BINDURA UNIVERSITY OF SCIENCE EDUCATION

DEPARTMENT OF ENVIRONMENTAL SCIENCE

EVALUATION OF CONTRACTOR'S OCCUPATIONAL SAFETY AND HEALTH MANAGEMENT SYSTEMS IN THE PREVENTION OF OCCUPATIONAL ACCIDENTS AT SHAMVA MINE.

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DEDICATION

To my wife, my two boys Tawonga and Tinevimbo for motivation even when the chips were down.

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I give thanks to the Almighty for completing this research. Sincere gratitude goes to my supervisor Dr V. Dudu for her patience and inspiration and knowledge towards the guiding this study. I also appreciate Shamva Gold Mine management for granting the permission to undertake the research at their premises, as well as thanking the employees that participated in questionnaire interviews. I also thank my workmates who sacrificed their time to cover some of my duties for me to attend lectures.

ABSTRACT

Background: Approximately 350 million occupational accidents and diseases occur globally per year resulting in nearly 2.2 million work-related deaths. The mining industry is also responsible for most of these accidents due to the strenuous working conditions and sophisticated equipment involved. In addition, most mining companies hire labour in the form of contracting companies to undertake specialised tasks in underground and surface operations. However, these contractors lack rigid occupational health and safety (OHS) management systems and rarely adhere to OHS regulations thereby increasing the risk of accidents.

Objectives: Causes of occupational accidents in contractors were investigated. The establishment of contractor OHS management system was evaluated. The efficiency of OHS management system in reducing accidents was determined.

Methods: The study employed a complete randomised block design, with four mining departments security, SHEQ, transportation and underground as the blocks. Questionnaire dissemination was done to random participants in each department, whereas structured interviews were done with supervisors and managerial staff. In addition, observations with the aid of a checklist were done to augment the questionnaire.

Key findings: Fatigue (22.0%) and machinery failure (17.8%) were the major causes of accidents among contractors and this was worsened by manual handling, speed working and not wearing adequate PPE. In addition, age (X^2 = 14.63; p = 0.0164), educational level (X^2 = 11.38; p = 0.0029), and work experience (X^2 = 10.54; p = 0.0047), significantly influenced the occurrence of an accident. Lack of resources (57.4%) and lack of training (53.7%) significantly affected the establishment of OHS management system whereas the proposed strategies of improving OHS management system were OHS training (25.4%) and providing resources (23.2%). Accidents were prevalent in the underground and transportation sections but generally declined from January to June 2022.

Conclusions: Regular OHS training to employees to increase OHS awareness and the provision of adequate resources and allocating sufficient time for effective OHS system management among contractors should be exercised. Future research efforts to focus on ways of improving OHS management systems among contractors

Key words: accidents, contractors, OHS management system, mining.

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CHAPTER 1: INTRODUCTION AND BACKGROUND

1.1 Introduction

Contracting out of mining operations has increased significantly in the mining industry over the last two decades. Some contractors are used in mining to undertake specialized tasks in underground and above ground operations. Subcontracting of this variety provides for gains in specialization to the operator and in terms of economic efficiency more broadly. According to Buessing and Boden (2016) contracting has also been used as a means of shifting liability for pension and health obligations of union mine operators to other entities such that they lower the cost of civil penalties and to avoid other employment related costs. Furthermore, it is clear that contractors have become and will remain into the future an important part of the mining industry workforce. This study will assess management systems of contractors are in the prevention of occupational accidents at Shamva mine.

There appears to be a general recognition amongst stakeholders that the growing use of contractors in the mining industry has implications for Occupational Safety and Health (OHS) that require attention. This view is supported by a growing body of international research on the Occupational Safety and Health (OHS) effects of contract labour, whether they are self-employed, contractor employees or labour hired workers. Albin and Mantouvalou (2012) revealed that contract workers are a vulnerable group and hence exposed to health and safety risks: low bargaining power, ignorance of legislation and high unemployment. Contract workers are exposed to risks beyond their control, contribute to risks because of lack of job-specific knowledge and experience in the diverse work they encounter. According to Saleh and Cummings (2011) contracted coal mines in China have killed a lot of people due to poor safety management and considering production first and disregarding safety. For example, on 14 February 2005 sections of the Sunjiawan mine in Liaoning province, where a gas explosion killed 214 miners (Saleh and Cummings, 2011).

In addition, 21 contractors lost their lives in Jinjiangpanhai coal mine due to gas explosion. Coal mine accident investigations point out that the mines lack the conditions to ensure safe production like basic ventilation system. The International labour organization (ILO) estimates that 2 million workers die every year as a result of work-related accidents Molla *et al.* (2015). Based on a report by Mutumbuki (2020) in Zimbabwe over 200 people die every year as a result of work-related accidents. What this translates to is that one in every hundred

thousand (1/100 000) of the world occupational fatalities is a Zimbabwean. Which means we are certainly world leaders but in the wrong race. Zimbabwe is certainly not one of those developed countries with a very small population, even smaller than that in cities in Europe, India or Asia yet it records so many deaths caused by occupational accidents.

Shamva Gold mine which is located in Mashonaland Central Province in Zimbabwe is part of the Kuvimba Mining House of Zimbabwe which is group of mines some of which are Freda Rebecca Mine, Bindura Nickel Mining Company in Bindura and Jena Mines among others. Shamva Mine were first claims in the year 1893. Little work was performed until 1909. In April 1910, Shamva Mine limited was registered as a mine to start operations. After the railway line that linked Harare and Shamva was completed, heavy machinery and a plant were introduced. In January 1914 crushing of ore commenced.

Ore was initially extracted from the main open pit, which grew rapidly in size, forming a hole 700m long, with a width of 120m and a depth of 170m. The Western section of the South parallel zone was also developed into a large open pit, which is known as the Goromonzi Stope. Due to operations issues the mine closed in May 1930 thereafter, it was leased to various small miners. Mine ownership changed hands from then until it finally became Metallon Gold Zimbabwe. At the end of 2018 operations were suspended as Metallon Gold Zimbabwe failed to maintain all its five mines. In March 2020, Kuvimba Mining House took over all operations of Shamva Gold Mine under Mine Rescue Operations.

1.2 Background

Outsourcing of non-core business activities such as construction, maintenance and engineering have increased over the years, with the contractors facing higher incident and accident rates than employees of the outsourcing company (ILO, 2015). In addition, Chigumbu (2016) acknowledged that use of contractors is highly associated with a rise in adverse OHS outcomes. Globally it is estimated that nearly 2.2 million work related deaths occur annually, whereas approximately 1.7 million deaths occur from occupational diseases (Bin *et al.*, 2014; Takala, *et al.*, 2017).

Arntz-Gray (2016) deduced that mining accounts for nearly 1% of the global workplace, but is responsible 5% of fatal accidents at work. Most employees are affected by occupational diseases such as pneumoconiosis, hearing loss and the effects of vibration whose premature disability and even death can be directly attributed to their workplace (Saes and Muradian,

2021). In addition, the developing countries are mostly affected (Ezejiofor *et al.*, 2014). For example, the South African Mining industry recorded 391 fatalities and 7737 injuries in 2007 and 2008 collectively (Oil and Gas Commission 2009). In Zimbabwe, the mining industry accounted for 2886 injuries from 2004 to 2009 (ILO, 2015).

1.3 Problem Statement

Shamva mine before Kuvimba house group, embarked and adopted the OHSAS 18001 and Behavior Based Safety to manage occupational accidents in 2010 and 2013 respectively. Furthermore, given the experience the company has gone through when implementing the system, it should have observed a downward trend of incidents. However, incidences that occurred in the interim period from Metallon Gold to Kuvimba House of illegal artisanal mining accidents portrayed badly on any potential investor. Besides that, at risk behavior/unsafe behavior used to be high in contractors. Through random alcohol testing at the main mine gate 90% of contractors were found to be under the influence of alcohol whilst the work premises are an alcohol-free area. The coming in of Kuvimba house with its zero tolerance on poor management systems on contractors, is one of the reasons for undertaking this review. Apart from that, there is an increase in the number of projects and number of contractors on site and this points to a likelihood of a surge in accidents.

1.4 Justification of the study

The findings of the research will benefit Shamva mine to establish or to enhance a comprehensive occupational safety and health management system so as to prevent the occupational accidents and health risks for the benefit of the workers. This will improve the mine's performance in service delivery due to increased productivity, reduced absenteeism from work, reduced compensation costs and ultimately benefit the society and ensure worker's protection. The research will provide an understanding to the top management of the contractor's occupational safety and health risks associated with mining operations and will assist in determining effective interventions in accident prevention. Ultimately, a safe working environment will be available which will boost employees morale and in turn Shamva Mine production. A safe workplace also enhances the organisation's cooperate image hence improve its competitive status.

1.5 Aim

To explore the contractor's occupational safety and health management system in the prevention of occupational accidents at Shamva Mine.

1.6 Objectives

1) To analyze causes of accidents and safety culture in contractors.

2) To evaluate establishment of contractor OHS management system.

3) To determine efficacy of the OHS management system in accidents reduction.

CHAPTER 2: LITERATURE REVIEW

This chapter reviews literature related to accident factors that expose employees to injuries and looks at preventive and control measures that are recommended in workplaces mainly relating to the mining industry. The operation of management systems, how they relate and how they differ, is assessed so as to maintain safe working environment. The mine of study has adopted what they call Business Excellence Management Systems (BEMS). This is whereby they have integrated three management systems (ISO14001, ISO9001, and ISO45001) to become one working document across all operations. Safety cultures and safety climate as described by various authors are also be reviewed.

2.1 Global status of workplace safety and health

The World Health Organization (WHO) considers workplace safety as a priority setting for health promotion in the 21st century (WHO, 2010). Reports from the International Labour Organization (ILO) and WHO indicate that workplace injuries are prevalent among employees due to accidents, with property damage also occurring resultantly (ILO, 2015; WHO, 2010). However, most organisations prefer a single OHS performance measurement which only minimises the risks but does not eliminate them (Alkilani *et al.*, 2013). As such, promoting OHS practices such as awareness, research and education requires a broader platform (Ayim and Salminem, 2010). In a survey by Rantanen *et al.* (2013) it was concluded that 70% of the countries had OHS systems in place, whereas employees with OHS services was 18%. Globally, an estimated 150 million workers experience workplace accidents annually and nearly 2.5 million people die as a result of unsafe or unhealthy workplace conditions (ILO, 2015) resulting in a 4% loss of global Gross Domestic Product (GDP) (ILO, 2020).

Abzakh *et al.* (2013) reported that safety management is still in its infancy in developing countries resulting in low productivity due to the nature of the adverse nature of the work environment. In addition, most of African countries resort to poor OHS practices (Ayim and Salminen, 2010) focussing more on clientele satisfaction at the expense of employee safety and wellness. Zimbabwe is rich with over 40 minerals with most people employed in the mining sector, however most are informal miners (ILO, 2012). The formal sector is also hampered with high accidents and occupational diseases thus it is important to carry out a study in the mining industry.

2.2 Safety culture and climate

According to Bentley and Tappin (2010) safety culture and safety climate refer to similar concepts. Safety climate is generally an outline of the safety culture and is relatively unstable and subject to change (Wiegmann *et al.* 2004). Safety climate is thus a superficial construct that encompasses attitudes and beliefs of employees which control their behavior (Bentley and Tappin, 2010). In each organisation, a certain internal attribute called culture exists, and is defined as the common ways of thinking, behaving and believing that members of a social unit possess (O'Connor *et al.* 2011). Culture can be static or dynamic and affects employees exposure to risk and health effects due to differences in social and cultural differences in working conditions and employment structure (Olsen, 2010). Shamva mine through BEMS, has a culture of legal compliance and continual improvement which is adopted by eight contractors. By adhering to policies such as ISO 14001;9001and 45001 dynamism in culture can be appreciated through leadership commitment to continually review and implement new culture systems (Bentley and Tappin, 2010).

Although the concepts used to assess safety climate vary, the measured domains generally include management commitment, supervisor support, safety awareness, safety training, safety policy, safety knowledge, safety communication, and co-worker support (Olsen, 2010). A culture of trust aids the organization in having confident employees that are able to report accidents to management (Wiegmann *et al.* 2004). On the other hand, absence of a culture of trust, results in failures to report hazards and near misses which may be fatal to employees and property (Hollnagel, 2014).

2.3 Safety management systems (SMS)

Huang (2009) defines safety management systems (SMS) as an organized approach of managing safety, to include the necessary organizational structures, accountabilities, policies, and procedures. SMS are governed by four pillars which are: safety policy, risk management, safety assurance and safety promotion. Fan and Stevenson (2018) deduced that SMS should continuously evaluate and improve its effectiveness through all interested and affected parties. As such, information dissemination should be mandatory as a requirement of occupational and environmental health laws and voluntary initiatives (Fan and Stevenson, 2018). Despite the adoption of SMS by organizations, its effectiveness has been continually debatable. Gunduz and Laitinen (2017), postulated that adapting SMS is beneficial to an organization's overall performance. Table 1 shows the similarities and differences between QMS, EMS and SMS in any organization trend, adopted from Jilcha and Kitaw, (2016).

Table 2.1 Similarities and differences between management systems

Similarities among QMS, EMS, SMS	Differences among QMS, EMS, SMS
They all talk of • System requirement • System documentation • Verification • Auditing • Conformity • Continuous improvements Prevention • Leadership (management responsibility) • Management of resources • Management of process • Monitoring and measuring • Deming principle (PDCA)	Aims: • QMS aims toward customer satisfaction • EMS aims for safe environmental protection. • SMS aims towards occupational risks control to improve safety and health related performance. • EMS focuses on environmental protection and energy conservation while SMS focus on creating and maintaining safe environment while protecting and maintaining the good health of the workers • In terms of System management ✓ QMS applied 100% voluntarily ✓ EMS partly voluntarily and partly obligated by legal demands.

2.4 Safety standards, policy and safety training

Only 24 countries ratified the ILO Employment Injury Benefits Convention No. 121 (Hilgert, 2013). This convention lists occupational diseases for which compensation should be paid . in addition, only 31 countries have ratified the Convention on Occupational Health Services No. 161 (ILO, 2015). This is because some countries have criticized the lack of flexibility in ILO standards in allowing less developed countries to adapt standards to their local context. This, allows greater accommodation of management option at the workplace (Hilgert, 2013). As such, ILO standards are not efficient in solving OHS problems thus a holistic improvement approach is required so as to improve the workplace safety and health.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This research is to evaluate contractor's occupational safety and health (OHS) as well as management systems in the prevention of occupational accidents at Shamva Mine in Mashonaland Province. The study will be mainly qualitative research method in order to observe, discover, describe and analyse factors leading to this evaluation.

3.2 Study Area

The study was conducted at Shamva Gold Mine (17.313967ºS and 31.569625ºE), situated approximately 90km north east of Harare. The Mine is involved in the exploration, extraction, and processing of gold, though currently its processing is done at Freda Gold mine, which is a sister company located 26km away. A total of 720 precious metal claims is held by an organisation named Kuvimba Mining House, Zimbabwe, in and around Shamva area. Work force is mainly drawn from Shamva Mine and Wadzanayi township, and surrounding farms (Magobo, Chisaka and Ngeure). The underground workings, processing plant and accommodation sites are under the jurisdiction of the Kuvimba Mining House. The area has low diversity of life forms and the ecosystems are characterized by sparse vegetation cover.

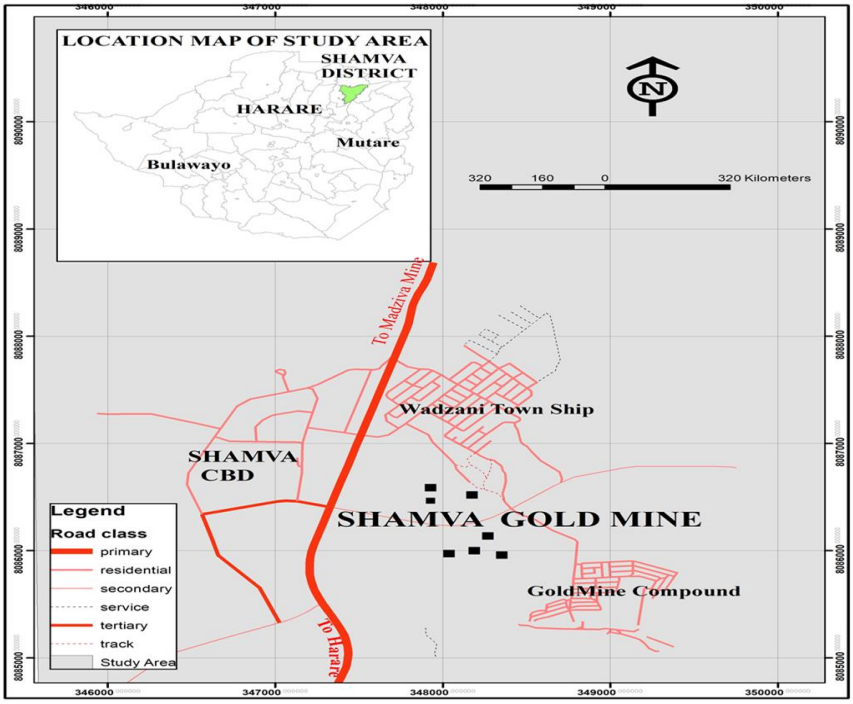


Fig 3.1: Location of study area

3.3 Target population

Population is defined as the collection of elements or subjects that possess the information sought by researcher and about which inference are to be made (Yoon *et al.*, 2013). In this case, the researcher was concerned with evaluation of OHS management system of contractors in reduction of accidents. The key respondents in the study were from underground, transportation, SHEQ reps and Security. The target population from which the sample was drawn was 199. The total sample size was 40 which comprised of 29 non-managerial and 11 managerial positions as shown in Table 3.1.

Table 3.1: Distribution of the sample size

Section	Non-managerial	Managerial	Sample population	Total population
Security	3	1	4	22
Transportation	2	1	3	15
SHEQ reps	2	1	3	12
Underground	22	8	30	150
Total sample size	29	11	40	199

3.4 Sample size determination and selection

A sample is a sub unit of a target population and is a true representation of the target population (Etikan *et al.* 2016). Participants were randomly selected from departments using the rule of thumb as stated by Rahi *et al.* (2019). Also, purposive sampling was employed and it involved disseminating questionnaires to respondents present at the premises on each visit. Workers were stratified according to operating sub-sections in the contracting companies, thus ensuring representation of all contracting workers within the mine.

3.5 Research Instruments

3.5.1 Questionnaires

A questionnaire is an instrument that serves to measure specific aspects of researcher's objectives (Taherdoost, 2016; Ko and Chou, 2020). In this research the questionnaire (Appendix I) included both open-ended and closed ended questions to collect both qualitative and quantitative data. The questionnaire was designed in such a way that the questions were clear and unambiguous, short, avoided unnecessary jargon and specialist language. A total of 40 questionnaires were distributed to the respondents as shown in Table 3.1. The questionnaire was divided into sections corresponding with the objectives of the study. Some

of the issues covered in the questionnaire were causes of accidents, establishment OHS management system, and efficacy of the OHS in accidents reduction and analysis of safety culture of contractors.

3.5.2 Semi Structured Interviews

Structured interactive interviews were used on managerial staff (Appendix II). Doody and Noonan (2013) defined interview as any interaction between two or more individuals with a specific purpose in mind. Data collecting techniques of interviewing involve oral questioning of respondents. Interviews were conducted with all the 40 participants. To reduce bias and give room to the interviewee to do much of the majority of the talking, the researcher used open ended questions. This enabled respondents to freely say their opinions concerning establishment of contractors to OHS management system. Interviews aided in the acquisition of reliable and accurate information on the system requirements and gaps that exist.

3.5.3 Observations

Direct observations were undertaken by going into the plant, noting down some observations without talking to anyone. This was done through compliance inspections whilst the contractors were carrying out their respective duties. This was guided by an observation guide (Appendix III). This gave the researcher opportunity to have direct contact with what is happening on the ground.

3.5.4 Secondary data

Data was also acquired through secondary sources that included company records, safety statistics, alcohol tests, road behavior checks, peer to peer observations, planned job observations and visible felt leadership observations. These documents enabled the researcher to identify the company's lagging and leading indicators. Secondary data also facilitated appropriate scoping of the later stages of the site investigation and reduces wastage on inappropriate intrusive ground investigations (Favaretto *et al.* 2020).

3.6 Pre-Testing of questionnaire

The questionnaire was pretested on ten respondents in a pilot survey. This allowed for the scrutiny of the research questions to meet desired objectives (Perneger *et al.* 2015). As such, adjustments to questions were made through re-arranging questions, avoidance of vagueness, ambiguity, bias, illogical sequence and deleting some questions which respondents felt were monotonous. The pilot study also aided in reducing bias.

3.7 Ethical Consideration

Code of ethics by the American Psychological Association (APA, 2017) were used to guide ethical issues. Permission to conduct this study in the selected area was granted by Bindura University of Science Education and Shamva Mine. The respondents were debriefed about the nature and goal of the research and their participation was voluntary. Face to face interviews with the respondent wade it easier for the respondents to trust the intentions of the research. Thus, verbal informed consent was obtained from the respondents before questionnaire dissemination. Respondents were informed that their participation in the research was entirely voluntary and their responses were for academic purposes. No information on personal identifiers was recorded to allow confidentiality thus code numbers were used.

3.8 Statistical Analysis

The Statistical Package for Social Sciences (SPSS) version 22.0 was used for data analysis, with the data tested for normality using the Smirnov-Kolmogorov test prior to analysis. The Chi-square test was used to test the association between sociodemographic characteristics and OHS management systems.

CHAPTER 4: DATA PRESENTATION

4.1 Sociodemographic characteristics

Table 4.1 shows the sociodemographic attributes of the respondents. Most respondents were male (77.5%), and were in the 21–40 years age group (52.5%). In addition, the respondents were mostly married (47.5%), and attained ordinary level education (57.5%). Also, most respondents had worked for the organisation for a period more than 10 years (27.5%). In addition, age class (X^2 = 14.63; p = 0.0164), educational level (X^2 = 11.38; p = 0.0029), work experience (X^2 = 10.54; p = 0.0047) and work department (X^2 = 9.157; p = 0.0196) were significantly associated with knowledge on OHS management.

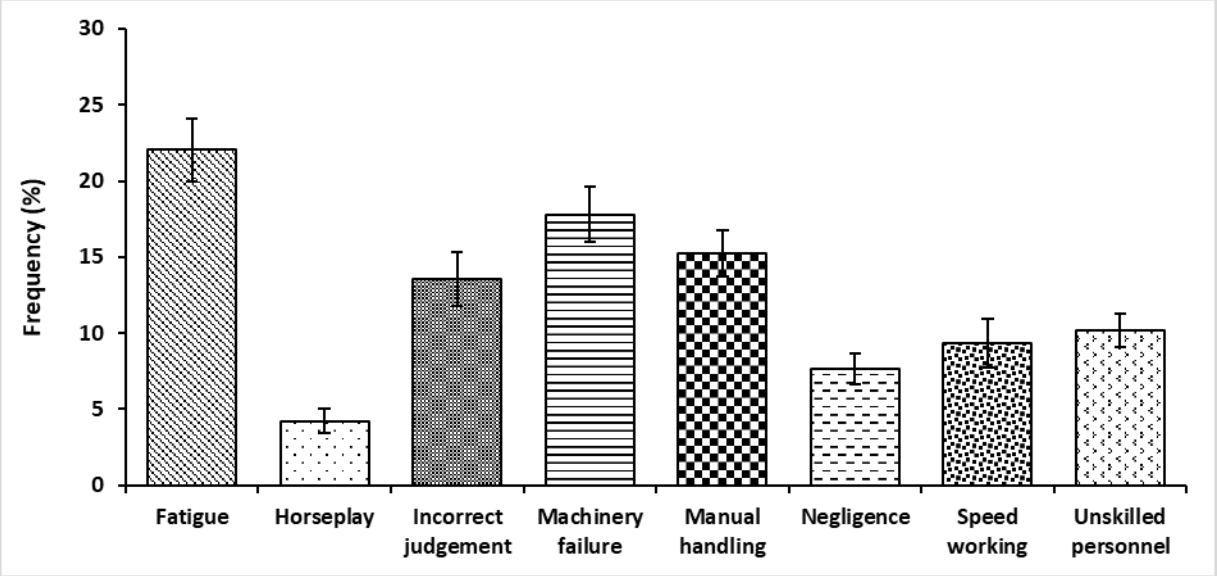
Table 4.1: Association of sociodemographic characteristics with knowledge on OHS management systems

Variable	Category	Count	Freq.	Pearson's X^2 - *Test*	
				X^2 – Test Value	*p-value*
Gender	Male	31	77.5	7.29	1.5632
	Female	9	22.5		
Age class	< 20 years	2	5	14.63	0.0164*
	21 – 40 years	21	52.5		
	41 – 60 years	14	35		
	> 60 years	3	7.5		
Marital status	Married	19	47.5	6.42	2.6341
	Divorced	4	10		
	Widowed	5	12.5		
	Single	12	30		
Educational level	Primary level	1	2.5	11.38	0.0029*
	Ordinary level	23	57.5		
	Advanced level	11	27.5		
	Tertiary level	5	12.5		
Work experience	< 1 year	6	15	10.54	0.0047*
	1 - 5 years	9	22.5		
	6 - 10 years	14	35		
	> 10 years	11	27.5		
Work department	Security	4	10	9.157	0.0196*
	Transportation	3	7.5		
	SHEQ reps	3	7.5		
	Underground	20	50		

*Denotes significantly different means (p < 0.05).

4.2 Causes of accidents and safety culture in contractors

Fig. 4.1 shows the causes of occupational accidents among contractors at Shamva Mine. The most recognised causes of work-related accidents were fatigue (22.0%) and machinery failure (17.8%), whereas horseplay (4.2%) was the least. Fatigue and horseplay were significantly different ($p < 0.05$) whereas incorrect judgement, machinery failure and manual handling were not significantly different ($p > 0.05$). In addition, negligence, speed working and unskilled personnel were not significantly different ($p > 0.05$).



Superscripts [a, b, c, d] denotes significantly different ($p < 0.05$).

Fig. 4.1: Causes of occupational accidents among contractors at Shamva Mine

The observation checklist was also used to identify some of the factors causing accidents among contractors (Table 4.2). It was observed that in most cases, employees were crowded at work stations (53.6%) and did not wear adequate PPE (62.5%). Though safety toolbox talks were duly conducted (96.1%), there were no standard operational procedures (87.6%) at work stations. In addition, housekeeping was mostly not done (55.5%), and there was a lot of manual handling whilst executing work tasks (78.4%) and speed working (59.3%). All these factors led to the occurrence of accidents.

Table 4.2: Observation checklist for causation of accidents among contractors

Observations	Yes (%)	No (%)
1) Crowded employees at work station	46.4	53.6
2) Employees wearing adequate PPE	37.5	62.5
3) Safety toolbox talk conducted and signed in daily register	96.1	3.9
4) OHS policy present at work station	41.8	58.2
5) OHS policy written in English and vernacular languages	100	0
6) Standard Operational Procedures available at work stations	12.4	87.6
7) Employees partake in horseplay when undertaking tasks	8.3	91.7
8) Housekeeping properly done around work stations	44.5	55.5
9) Fire-fighting equipment present and up to date	61.8	38.2
10) Manual handling when executing work tasks	78.4	21.6
11) Speed working by employees	59.3	40.7

Fig 4.2 shows the influence of demographic attributes as causes of occupational accidents among contractors at Shamva Mine. Gender was perceived as the major cause of accidents in the Underground (39.3%) and SHEQ (27.9%) departments. On the other hand, in the Transportation section, age (45.1%) and work experience (50.0%) influenced the occurrence of work accidents, whereas educational level induced accidents in the Underground (49.2%) and Transportation (41.3%) departments.

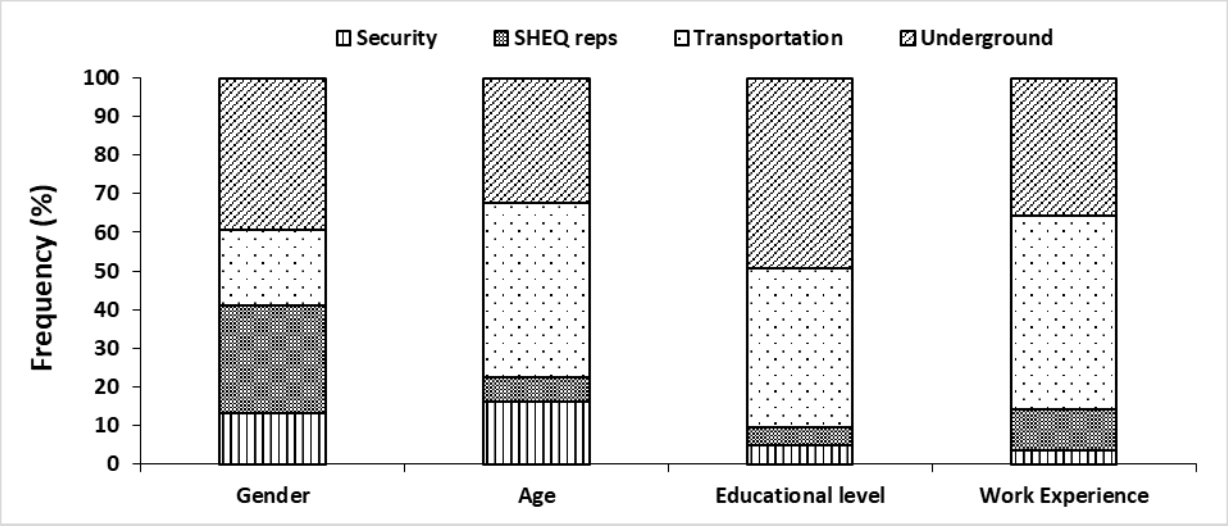
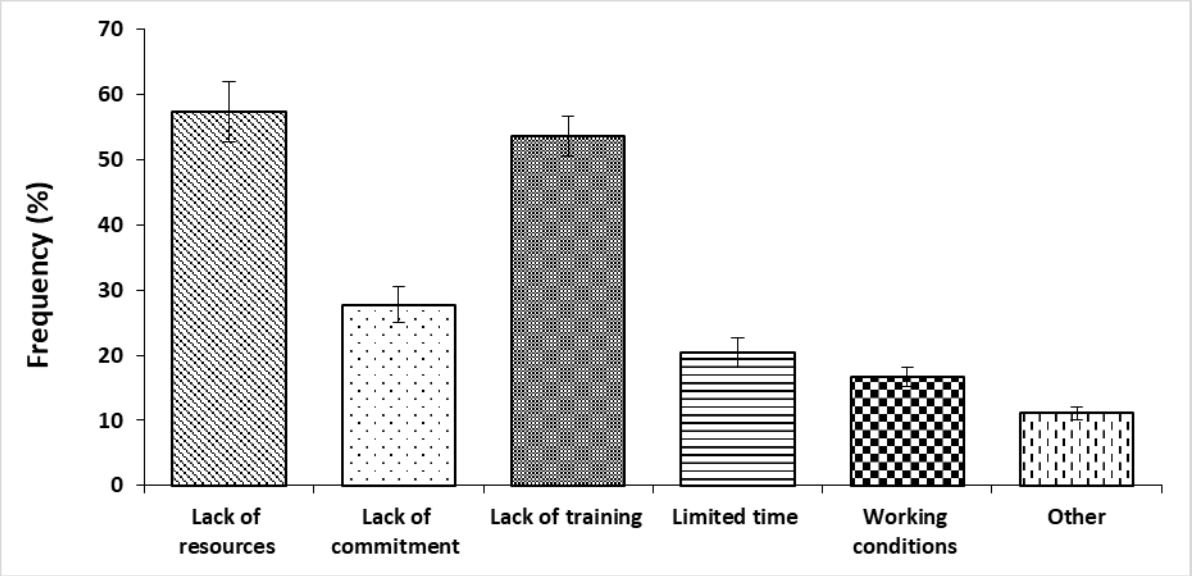


Fig. 4.2: Influence of demographic attributes on causes of occupational accidents among contractors at Shamva Mine

4.3 Establishment of contractor OHS management system

The challenges faced by contractors in the establishment of OHS management systems are shown in Fig. 4.3. The most significant challenges to OHS management systems were lack of resources (57.4%) and lack of training (53.7%). In addition, lack of resources and lack of training were not significantly different ($p > 0.05$). The lack of commitment was significantly different from other challenges ($p < 0.05$). Other (11.1%), represented discrimination, negligence, and the Covid-19 pandemic.



Superscripts [a, b, c, d] denotes significantly different ($p < 0.05$).

Fig. 4.3: The challenges to establishment of OHS management systems among contractors at Shamva Mine

Fig. 4.4 illustrates the ways of improving the establishment OHS management systems among contractors at Shamva Mine. Most respondents recognised OHS training (25.4%) and providing resources (23.2%) as the most significant strategies of improving OHS management system. Provision of welfare facilities (7.0%) was the least mentioned strategy.

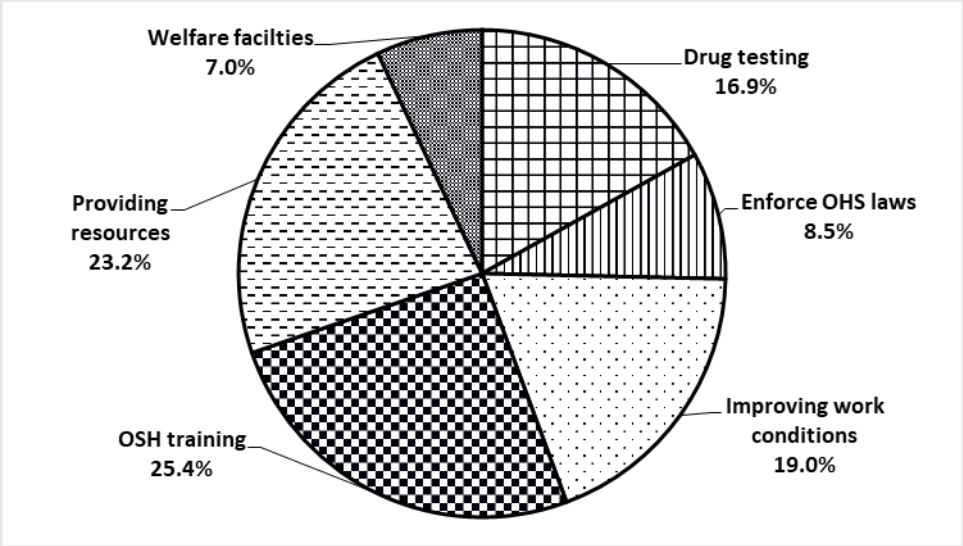


Fig. 4.4: Strategies of improving the establishment of OHS management systems among contractors at Shamva Mine

4.4 Effectiveness of the OHS management system in reducing accidents

Fig 4.5 shows the total accidents and incidents recorded from January to June 2022 in different departments among contractors at Shamva Mine. The number of recorded accidents and incidents was significantly different among departments. Overall, accidents declined from January to June 2022 in all departments. However, the Underground and Transportation sections had higher accident and incident cases compared to the Security and SHEQ representatives for all months though the Transportation recorded the highest accident cases (5) in the last month of assessment whereas the Security and SHEQ representatives had equal recorded accident cases (1).

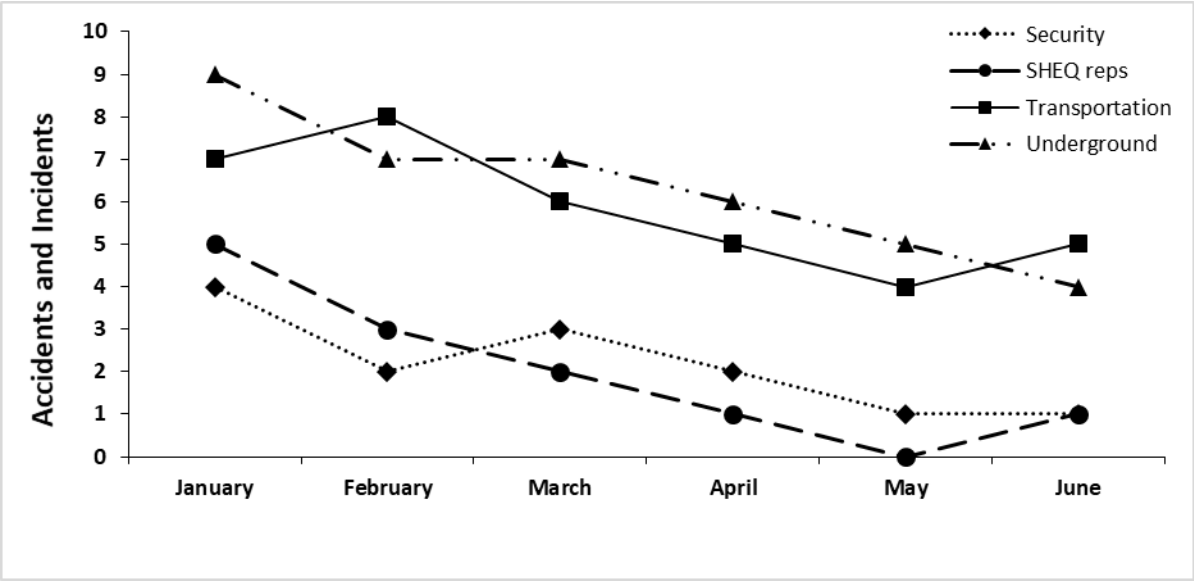


Fig. 4.5: Departmental comparison of work accidents among contractors in 2022

CHAPTER 5: DISCUSSION

5.1 Causes of accidents and safety culture in contractors

The most accidents among contractors were mainly caused by fatigue and machinery failure. Fatigue results in employees making poor decisions and in turn cascades to incorrect judgement leading to accidents. On the other hand, machine failure can result in entanglement or cuts from rotating parts. Similarly, Arquillos *et al.* (2012) and Boniface *et al.* (2013), concluded that accidents related to machinery and equipment are high in the workplace, and are caused by interactive failure between workers, workplace, materials, and equipment involved. Likewise, ILO (2020) asserted that machine failure leads to prevalent injuries and accidents among contractors.

Also, there were significant mentions of manual handling and unskilled personnel as causes of accidents among contractors. Continuous bending during lashing in the underground section whereas repetitive movement of when manually carrying loads in the transportation department contributed to accidents. This results in damage to the cardiorespiratory or musculoskeletal system and traumatic injuries and in worst cases permanent disability (WHO, 2018). Unskilled personnel cannot execute work tasks properly and efficiently hence the risk of accidents is high.

Observations revealed that speed working to quickly accomplish tasks and not wearing adequate PPE resulted in safety procedures being omitted by employees increasing the risk of accident causation. This concurs with Dudarev and Odlaand (2013) who reported that failure to understand and execute properly the required procedures hugely contributes to occupational accidents. In addition, crowded workstations and untidy work stations increased the possibility of accident occurrence through being hit by equipment or tripping and falling respectively (ILO, 2015).

Gender was perceived as the major cause of accidents in the underground department and this could be due to the strenuous and physically demanding activities undertaken in this section which require stamina hence it is a male dominated field (Nawi *et al.* 2016). In addition, educational level influenced accidents in the Underground and Transportation departments. Those who attained tertiary education were better equipped on OHS issues tallying with the findings of Sharma and Mishra (2020) who asserted that there is a positive association between the enhancement of OHS knowledge and the academic credentials of employees.

In the Transportation section, age and work experience mostly influenced the occurrence of work accidents. This is because operating mobile equipment requires experience and some of the employees had less than a year of working experience as such had not familiarised with the working environment. This tallies with Sharma and Mishra (2020) who reported that working experience help in identifying risks and hazards thus minimising the likelihood of accident occurrence. Similarly, Loosemore and Malouf (2019) deduced that the 20-29 years age group had the highest accident frequency as it lacks experience. Also, Basaga *et al.* (2018) concluded that employees at a younger age usually possess a lesser understanding of work ethics than higher age groups. However, at higher age groups, poor sight and hearing may develop due to old age thus increasing the risk of accidents.

5.2 Establishment of contractor OHS management system

Lack of resources and lack of training were the major challenges to the successful establishment of contractor OHS management systems. Unavailability of resources such as PPE and other safety and training equipment generally, leads to a high accidents and injuries. This was evident in the unavailability of adequate PPE in some employees. This could be attributed to organisation regarding PPE as not important as well as additional expenditure. Similarly, Gusti *et al.* (2019) reported that limited OHS funds is a major barrier to effective OHS management system. This is due to management mostly concerned with production hence, key information on OHS is not properly communicated to employees (Bouckenooghe *et al.* 2015). This creates a negative OHS culture with adverse effects to OHS performance, increasing the risk of work-related accidents (Kim *et al.* 2016). Without adequate training, OHS officers fail to effectively monitor and report the OHS system, whereas the employees cannot abide to regulations they do not understand (Annan *et al.* 2015; Sharma and Mishra, 2020). As such, employees do not report near misses resulting in recurrence of the incident with adverse effects (Nawi *et al.* 2016).

Other challenges like lack of commitment, limited time and poor working conditions also proved to be obstacles in the establishment of contractor OHS management system. Top management are usually committed to maximising production targets, hence prioritise less time to OHS management. Similarly, lack of supervision leads to employees become negligent and develop negative attitude towards OHS thus hampering the success of an OHS management system (Nawi *et al.* 2016). This tallies with Gusti *et al.* (2019) who concluded that low OHS priority and weak supervision significantly deters the success of OHS management. On the other hand, working overtime to get extra allowances, and speed

working to meet targets usually leads to a reduction in concentration due to fatigue thereby increasing the likelihood of accidents (Yoon *et al.* 2013). Also, absence of distinct gender-based facilities mainly affects women when it comes to provision of sanitation and restrooms (Kim *et al.* 2016). Tools and equipment are designed using male anthropometry yet are used by both genders.in addition, females are discriminated thus affecting their morale and work performance (Jwasshaka and Amin 2020).

To improve the establishment of contractor OHS management systems it was mostly suggested to conduct OHS training and provide resources. These strategies of OHS system management have an impact on general safety, financial and competitive functioning of contractors. This is because they reduce accidents, injuries, property damage, personal injuries and absenteeism of employees. On the other hand, they improve productivity, profits and enhance the organisation's reputation (Gusti *et al.* 2019). Employees trained on OHS can identify hazards and make safe decisions when undertaking work tasks hence a safety culture is maintained. Likewise, providing resources such as PPE, OHS training material, engineering controls, safety signage and incentives for safe work greatly improves the OHS system (Ncube and Kanda, 2018) as workers will be motivated to towards an accident free-shift and in return their safety is guaranteed whereas (Kim *et al.* 2016).

Other respondents proposed alcohol and drug testing, and improving working conditions as strategies of enhancing OHS system management. This aids in increasing safety awareness as it eliminates working under the influence of drugs which impairs judgement increasing likelihood of accidents (Pidd and Roache, 2014). As opined by Knightly (2015) most contractors do not have the capacity and authority to randomly test employees for alcohol or drug use. Thus, undertaking such an initiative will be essential in the establishment of an effective OHS system management. On the other hand, Gopang *et al.* (2017), asserted that effective OHS system management can be achieved through improvement of working conditions. This is realised through consistently supervising the wearing of PPE and provide additional welfare support for overtime and late-night working (Gusti *et al.* 2019). Also, Wendler *et al.* (2012) further proposed that organisations should prioritise OHS and balance the pressure of demand and competition. In so doing, accidents and injuries are reduced and production is increased, costs are reduced, profitability and performance is also increased.

5.3 Effectiveness of the OHS management system in reducing accidents

There was a relatively high number of accidents in the Underground and Transportation departments compared with the Security and SHEQ departments. This could be attributed to the nature of work in these departments. Most of the work is manual handling of heavy loads as well as physically demanding tasks. Moreover, in the Underground section ventilation and heat worsen the working conditions resulting in difficulties in breathing and heat stress, ultimately affecting work performance (Maurya *et al.* 2015). The high number of recorded cases in the Transportation section were mainly falling loads and minor collisions with property.

However, there was a general decline in the accidents and incidents from January to June and this could have been attributed to consistent safety toolbox talks and safety awareness done by the SHEQ representatives. In addition, the employees were gaining OHS experience by each passing day hence they could identify hazards as well as exercise corrective action to reduce accidents. Likewise, Kim *et al.* (2016) and Nawi *et al.* (2016) asserted that employees gain experience overtime and avoid workplace hazards thus reducing risk of injury and illness. However there still remain some employees who are reluctant to wearing adequate PPE.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 Summary

This chapter summarises the research findings and provides recommendations on OHS management systems. The study investigated the contractor's occupational safety and health management system in the prevention of occupational accidents at Shamva Mine. This was achieved by determining the causes of accidents and safety culture in contractors, as well as determining strategies of improving the OHS management.

6.2 Conclusion

The study revealed that fatigue and machinery failure were the major causes of accidents among contractors and this was coupled with manual handling, speed working and not wearing adequate PPE which increased the likelihood of an accident occurring. In addition, low work experience and low level of education significantly influenced the occurrence of an accident.

The most significant challenges to establishment of OHS management systems were lack of resources and lack of training, whereas the proposed strategies of improving OHS management system were OHS training and providing resources towards OHS management.

Overall, the number of recorded accidents and incidents among contractors declined from January to June 2022 in all departments. The Underground and Transportation departments had higher accident and incident cases compared to the Security and SHEQ representatives.

6.3 Recommendations

1. Regular OHS training to employees to increase OHS awareness.
2. Provision of adequate resources and allocating sufficient time for effective OHS system management.
3. Future research should focus on ways of improving OHS system management among contractors.

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APPENDICES

Appendix I: Questionnaire for non-managerial employees

My name is Nelius Damu and l am studying at Bindura University of Science Education. Information gathered will be for learning purposes only and will remain confidential. I would like to ask you some questions pertaining factors which influence injuries on duty and compliance with Safety standards. The information has no monetary benefits associated with participating in the study. NO NAMES TO AVOID VICTIMIZATION OF PARTICIPANTS.

SECTION A: Demographic data (*Write or tick in the spaces provided)*

1. How old are you? ……..…

2. Gender: Male ☐ Female ☐

3. Marital Status: Married ☐ Single ☐ Divorced ☐ Widowed ☐

4. What is your highest level of education? Primary ☐ Secondary ☐ Tertiary ☐

5. How many years have you worked for this company? …….

SECTION B: Safe working procedures

6. Do you drink beer? Yes ☐ No ☐

7. If yes, how often? ……..

8. What time do you usually sleep? ……...

9. Have you ever been injured at work? Yes ☐ No ☐

10. If yes, when did it occur? <6 months ☐ 6-12 months ☐ >12 months ☐

11. How many times have you been injured at work? ……

12. Have you received any OHS training? Yes ☐ No ☐

13. Are you provided with adequate protective clothing? Yes ☐ No ☐

14. If yes, how often do you receive protective clothing? ……

15. Do you receive job briefings before starting work? .....

16. Do you always follow safe work procedures? Yes ☐ No ☐

17. If no, why? ……

18. Do you have enough time to learn about the safe work procedures? .....

19. Do you do risk assessment when you start a new task? Yes ☐ No ☐

20. Have you ever been diagnosed with any work related illness? Yes ☐ No ☐

21. If yes, when was your last illness? <6 months ☐ 6-12 months ☐ >12 months ☐

22. In your line of work, what are the chances of getting injured? low ☐ medium ☐ high ☐

23. What are the common causes of injuries and/or accidents or ill health at your workplace? human error ☐; machinery failure ☐; unskilled personnel ☐; fatigue ☐; chemical fumes ☐; manual material handling ☐; *Other, please specify* ……
……

24. Is First Aid equipment and assistance available? Yes ☐ No ☐ Don't know ☐

25. What are the challenges that your organization is facing in implementing OHS systems? (Please TICK as many as necessary). lack of resources ☐ lack of commitment ☐ lack of training ☐ working conditions ☐ *Other, please specify* ……..

……

26. Where do you think the challenges mentioned above are emanating from? inflation ☐ competition ☐ unstable economic environment ☐ lack of knowledge ☐ *Other, please specify*

……

27. In your opinion, is the current OHS system at your workplace effective? Yes ☐ No ☐

28. What approaches can you suggest to improve OHS systems at your workplace? provide resources ☐ enforcing OHS regulations ☐ training ☐ improving the working environment ☐ welfare facilities ☐ drug testing ☐ *Other, please specify* ……

……..

29. Rate the safety and health practices on scale 1-5 by putting a tick

Variable	Strongly agree (5)	Agree (4)	Uncertain (3)	Disagree (2)	Strongly disagree (1)
There is appreciation of safety and Health at the organization.					
The organization takes action when there is an accident.					
There are systems in place to manage all hazards and risk.					
We anticipate problems before they occur					
Health and safety are our way of doing business, audits, incident					

reporting, training.					

Appendix II: Interview guide for supervisory staff

My name is Damu Nelius. l am studying Safety Health and Environment with the Bindura University of Science Education. I am conducting research on safety systems within the mining environment. My questions to you pertains causes of injuries on duty and compliance with Safety standards. The information that you will give me will be kept confidential and will be used solely for learning purposes. It will also assist the mine to improve its on current safety systems. No monetary benefits associated with participating in the study will be given. Everyone is free to ask questions related to the study. Write or tick in the spaces provided **NO NAMES** to be written so as to avoid victimization.

SECTION A: Demographic data

1. How old are you? 19-24 ☐ 25-30 ☐ 31-35 ☐ 36-40 ☐ 41-45 ☐ > 45 ☐
2. Gender: Male ☐ Female ☐
3. Level of education: Primary ☐ O' Level ☐ A' Level ☐ Tertiary ☐
4. Marital status: Single ☐ Married ☐ Divorced ☐ Widow ☐

SECTION B: Compliance with occupational health and safety standards

5. How often do you hold meetings and trainings across all levels? ……
6. Do you have laid down procedures for different tasks which your teams perform? Yes ☐ No ☐
7. If yes, how are they availed to the employees? ……
8. What treatment is given to employees who do not follow instructions? …….....
9. What is being done to employees who come to work drunk? …….
10. Do you provide short breaks in between tasks? Yes ☐ No ☐
11. If yes, how long are the breaks? ……

12. Are work procedures reviewed and updated if there is an incident report? Yes ☐ No ☐

13. How quick is the response to major accident? .....

14. Do the employees conduct OHS discussions at work? Yes ☐ No ☐

15. If yes, how often? daily ☐ weekly ☐ monthly ☐

16. Are employees provided with PPE? Yes ☐ No ☐

17. Are First Aid equipment and assistance available? Yes ☐ No ☐ Don't know ☐

18. How do employees get to know what is expected of them with regards to OHS? human resources ☐; managers ☐; task supervisors ☐; notice board ☐; Other, *please specify*……...

19. What are the chances of one getting injured or ill at the workplace? low ☐ medium ☐ high ☐

20. How many work-related accidents have been recorded in the previous year? <25 ☐ 26-50 ☐ >50 ☐

21. How many work-related illnesses have been recorded in the previous year? <25 ☐ 26-50 ☐ >50 ☐

22. Which department/s recorded the most accidents and illnesses? *Please specify*: ……

23. What are the common causes of injuries and/or accidents or ill health at this organisation? *(Please TICK as many as necessary)*? human error ☐ machinery failure ☐ unskilled personnel ☐ fatigue ☐ chemical fumes ☐ manual material handling ☐ *Other, please specify* ……

24. What OHS challenges are being faced at this organisation? *(Please TICK as many as necessary).* lack of resources ☐ lack of commitment ☐ ineffective policies ☐ lack of training ☐ working conditions ☐ Other, *please specify* ……

25. Where do you think the OHS, challenges mentioned above are emanating from? inflation ☐ competition ☐ lack of knowledge ☐ lack of resources ☐ *Other, please specify* ……

26. Is the current OHS system effective? Yes ☐ No ☐

27. What approaches can you suggest to improve contractor OHS systems at this organisation? provide resources ☐ enforcing OHS regulations ☐ training ☐ improving the working environment ☐ welfare facilities ☐ drug testing ☐ *Other, please specify* ……

Appendix III: Observation checklist

Observations	Yes (%)	No (%)
1) Crowded employees at work station	☐	☐
2) Employees wearing adequate PPE	☐	☐
3) Safety toolbox talk conducted and signed in daily register	☐	☐
4) OHS policy present at work station	☐	☐
5) OHS policy written in English and vernacular languages	☐	☐
6) Standard Operational Procedures available at work stations	☐	☐
7) Employees partake in horseplay when undertaking tasks	☐	☐
8) Housekeeping properly done around work stations	☐	☐
9) Fire-fighting equipment present and up to date	☐	☐

10) Manual handling when executing work tasks	☐	☐
11) Speed working by employees	☐	☐