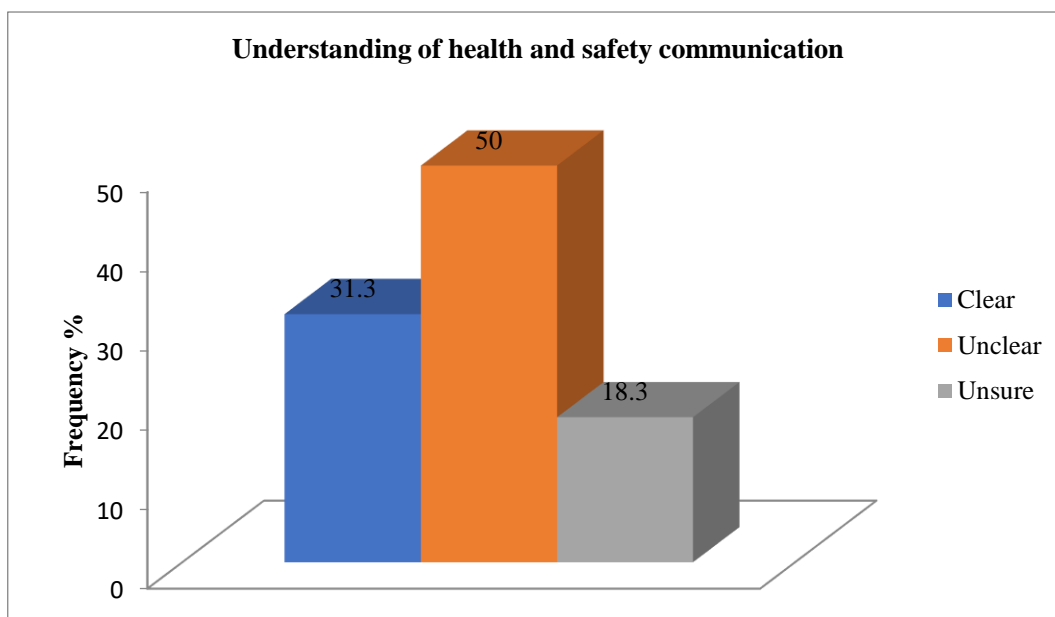


Figure 21 a: Understanding of health and safety communication

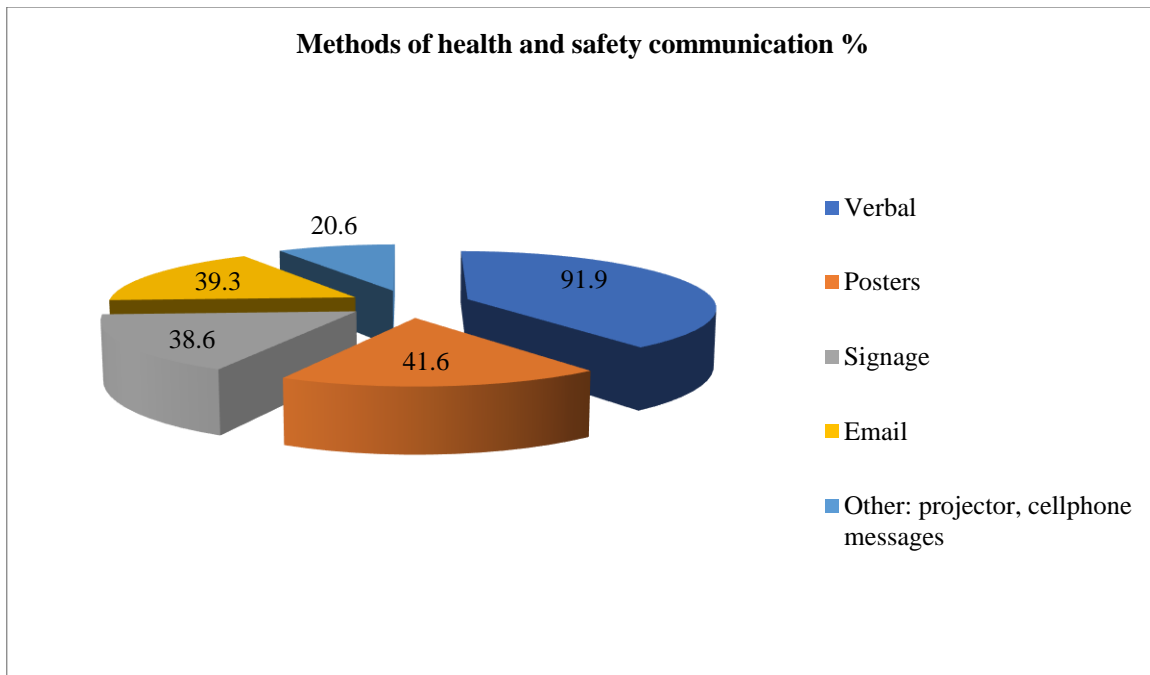


Figure 21 b: Methods of health and safety communication

As illustrated in Figure 22, the top three barriers to effective communication are (1) the lack of time allocated to health and safety communication; (2) poor communication; and (3) the effects of the Covid-19 pandemic (26.3%, 20.7% and 17.7%). Lack of access to communication and poor work environment accounted for 0.8% of communication barriers. A few workers reported that there were no barriers to effective health and safety communication (0.8%).

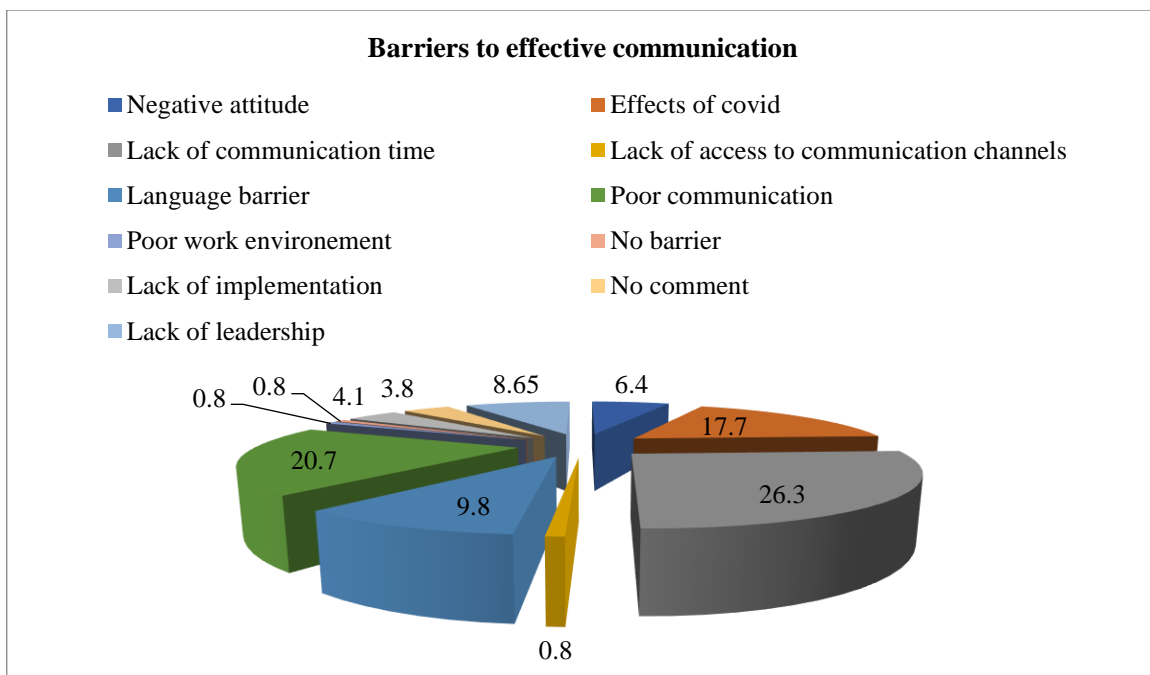


Figure 22: Barriers to health and safety communication

Table 12: Manager, Supervisor and Worker opinion on health and safety communication

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Health and Safety communication plays a role in incident occurrence	15 (1.7%)	13 (4.4%)	38 (13%)	127 (43.3%)	110 (37.5%)
Health and Safety communication is necessary to promote good health and safety performance	0 (0.0%)	5 (1.7%)	39 (13.3%)	136 (46.3%)	114 (38.8%)
Current methods of health and safety communication problematic in your area	32 (10.9%)	102 (34.7%)	99 (33.7%)	43 (14.6%)	18 (6.1%)
Lack of health and safety communication will increase health and safety incidents	8 (2.7%)	25 (8.5%)	66 (22.5%)	124 (42.2%)	71 (24.2%)
Health and safety communication is fundamental in your work area	9(3.1%)	27 (9.2%)	78 (26.5%)	104 (35.4%)	76 (25.9%)
Health and safety communication does address challenges which cause incidents	19 (6.5%)	64 (21.8%)	83 (28.2%)	89 (30.3%)	38 (12.9%)
Effective health and safety communication positively impacts on health and safety performance	14 (4.8%)	29 (9.9%)	70 (23.8%)	113 (38.4%)	68 (23.1%)
The views of workers are considered during the health and safety communication process	112 (38.1%)	76 (25.9%)	48 (16.3%)	46 (15.7%)	12 (4.1%)
Workers are able to contribute to continual improvement of health and safety communication	101 (34.4%)	112 (38.1%)	40 (13.6%)	30 (10.2%)	11 (3.7%)

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Health and safety communication must be stopped	88 (29.9%)	56 (19.1%)	53 (18.3%)	37 (12.6%)	60 (20.4%)

Table 13: Manager, Supervisor and Worker opinion on occurrence of health and safety incidents

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Non-adherence to the wearing of PPE contributes to the occurrence of injuries arising out of incident occurrence.	12 (4.1%)	7 (2.4%)	46 (15.7%)	145 (49.3%)	84 (28.6%)
The use of defective tools and equipment has resulted to health and safety incidents.	0 (0%)	6 (2.0%)	33 (11.2%)	130 (44.2%)	125 (42.5%)
Incorrect use of tools and equipment has resulted to health and safety incidents.	1 (0.3%)	9 (3.6%)	78 (26.5%)	120 (40.8%)	86 (29.3%)
Poor housekeeping is a major contributory factor to many health and safety incidents.	2 (0.7)	9 (3.1%)	74 (25.2%)	135 (45.9%)	74 (25.2%)
I understand the principle of good housekeeping.	4 (1.4%)	10 (3.4%)	68 (23.1%)	103 (35.0%)	109 (37.1%)
Health and safety incidents have occurred as a result of poor housekeeping.	4 (1.4%)	21 (7.1%)	80 (27.2%)	113 (38.4%)	76 (25.9%)

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Health and safety standards and safe work procedures are there to guard against the occurrence of incidents.	11 (3.7%)	33 (11.2%)	100 (34.0%)	101 (34.4%)	49 (16.7%)
Non-adherence to safe work procedures can result to incident occurrence.	20 (6.8%)	42 (14.3%)	91 (31.0%)	90 (31.0%)	50 (17.0%)
Health and safety standards ad safe work procedures are well communicated and understood.	75 (25.5%)	96 (32.7%)	58 (19.7%)	46 (15.6%)	19 (6.5%)
The Company does not compromise on the health and safety of its workers.	87 (29.6%)	122 (41.5%)	48 (16.3%)	16 (5.4%)	21 (7.1%)

Table 14 presents a cross tabulation measure of the association between the effectiveness of health and safety communication and whether it positively impacts on health and safety performance. Out of the 28 participants (n=28), the majority (50%) agree that it does impact on health and safety performance and a further 14,3% strongly agree whereas 35.7% are neutral. Across all the 3 scales of measurement (n=28), the majority (42.9%) agree and 25% strongly agree that effective health and safety communication positively impacts performance. However, 32.1% gave a neutral response.

Table 14: Cross tabulation between the effectiveness of health and safety communication and its positive impact on health and safety performance

Table of effectiveness of health and safety communication and its positive impacts on health and safety performance						
Effectiveness of health and safety communication	Impact on health and safety performance				P value	Cramer's V
	NEUTRAL	AGREE	STRONGLY AGREE	Total		
No Effect	5 35.7 55.6	7 50 58.3	2 14.3 28.6	14 100	0.130	0.356
Neutral	3 37.5 33.3	4 50 33.3	1 12.5 14.3	8 100		
Moderate Effect	1 16.7 11.1	1 16.7 8.3	4 66.7 57.1	6 100		
Total	9 32.1	12 42.9	7 25	28 100		

$P > 0.05$ there is no statistically significant correlation between the effectiveness of health and safety communication and its impact on health and safety performance.

Table 15 shows the education level of the participants and how it compares to their understanding of health and safety communication. Out of 57 participants (n=57) with low

education (Grade 8-11), most of the participants (35.1%) do not understand health and safety communication, while 26.3% of them have reported to always understand and 38.6% sometimes understand. From the total number of participants with matric (n=180), many of them indicated that they understood health and safety communication occasionally (52.2%), while 32.2% indicated that they understood it and only 15% indicated that they did not understand health and safety communication. The minority of participants with matric (0.6%) indicated an unknown response to their understanding of health and safety communication. The full complement of Bachelor of Technology degree holders (100%) reported that they understood health and safety communication.

Table 15: Cross tabulation on participant's level of education and their understanding of the health and safety communication

Table of level of education compared to the participant's understanding on the health and safety communication						
Participant's level of education	Understanding of health and safety communication					P Value
	Yes	Sometimes	No	Unknown	Total	
Grade 8-11	15 26.3 18.3	22 38.6 16.8	20 35.1 41.7	0 0.0 0.0	57	0.956
Matric	58 32.2 70.7	94 52.2 71.8	27 15.0 56.3	1 0.6 100	180	
3 years national diploma	8 34.8 9.8	14 60.9 10.7	1 4.4 2.1	0 0.0 0.0	23	
Advanced diploma	0 0.0 0.0	1 100 0.8	0 0.0 0.0	0 0.0 0.0	1	
4 years btech degree	1	0	0	0	1	

	100	0.0	0.0	0.0		
	1.2	0.0	0.0	0.0		
Total	82 31.3	131 50	48 18.3	1	262	

$P > 0.05$ there is no statistically significant correlation between the participants' level of education and their understanding of health and safety communication.

Table 16 shows that even though the majority of participants did not respond to the use of posters and its complications in health and safety communication ($n=153$), the participants that did respond ($n=109$), reported that they disagreed with the statement that the use of posters presents complications in health and safety communication (32.1%) and a further 27.5% gave a neutral response to the statement, while 23.9% of the respondents agreed that there are difficulties presented by the use of posters in communicating health and safety matters in the workplace. Similar percentages were reported for participants who strongly disagreed with the statement and those who strongly agreed (9.2% and 7.3%, respectively). There is a statistically significant correlation between the use of posters and the complications it presents in the communication of workplace health and safety ($P=0.0510$).

Table 16: An association between the use of posters for health and safety communication and its complications.

The use of posters for health and safety communication and its complications in the workplace								
The use of posters for health and safety communication	Complications caused using posters in the workplace						P value	Cramer's value
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total		
.	18 11.76 64.29	49 32.03 58.33	60 39.22 66.67	17 11.11 39.53	9 5.88 52.94	153	0.0510	0.1898
Posters	10 9.2 35.7	35 32.1 41.7	30 27.5 33.3	26 23.9 60.5	8 7.3 47.1	109		

The use of posters for health and safety communication and its complications in the workplace								
The use of posters for health and safety communication	Complications caused using posters in the workplace							
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total	P value	Cramer's value
Total	28 10.7	84 32.1	90 34.4	43 16.4	17 6.5	262		

Table 17 shows that 38.4% (n=113) of participants agree that safety incidents have occurred due to poor housekeeping, while 27.2% gave a neutral response to the statements and 25.9% strongly agreed (and with the statement. An insignificant number of participants strongly disagreed that poor housekeeping resulted in safety incidents (1.4%). Scientifically, statistics indicate that there is significant ($P = 0.0233$) correlation between the participants' understanding of good housekeeping principles and the occurrence of safety incidents due to poor housekeeping.

Table 17: A cross tabulation measuring poor housekeeping as a cause to safety incidents.

Poor housekeeping as a cause to safety incidents							
Participant's understanding of good housekeeping principle	Safety incidents have occurred due to poor housekeeping						P value
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total	
Strongly disagree	0 0.0 0.0	1 25.0 4.8	1 25.0 1.3	2 50.0 1.8	0 0.0 0.0	4	0.0233
Disagree	0 0.0 0.0	1 10.0 4.8	6 60.0 7.5	2 20.0 1.8	1 10.0 1.3	10	

Poor housekeeping as a cause to safety incidents							
Participant's understanding of good housekeeping principle	Safety incidents have occurred due to poor housekeeping						P value
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total	
Neutral	3	8	25	18	14	68	
	4.4	11.8	36.8	26.5	20.6		
	75.0	38.1	31.3	15.9	18.4		
Agree	0	5	26	46	26	103	
	0.0	4.9	25.2	44.7	25.2		
	0.0	23.8	32.5	40.7	34.2		
Strongly disagree	1	6	22	45	35	109	
	0.9	5.5	20.2	41.3	32.1		
	25.0	28.6	27.5	39.8	46.1		
Total	4	21	80	113	76	294	
	1.4	7.1	27.2	38.4	25.9		

CHAPTER 5: DISCUSSION

5.1. Introduction

This chapter discusses the impact of health and safety communication on the company's overall workplace health and safety and its impact on the health and safety incidents. Furthermore, the barriers to effective health and safety communication in the company are discussed.

5.2. Health and safety at Eskom ECOU

The workers' health and safety are of utmost importance to the company. The monitoring of the safety of workers was conducted through planned task observations on workers who performed high risk activities, such as working at heights, operating on medium and low voltage electrical equipment, driving extended hours on bad road conditions, repositioning of a pole, replacing a morsdofer fuse carrier, replacing a fuse, removing a breaker, and replacing a pole while standing on an aerial bucket. The observations were conducted to identify the safety signs and posters used by the employer, as well as to monitor whether workers adhere to the safety signs and posters at the sites. Safety signs and posters are a common means of communicating health and safety matters to workers (Vecchio-Sadus, 2007). According to Lunenburg (2010), communication is the transmitting of a message verbally, non-verbally or written through various mediums such as face to face talks, email, written reports, and telephone. Similarly, the findings of this research study revealed that verbal communication and the use of posters and signs were commonly used mediums of health and safety communication.

In construction sites, the use of signs and posters is an acceptable means of communicating health and safety issues to the workers (Phoya, 2012). King et al. (2021). suggest that the use of signs to communicate improves workplace safety. Likewise, Ajayi et al. (2021), argues that safety signs can be used to enhance safety awareness among workers. Similarly, this was evidently displayed when workers were found wearing the required personal protective equipment as per the sign mounted at the entrance of the substation. Upon questioning, the participants confirmed that health and safety communication was frequently done through various mediums, including safety signs and posters, as shown in Figure 19. Regulation 2b of the General Safety Regulations in the Occupational Health and Safety Act 85 of 1993, legislates for the use of safety signs and notices in the workplace (South Africa, 1993). Furthermore, section 14 of the Occupational Health and Safety Act 85 of 1993, stipulates that "every employee shall at work carry out any lawful order given to him and obey the health and safety

rules and procedures laid down by his employer or by anyone authorized thereto by his employer, in the interest of health or safety” (South Africa, 1993). This compels workers to adhere to the safety signs and posters displayed in the workplace. Observations during site visits suggest that workers adhere to the safety signs displayed at the entrance of the substation regarding the wearing of hard hats when entering the substation. The safety signs are a means of communication to the workers to wear the required personal protective equipment. Scott & Goncalves (2021), suggest that the use of safety signs is one of the methods which can be employed to achieve effective communication. Therefore, the findings of this study agree to that the use of safety signs is a good medium to promote awareness amongst workers.

Figure 16 shows workers wearing the required personal protective equipment prior to commencement of work. Such findings suggest that the workers comply with the stipulations of section 14 of the Occupational Health and Safety Act 85 of 1993, which mandates the workers to adhere to any lawful order or instruction given by the employer, in the interest of workplace health and safety (South Africa, 1993). Furthermore, the findings from the observations suggest that the use of safety signs to promote the wearing of personal protective equipment is effective. Although adequate signs and posters on the use of personal protective equipment regarding the use of personal protective equipment were displayed, there was no evidence of any signs and posters requiring the wearing of face masks and other safety protocols to prevent the spread of Covid-19 at the substation. ISO 45001 guides that personal protective equipment should be provided, free of charge, to the workers as a last resort to eliminate hazards and reduce risks. Hirschmann et al. (2020), argues that personal protective equipment for Covid-19 is necessary for protection against viral infection. The wearing of personal protective equipment is essential in ensuring the safety of workers (Lockhart *et al.* 2020). The results of the questionnaire suggest that not wearing personal protective equipment contributes to the occurrence of incidents. Section 8 of the Occupational Health and Safety Act 85 of 1993 mandates the employer to issue the workers with personal protective equipment, free of charge (South Africa, 1993). Therefore, clear policies regarding the use and availability of Covid-19 personal protective equipment are required to prevent the spread of transmission of the virus (Chughtai & Wang, 2020). The display of safety signs relating to Covid-19 increases workplace performance and ensures the safety of workers (Pamidimukkala & Kermanshachi, 2021). As shown in Figure 19 of the research results, the use of safety signs is one of the many common and preferred methods of communicating health and safety matters in the workplace. Therefore, it is important for workers to display safety signs and poster to

enhance awareness on the wearing personal protective equipment as a measure to minimize the risk of incident occurrence. For this reason, the company needs to enhance Covid-19 workplace safety by placing safety signs encouraging workers to maintain safe distances between each other, wear face masks and use hand sanitizers.

Working at heights, operating on electrical apparatus, driving, repairing, and replacing electrical equipment are amongst the high-risk activities observed during this research project. Observations revealed that workers who had to climb a 9-metre wooded pole with climbing irons were at a significant risk of falling from heights. When working at heights, workers are at risk of sustaining serious injuries from falling. According to Al-kotb (2017), injuries sustained from falling from heights were the most common injuries sustained by construction workers. In fact, falls sustained from working at heights are the primary cause of fatalities in construction (Meng *et al.* 2018). Hanna *et al.* (2017), argues that in construction sites, falling from heights is the second leading cause of workplace injuries. Recent studies reveal that fall incidents are among the most frequent causes of fatalities and injuries in construction workplaces (Lee *et al.* 2021; Lee & Han, 2021). However, as shown in Figure 5, fall incidents are not amongst the top three prominent incidents. Even though workers conduct work at height, the observations further revealed that they use a fall arrest system (FAS) as a preventative measure to the risk of falling. Therefore, the findings of this study do not support work at heights as a significant risk at the company. The FAS is composed of three components, namely: a full body harness, shock absorber lanyard and a positioning belt. Verbal awareness communication on the procedures for using FAS when working at heights is conducted by supervisors to highlight the hazards relating to working at heights and promote worker safety while doing so.

Observations further revealed that workers are conversant with the task manual pertaining to working at heights. Additionally, the findings from observations show that verbal communication is one of the commonly used methods of safety communication to prevent the occurrence of safety incidents in the company. Therefore, awareness of the task manuals is beneficial to the company. Landis and Valdes (2021), suggest that enhanced awareness increases the understanding of workplace hazards. Similarly, Samanta and Gochhayat (2021), in a study conducted in India, highly recommended safety awareness for the upgrading of health and safety standards in the country. Luri and Rinawati (2019), found that enhanced awareness of the risk of exposure to chemicals and working at heights improve health and safety programs. Sanni-Anibire *et al.* (2018), believe that extensive communication between

supervisors and workers improves health and safety performance. Likewise, the sharing of health and safety knowledge improves overall performance in terms of workplace health and safety (Jung *et al.* 2008). Table 13 shows that participants in the current study agree that non-adherence to safe work procedures can lead to incidents. Furthermore, the results obtained from the questionnaire suggest that health and safety communication should not be stopped as the verbal awareness about workplace hazards is effective in addressing safety challenges. The findings of this study advocate for the communication of safe work procedure to enhance the knowledge of the workers on the hazards involved in executing the tasks, thereby promoting the prevention of workplace incidents. The findings from the questionnaire further suggest that awareness communication is conducted on the safe work procedures, adherence to wearing personal protective equipment and workplace hazards.

There is insufficient awareness of the importance of safe worker behaviour in the company. Figure 8 shows that the negligence of the drivers is the leading cause of motor vehicle accidents in the company. Section 14 of the Occupational Health and Safety Act 85 of 1993 legislates that the workers should act responsibly for their own safety as well as the safety of those who may be affected by their actions (South Africa, 1993). Section 8 of the Occupational Health and Safety Act 85 of 1993 further forces the company to “provide such information, instructions, training and supervision as may be necessary to ensure, as far as is reasonably practicable, the health and safety at work of its employees” (South Africa, 1993). Therefore, the workers and the employer do not seem to comply to their legislative responsibilities, as the drivers act with negligence and the employer does not conduct awareness training or communication on the drivers’ unsafe behaviour. According to Dannoun and Nouban (2021), ineffective and poor safety awareness leads to workplace fatalities. Ajayi *et al.* (2021), found that low levels of safety awareness amongst workers regarding their behaviour led to amplified accidents and workplace fatalities. Uzuntarla *et al.* (2020), suggest that an enhancement in safety awareness activities can lead to an improvement in the workers’ safety behaviour. Mixed reality (MR) devices can be used to motivate safe worker behaviour (Rauh *et al.* 2021). Shen and Wei (2021), suggest that improving driver safety awareness potentially reduces the severity of motor vehicle accidents. The occurrence of motor vehicle accidents in the company is exacerbated by the negligence of drivers. Therefore, measures such as driver behaviour awareness communication and computerized vehicle monitoring devices need to be strengthened.

5.3. Health and safety incidents at Eskom ECOU

Health and safety incidents that have occurred in the company over a five-year period (2015–2019) include incidents such as motor vehicle accidents (MVA), damage to property and operating errors. The incidents require the employer to take reasonable care to prevent re-occurrence. The South African legislation obligates the employer to put measures in place to manage hazards, thus preventing the occurrence of health and safety related incidents (South Africa, 1993). At the company, motor vehicle accidents occur more frequently than any other type of incident. The Mthatha sector is a major contributing sector to motor vehicle accidents. This sector provides maintenance of the rural electricity network, where workers drive long distances to reach their destination to repair and maintain the existing electricity distribution network structures. The long driving distances on gravel roads, at a maximum speed of 60km/h expose workers to fatigue. Kifle et al. (2014), argue that fatigue leads to reduced cautiousness and poor alertness, as well as poor decision making and errors. Many researchers agree that driver fatigue accounts for numerous motor vehicle accidents and contributes negatively to safety performance (Quddus *et al.* 2021; Wang *et al.* 2021). In day to day living, motor vehicle accidents arise from the drowsiness and driver fatigue (Stephen & Sri, 2020). Kumar (2020), argues that there is a noteworthy correlation between driver drowsiness and road accidents. In his findings, he stresses that motor vehicle accidents occur when the driver of a motor vehicle becomes strained to keep focused and alert on the road while driving. West et al. (2012), also argue that effective management of fatigue is essential in promoting personal safety. A driver always needs to remain focused on the driving task (Kale *et al.* 2021). Failure to remain focused can lead to lowered levels of concentration, which can compromise the safety of workers (Hide *et al.* 2003). Essentially, increased levels of driver fatigue contribute to poor vigilance, which can result in motor vehicle incidents. This study articulates that failure to prevent the workers from being exposed to fatigue could lead to serious injuries and fatalities from motor vehicle accidents.

A low number of near-miss incidents have been reported across the company between 2015 and 2019. This raises a concern as near-miss incidents are closely associated with the occurrence of incidents. The Occupational Health and Safety Act 85 of 1993 (South Africa, 1993) encourages workers to report all work-related health and safety incidents to the employer before the end of each shift. The voluntary reporting of near-miss incidents is encouraged to promote an incident-free workplace (Labib *et al.* 2019). However, according to Foromo et al. (2016), near-misses were rarely reported to the employer. Similarly, the findings of this study

show an insignificant number of near misses reported at the company. The occurrence of near misses creates an opportunity for incidents and injuries to occur. Zen (2019) suggests that the implementation of measures to eliminate near-miss incidents promotes an incident free workplace.

In the Mthatha sector, near-misses were not reported prior to the occurrence of motor vehicle accidents. Such has led to the mismanagement of hazards, which subsequently resulted to the high number of motor vehicle accidents. According to Anderson and Denkl (2010), the frequency of incidents indicates that there have been near-miss incidents prior to the occurrence. Frank Bird's model has shown that lack of treatment of numerous close incident calls or near-misses leads to the occurrence of serious incidents (González *et al.* 2016). Therefore, if near-misses are reported, investigated and preventative and/or control measures are implemented, motor vehicle accidents could be avoided in Eskom ECOU.

There are various other factors that can result in workplace incidents. As shown in Figure 5, unsafe worker behaviour is the most common cause. Hallowell (2010) and HSE (2020), suggest that the unsafe actions of workers have an immense effect on the regularity and severity of incidents in the workplace. Sanni-Anibire *et al.* (2018), reported that seventy percent (70%) of accidents were influenced by issues arising from workers. A recent study shows that "human errors are a major cause of accidents which occur in industries" (Aliabadi *et al.* 2020). Therefore, there is a significant relationship between the attitude of workers and workplace incidents (Monazzam and Soltanzadeh, 2009; Mohamed, Ali & Tam, 2009). Figure 8 illustrates the lack of personal safety responsibility among workers, as 400 motor vehicle accidents are caused by the negligence of drivers in the company. This clearly argues that negligence of workers allows for an opportunity for workplace incidents to occur. In South Africa, the Occupational Health and Safety Act 85 of 1993 obligates workers to take responsibility for their own health and safety (South Africa, 1993). The increased frequency of motor vehicle accidents due to negligence in the Mthatha sector suggests a lack of adherence to section 14 of the Occupational health and Safety Act 85 of 1993 by the workers (South Africa, 1993). Such acts necessitate the implementation of stringent measures to enforce legislated worker safety responsibilities in the workplace.

The results of the study of the health and safety incidents in the company revealed that workplace conditions are not a major contributor to the occurrence of incidents. Legislation covering the safety of the workplace and its equipment is one of the most crucial laws in South Africa, and it mandates every employer to ensure "the provision and maintenance of systems

of work, plant and machinery that, as far as is reasonably practicable, are safe and without risks to health” (South Africa, 1993). World-class occupational health and safety management systems suggest that the identification of hazards assists the employer to determine and understand the workplace hazards “in order to assess, prioritize and eliminate hazards or reduce OH&S risks” (ISO 45001). Figure 8 shows that unsafe equipment was amongst the least common causes of motor vehicle accidents. The observations conducted show that the company provides its workers with working tools that are safe and free from defect. However, the workers expressed the view that health and safety incidents do occur from unsafe workplace conditions caused by poor housekeeping. Therefore, in this regard, the principles of good housekeeping in the workplace need to be enforced, as per the guidelines set out in regulation 6 of the Environmental Regulations for Workplaces (South Africa, 1993).

5.4. Barriers to health and safety communication at Eskom ECOU

While it is an obvious duty for the company to communicate with its workers on the workplace safety hazards and risks (South Africa, 1993), various barriers remain a challenge to the achievement of effective communication. Different interpretations of the same message misrepresent the intent of the message, thus causing a communication barrier (Lunenburg, 2010). Misreading of instructions by workers is another barrier to effective communication (Olanrewaju & Kwan, 2017). Buniya et al. (2021), reveal that poor safety awareness hinders the successful implementation of safety programs. During this research project, toolbox talks were held daily for thirty (30) minutes to promote safety awareness on workplace hazards and risks, as well as sharing various case studies on health and safety incidents which have occurred in the company. However, the toolbox talks stopped since the outbreak of the Covid-19 pandemic.

Section 8 of the Occupational Health and Safety Act 85 of 1993, compels the company not to expose workers to a workplace which could potentially endanger their health and safety (South Africa, 1993). Figure 22 reveals that insufficient time allocation for health and safety matters is the leading barrier to effective health and safety communication in the company. Furthermore, this figure show that the outbreak of the Covid-19 pandemic has been a barrier to achieving effective health and safety communication in the company. The outbreak of Covid 19 caused for the employer and the workers to not communicate face to face. This led the employer to rely mostly on the use of email for communication. Operators who lack the skill to operate a computer missed on the safety communication. The World Health Organization (WHO, 2019) advises workers to avoid exposing others to health and safety risks brought about

by the coronavirus. However, the need to promote health and safety awareness remains, since its aim is to prevent the occurrence of incidents (Kim *et al.* 2019). Therefore, virtual methods must be explored to raise safety awareness on health and safety matters, without exposing workers to Covid-19.

Language is another common barrier to effective communication (Olenrewaju and Khan, 2017; Oswald *et al.* 2019). The findings of the survey evinced that the workers in the company hail from various ethnic groups. The findings further revealed that the workers have different native languages. Commonly, English is the language used in all health and safety communication in the company, despite the various native languages and cultures. The findings of the survey show that language is in the top five barriers to successful health and safety communication in the company. Figure 21b depicts that worker view the health and safety messages as unclear. Even though the use of English has global acceptance amongst people of different native languages, traditions, and culture (Rao, 2019), it creates a language barrier, which affects production (Ne'Metulla *et al.* 2021). The use of an uncommon language amongst workers creates a problem (Vecchio-Sadus, 2007). According to Makayev *et al.* (2021), workers must be equipped with communication competencies on all matters in the workplace. Workers must understand the language used to prevent risk (Ne'Matulla *et al.* 2021). According to Vecchio-Sadus (2007), the use of an uncommon language to communicate with construction workers presented a problem which could be solved by the use posters. Therefore, safety posters and signs must be written in other languages to enhance effective understanding of the message.

5.5. Summary

It is essential for the company to recognize its obligation to effectively communicate health and safety matters to workers. In areas where the lack of health and safety communication exists, the employer should employ various communication methods to enhance the communication of health and safety matter in the workplace and evaluate the effectiveness of the communication methods used. The key findings presented in this chapter include (a) motor vehicle accidents as the leading type of accident experienced in the company; (b) negligence of workers is the common cause of health and safety incidents; (c) the safety awareness conducted does not address unsafe behaviour of drivers; (d) lack of time is a common barrier to effective health and safety communication; (e) the current health and safety methods can still be improved to enhance awareness on workplace health and safety; (f) the use of safety jargon is a language barrier to effective health and safety communication. Therefore, the findings of the current study suggest a positive approach to health and safety communication,

which aims to achieve a positive influence on the health and safety performance of the company.

CHAPTER 6: CONCLUSIONS

6.1. Introduction

This chapter highlights the key themes emanating from the research project by summarizing the major findings. It draws conclusions, and provides recommendations based on the evidence collected throughout the research. The main purpose of the research study was to assess the current health and safety communication methods and their impact on the occurrence of health and safety incidents in the company. The research was divided into chapters to answer the research questions and ensure achievement of the research objectives.

6.2. Conclusion

The company's mandate to ensure continual distribution of electricity to its customers often requires the workers to perform potentially dangerous activities. These dangerous activities necessitate health and safety obligations, which may be achieved by implementing measures to demonstrate care for the health and safety of workers. These measures include the reporting and investigation of health and safety incidents to establish the cause, raising awareness on hazards to prevent the occurrence of incidents as required by the occupational health and safety legislative framework (South Africa, 1993) as well as internal company processes. The company uses the SAP Environmental Health and Safety software to record all reported health and safety incidents and ensure their traceability and tracking until remedial strategies have been implemented to address the root cause.

Most incidents occurring at the company are motor vehicle accidents. Findings suggest that these accidents result from the negligence of workers. Respondents indicated that the ignorance of rules by the workers is a major contributing factor to incident occurrence, illustrating non-compliance to the health and safety obligations which requires workers to obey any lawful instruction given by the employer in the interest of health and safety.

The operational functions of the company have resulted in health and safety obligations to communicate with the workers on matters concerning their health and safety, as well as to put measures in place to preserve the health and safety of workers. The company has identified areas that experience high numbers of health and safety incidents and analysed them to establish the cause of such incidents. In this research project, the Mthatha sector was found to be sector with the highest numbers of motor vehicle accidents.

There appears to be a correlation between negligence and the ignorance of rules by the workers across all sectors of the company, i.e., Mthatha, Aliwal North, Matatiele and Mthatha sectors,

as well as the Power Plant Maintenance department. Importantly, this study has shown that there is a link between unsafe behaviour, i.e., negligence of workers, and the occurrence of motor vehicle accidents in the Mthatha sector. Incidents are caused by the unsafe behaviour of workers and unsafe conditions in the workplace. Respondents agreed to the statement probing the contribution of poor housekeeping to health and safety incidents. Despite their understanding of the principle of good housekeeping, many respondents stated that there have been incidents due to poor housekeeping.

Near-miss incidents are signs that there is a present hazard with a potential to cause injury to workers. Very few near-miss incidents are reported in the company, and this limits the company's ability to identify and communicate potential hazards. This further causes non-compliance to the occupational health and safety legislative obligations, which mandate the company to identify all hazards and communicate them, including its rehabilitation strategies, with the workers to prevent the occurrence of incidents. The respondents indicated that health and safety communication can address the challenges experienced regarding the occurrence of incidents and that lack of communication will result in an increase in health and safety incidents. The importance of health and safety communication in the prevention of incidents and promotion of health and safety performance is understood by many respondents.

Various methods are used to deliver safety awareness communication to the workers. Signs and notices are conspicuously displayed at various sections of the workplace, as required by the General Safety Regulation promulgated under the South African occupational health and safety legislative framework (South Africa, 1993). Safety posters are also displayed to promote awareness on workplace hazards. As such, the respondents indicated that they were aware of the required personal protective equipment to be worn when they are at the various work sites. Health and safety legislation obligates workers to wear the personal protective equipment in the workplace, as provided by the company. However, at some sites many workers were observed not wearing full personal protective equipment when working. This unsafe act illustrates ignorance to rules and non-compliance to the occupational health and safety legislation, which requires workers to wear personal protective equipment issued by the employer. This behaviour demonstrates negligence on the part of the worker as well as their ignorance of the safety rules. Most respondents are convinced that non-adherence to the wearing of personal protective equipment increases the risk of the occurrence of injuries from safety incidents.

Verbal communication of health and safety matters is also conducted by the supervisors. The legislative framework is not prescriptive on whether safety communication must be conducted verbally or by signs and notices only. Respondents indicated that verbal communication is the most preferred method. Some respondents believe that health and safety communication should not be stopped even though they could not evince to its contribution towards a positive safety performance. Generally, communication problems can arise between the sender and the receiver. This communication breakdown is often caused by many factors. The respondents held a neutral view on whether the current communication strategies are problematic. Some respondents viewed the lack of communication skills of the sender caused a barrier; as a result, they believe that health and safety verbal communication is not understood by the workers. This weakness in communication can lead to the occurrence of safety incidents and hinder the achievement of effective health and safety communication.

In some instances, there are regular safety communication engagements, such as monthly health and safety meetings and morning toolbox talks. These engagements enhance awareness of the identified hazards and their remedial strategies, as well as lessons learnt from health and safety incidents which have occurred. This shows that effective health and safety communication aimed at the reduction and prevention of incidents can be achieved. The effects of Covid-19 have brought new challenges to effective health and safety communication. The respondents indicated that the limited time for health and safety communication has created a communication barrier. The company is obligated to limit face-to-face interactions, as much as reasonably practicable, to limit the spread of the virus amongst workers. However, the respondents believe that this measure has negatively impacted on their ability to contribute to continual improvement of health and safety communication.

The company met some of its legislative requirements pertaining to the investigation of incidents and communication of hazards to its workers. However, near-miss incidents were not reported and, as such, the communication of certain potential hazards was not communicated. Additionally, many of the workers do not understand the safety awareness communication which is conducted verbally by the supervisors due to the supervisors' poor communication skills. This leads to workers not being aware of the hazards identified and remedial actions adopted to prevent the occurrence of incidents. For this reason, the impact of the communication conducted does not make a positive contribution towards the prevention of health and safety incidents. An occupational health and safety management option aimed at improving the company's communication methods is needed so that they can have a positive

impact on the reduction of health and safety incidents. Such a health and safety management option would force the company to investigate and analyse all causes of its health and safety incidents, and effectively communicate such to its workers regularly to prevent injury and/ or the occurrence of incidents. An occupational health and safety management system, such as ISO 45001:2018, is based on the planning, executing, checking and continual improvement principle on the company's health and safety performance. The company is in the early stages of implementing the ISO 45001:2018 management system. The impact of the new management system was not assessed, as it was not the aim of this research project.

6.3. Recommendations

The results of this research indicate that the company needs to effectively communicate health and safety matters to its workers to prevent and reduce the number of health and safety incidents. As such, supervisors, managers, and workers need to ensure understand their role in the chain of health and safety communication, the influence of their behaviour on incident occurrence, and the consequences of non-conformance to the company's health and safety rules and practices. The findings of this study suggest a positive approach to health and safety communication, which aims to achieve a positive influence on the health and safety performance of the company. Based on the research findings, the researcher would like to make the following recommendations:

There is an urgent need to manage motor vehicle accidents, by paying attention to the motor vehicle accidents caused by negligence of the company's drivers. This would mean holding the drivers accountable for such accidents and implementing strategies to recover the repair and/or replacement costs of the vehicles from the drivers by imposing hefty fines for negligent behaviour. Advanced driver training must be arranged for drivers to enhance their skills. Additionally, it is recommended that the company should enhance its safety awareness communication to focus on safe driving behaviour.

The company has experienced a high number of motor vehicle accidents, as reflected in the data collected between 2015 and 2019 (Figure 4). However, little evidence was found on the reporting of near-miss incidents. The workers are obligated to report all health and safety incidents to the employer. Likewise, the company is obligated to investigate all incidents, including near-miss incidents. Therefore, the following interventions are recommended: train workers on the classification of health and safety incidents; create an open-door policy for the reporting of near-miss incidents; raise awareness on the dangers of not reporting near-miss

incidents; lastly take disciplinary measures against workers who do not comply with the reporting of near-miss incidents. Such interventions will ensure that preventative measures for incident occurrence are in place.

Communication with workers is a key factor in ensuring excellent health and safety performance. Therefore, the use of intelligent systems, videos, posters in various languages is recommended to promote a sound understanding of workplace health and safety.

It is further recommended that the company should establish worker forums and dialogues to consult and ensure participation and effective communication on issues of health and safety.

Another important recommendation is for the company to simplify the safety jargon used in ISO 45001 and distribute amongst workers for clear and uniform understanding.

Negligence and ignorance of safety rules are a major cause of incidents in the company. The company imparts training and awareness as part of its health and safety system, yet workers continue to act with negligence and ignorance of safety rules, subsequently causing health and safety incidents. Therefore, the researcher recommends that evaluation of the trainers and the trainees' knowledge must be conducted; the training material must be supplemented; the training programmes must be updated and adapted to incorporate Covid-19 related hazards.

Poor housekeeping has contributed to health and safety incidents. The company is obligated to provide a safe workplace for its workers. It is recommended that the company should conduct monthly housekeeping inspections, raise awareness on the principles of housekeeping and make the workers aware of the dangers of poor housekeeping.

6.4. Future studies

Based on the findings of this study, the researcher proposes further research studies on the following:

- The effectiveness of advanced technologies in promoting awareness of workplace hazards.
- The effects of reporting near misses to the reduction of incidents.
- The challenges brought about by using advanced technologies on workplace health and safety.

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APPENDICES

APPENDICES 1: ESKOM CONSENT LETTER



Date:
23 January 2020
Enquiries:
Mrs Nomsa Qwemeshe
Telephone:
+27 43 703 5427

To: The Registrar
Centre for Postgraduate Studies
Central University of Technology
Private bag/ PO Box X20539
Bloemfontein
9300
Republic of South Africa

ETHICS CLEARANCE: CONFIRMATION OF ESKOM INTELLECTUAL PROPERTY RIGHTS AND SECURITY CLEARANCE FOR MASTERS RESEARCH – Mrs. Nomsa Qwemeshe

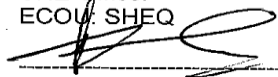
This memorandum serves as an ethics clearance; confirmation of Eskom intellectual property rights and security clearance for Masters level research and write-up by N. Qwemeshe. The research topic is "An investigation of the health and safety communication system and its impact on incident occurrence: a quantitative study with components of a qualitative study."

Mrs. Nomsa Qwemeshe has followed due internal processes in terms of gaining permission for this research.

It must be noted that this general clearance is for a limited period only, which will be for the rest of the financial year 2020 till end 2022, and in no way waives Eskom's Intellectual Property Rights.

Yours sincerely

Mrs. Nomsa Qwemeshe
SHE Officer
ECOU: SHEQ



23/01/2020

Mr. RA. McIntyre
SHEQ Manager
ECOU:



23/01/2020

Initials & Signature



APPENDICES 2: CONSENT LETTER TO PARTICIPANT

Letter giving consent to participate in the survey

Dear Participant

I am Mrs Nomsa Qwemeshe, a prospective Master's student in Environmental Health, at the Central University of Technology (CUT) in Bloemfontein, Free State. My student number is 210031182. I am also registered with the South African Council for the Projects and Construction Management Professionals, registration number CHSO/2944/2019. I am conducting research on how the worker's response to health and safety communicate impacts the health and safety performance of The Company.

The outcome of the research will assist me in concluding whether the studied subject benefits or fails The Company. This will in turn serve as an indicator for The Company to improve on its methods of communicating health and safety matters to its workers.

Your participation in the survey carries the following guarantees:

- Assistance to the researcher in drawing a scientific conclusion on the studies subject.
- The information provided on the survey remains confidential.
- Your identity remains anonymous.
- You will not be linked to any of the outcomes of the research.
- You have the right to withdraw from the survey at any time.
- You have the right to an interpreter.
- You have the right to ask questions to the researcher.
- You have the right to contact the researcher at any time on matters relating to the studied subject. Contact details of the researcher are 043 703 5422 or 072 3456 049.

Signature of the Researcher: _____

Participant's consent:

I confirm that I have read and understand the information above. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

I understand that my participation is voluntary and that I am free to withdraw from this study at any time without giving any reason and without any consequences to me.

I agree to take part in the above study.

Name and signature of Participant: _____ Date: _____

APPENDICES 3: OBSERVATION CHECKLIST

Activity 1:	Description of activity			
	Number of people observed	Employees: __ Contractors: ____ Visitors: _____ Other: ____		
	Number of people working safely	Employees: __ Contractors: ____ Visitors: _____ Other: __		
Safe	<input type="checkbox"/>	Comment on safe behaviour		
Unsafe	<input type="checkbox"/>	Identify unsafe behaviour categories by ticking boxes in below table		
PPE		Positions of People		Reactions of People
<input type="checkbox"/> Head	<input type="checkbox"/> Striking against or getting struck by	<input type="checkbox"/> Person is adjusting PPE		
<input type="checkbox"/> Eyes and face	<input type="checkbox"/> Caught in or between objects	<input type="checkbox"/> Person is adjusting position		
<input type="checkbox"/> Ears	<input type="checkbox"/> Falling/ Could fall	<input type="checkbox"/> Person is rearranging job		
<input type="checkbox"/> Respiratory system	<input type="checkbox"/> Contacting extreme temperature	<input type="checkbox"/> Person stopped activity		
<input type="checkbox"/> Arms and hands	<input type="checkbox"/> Contacting/ could contact electric current	Orderliness/Housekeeping		
<input type="checkbox"/> Truck	<input type="checkbox"/> Inhaling/ swallowing hazardous substance	<input type="checkbox"/> Housekeeping standards not known		
<input type="checkbox"/> Legs and feet	<input type="checkbox"/> Repetative motion	<input type="checkbox"/> Housekeeping standards not understood		
<input type="checkbox"/>	<input type="checkbox"/> Awkward position	<input type="checkbox"/> Housekeeping standards not followed		
Tools		Procedures		
<input type="checkbox"/> Wrong tools for the job	<input type="checkbox"/> Procedures are not available	<input type="checkbox"/> Procedures are not understood		
<input type="checkbox"/> Not used correctly	<input type="checkbox"/> Procedures are not adequate/ practical	<input type="checkbox"/> Procedures are not followed		
<input type="checkbox"/> In bad, unsafe condition	<input type="checkbox"/> Procedures are not known			
Reason for unsafe behaviour	<input type="checkbox"/> Not available	<input type="checkbox"/> Cost	<input type="checkbox"/> Not practical	
	<input type="checkbox"/> Unaware of risk	<input type="checkbox"/> Forgetting	<input type="checkbox"/> Time pressure	

	<input type="checkbox"/> Uncomfortable	<input type="checkbox"/> Knowledge (training)	<input type="checkbox"/> Unclear responsibility
Unsafe act description / comment			
Description of further action if required			

APPENDICES 4: RESEARCH QUESTIONNAIRE

QUESTIONNAIRE

DATE:

1. Thank you for completing the questionnaire, your time and effort.
2. Please indicate the correct response by an **X** on the applicable column, as indicated by the example below.

Example: *Do you know that Health and Safety Communication Health has a role to play in incident occurrence?*

1	2
No	Yes x

Section A: BIOGRAPHICAL INFORMATION (*Please mark with an "X" to be completed by Technical Officers, Supervisors and Managers.*)

1. What is your designation?

Technician	Supervisor	Manager
------------	------------	---------

2. Which s of the department do you work at? (Mark all that apply)

2.	Response	No	Yes
2.1	CNC		
2.2	PPM		
2.3	Energy Protection		

3. Which zone do you belong to?

1	East London Zone	
2	Mthatha Zone	
3	Port Elizabeth Zone	

4	Aliwal North Zone	
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If other, please specify: _____

4. How many years have you worked in the department?

1	0 - 2 years	
2	3 - 5 years	
3	6- 10 years	
4	10+ years	

5. Highest qualification obtained.

1	Grade 8-11	
2	Matric	
3	3-year National Diploma	
4	Advanced Diploma	
5	4-year B Tech Degree	
6	Other	

If other, please specify:

6. Which age group do you belong to?

1	18-29	
2	30-39	
3	40-49	
4	50-59	
5	60+	

7. What is your role in health and safety communication?

.....

.....

.....

.....

Section B: Health and Safety Communication (to be completed by Managers and Supervisors only)

1) Is there a formal process for the communication of health and safety related matters?

(Mark all that apply)

Yes (1)	No (0)

2) Does the organization provide mechanisms, time, training, and resources necessary for communicating with workers?

Yes (1)	No (0)

3) What are the resources available for health and safety communication?? (Tick more than one)

1	Verbal communication	
2	Posters and Signs	
3	Emails	
4	Videos	
5	Presentations	
6	Telephonic and Media	
7	None	

2) What is your role in health and safety communication?

.....

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.....

.....

.....

3) What is included in health and safety communication? (Tick more than one)

1	Health and Safety Departmental Performance	
2	Incident Case study	
3	Awareness messages	
4	Incident prevention measures	
5	Other (specify)	

4) In your opinion, does health and safety communication have any effect incident occurrence?

.....

.....

.....

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.....

5) What are the contributing factors to occurrence of incidents? (Tick more than one)

1	Health and Safety Rules not adequately communicated	
2	Health and Safety matters not clearly understood	
3	Health and Safety Rules ignored	
4	Other: Specify	

6) How do you evaluate the effectiveness of the health and safety communication methods?

.....

.....

.....

Section C: Health and Safety Communication (to be completed by Technical Officers only)

1) Are health and safety issues communicated at your department?

Yes (1)	No (0)

2) Who communicates issues of health and safety in your department?

(You can mark more than one)

Choose from below	0	1
10.1 Manager		
10.2 Supervisor		
10.3 H&S Representative		
10.4 H&S Officer		
11.5 Other.....		

3) How often do you communicate health and safety related matters?

0	1	2	3
Never	everyday	Once a month	6 months or more

4) Is health and safety communication clear and understandable? (Mark all that apply)

Yes (1)	No (0)

5) How is health and safety communication done?? (Tick more than one)

1	Open verbal discussions	
2	Posters	
3	Signage	
4	Email	
5	Other (specify)	

6) What is included in health and safety communication? (Tick more than one)

1	Health and Safety Departmental Performance	
2	Incident Case study	
3	Awareness messages	

7) List barriers to effective health and safety communication

.....

.....

.....

.....

8) Is there any feedback on health and safety concerns raised by workers?

Yes (1)	No (0)

9) Who gives feedback on health and safety concerns raised by workers?

(You can mark more than one)

Choose from below	0	1
10.1 Manager		
10.2 Supervisor		
10.3 H&S Representative		
10.4 H&S Officer		
11.5 Other.....		

Section C: PERCEPTIONS ON HEALTH AND SAFETY COMMUNICATION VS INCIDENT occurrence (to be completed by Technical Officers, Supervisors and Managers)

1) Please state to what extent do you agree with each of the following statements? Please indicate your answer using the following 5-point scale where: 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, and 5=Strongly Agree

Questions:	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Health and Safety communication has a role in incident occurrence	1	2	3	4	5
Health and Safety communication is necessary to promote good health and safety performance	1	2	3	4	5
Current methods of health and safety communication problematic in your area	1	2	3	4	5
Lack of health and safety communication will increase health and safety incidents	1	2	3	4	5
Health and safety communication has an impact on incident occurrence	1	2	3	4	5
Health and safety communication does address challenges which cause incidents	1	2	3	4	5
Effective health and safety communication positively impacts on health and safety performance	1	2	3	4	5
The views of workers are considered during the communication process	1	2	3	4	5

Workers can contribute to continual improvement of communication	1	2	3	4	5
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- 2) The following statements relate to health and safety incidents. Please state to what extent do you agree with each of the following statements? Please indicate your answer using the following 5-point scale where: 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, and 5=Strongly Agree

Answer the following.

Questions:	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Non-adherence to the wearing of PPE contributes to the occurrence of injuries arising out of incident occurrence.	1	2	3	4	5
The use of defective tools and equipment has resulted to health and safety incidents.	1	2	3	4	5
Incorrect use of tools and equipment has resulted to health and safety incidents.	1	2	3	4	5
Poor housekeeping is a major contributory factor to many health and safety incidents.	1	2	3	4	5
I understand the principle of good housekeeping	1	2	3	4	5
Health and safety incidents have occurred because of poor housekeeping.	1	2	3	4	5
Health and safety standards and safe work procedures are there to guard against the occurrence of incidents.	1	2	3	4	5
Non-adherence to safe work procedures can result to incident occurrence.	1	2	3	4	5
Health and safety standards ad safe work procedures are well communicated and understood.	1	2	3	4	5

The Company does not compromise on the health and safety of its workers.	1	2	3	4	5
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APPENDICES 5: PLAGIARISM REPORT

Qwemeshe 01

ORIGINALITY REPORT

16%	15%	7%	6%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	ujcontent.uj.ac.za Internet Source	1%
2	etd.cput.ac.za Internet Source	1%
3	ugspace.ug.edu.gh Internet Source	<1%
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