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**DEPARTMENT OF GEOGRAPHY AND SUSTAINABILITY SCIENCE**

**SCHOOL OF GEOSCIENCES**

**OCCUPATIONAL HAZARDS ASSOCIATED WITH MUNICIPAL SOLID  
WASTE COLLECTION IN SUNYANI, GHANA**

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OCCUPATIONAL HAZARDS ASSOCIATED WITH MUNICIPAL SOLID  
WASTE COLLECTION IN SUNYANI, GHANA

BY

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## DECLARATION AND CERTIFICATION

I hereby declare that this dissertation is my work towards the award of Master of Philosophy in Environmental Planning and Development in the Department of Geography and Sustainability Science, University of Energy and Natural Resources. This dissertation was supervised in accordance with procedures laid down by the University, and that, to the best of my knowledge, it contains no material previously published by another person nor any publication, which has been accepted for the award of any other degree of the University, except where due acknowledgment has been made in the text.

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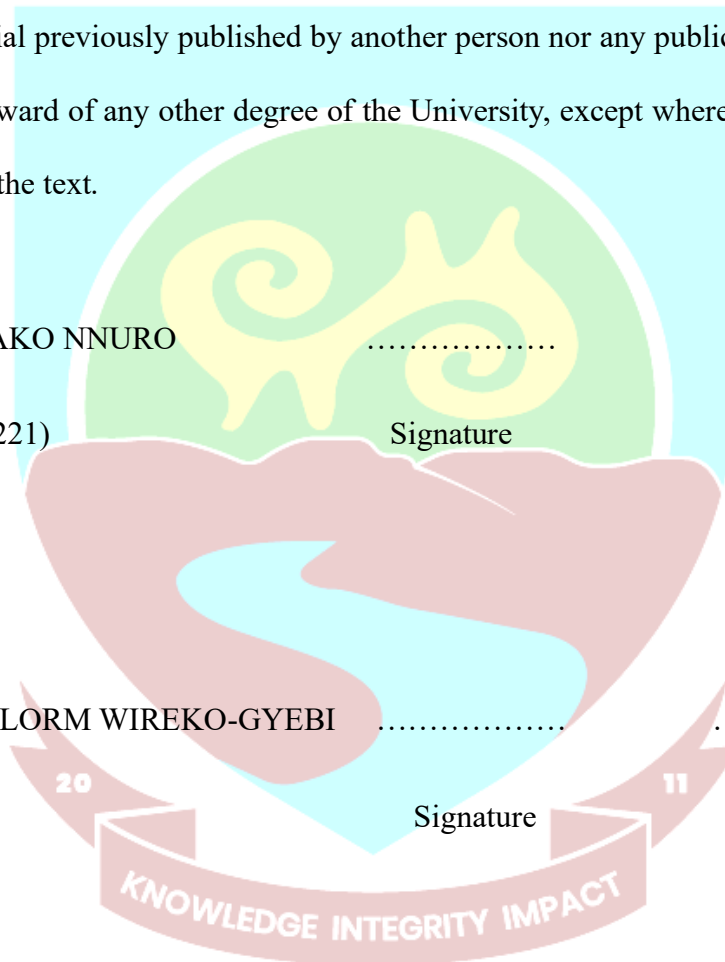
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## DEDICATION

I dedicate this piece of work to my son, Heinrich Nimako Antwi.

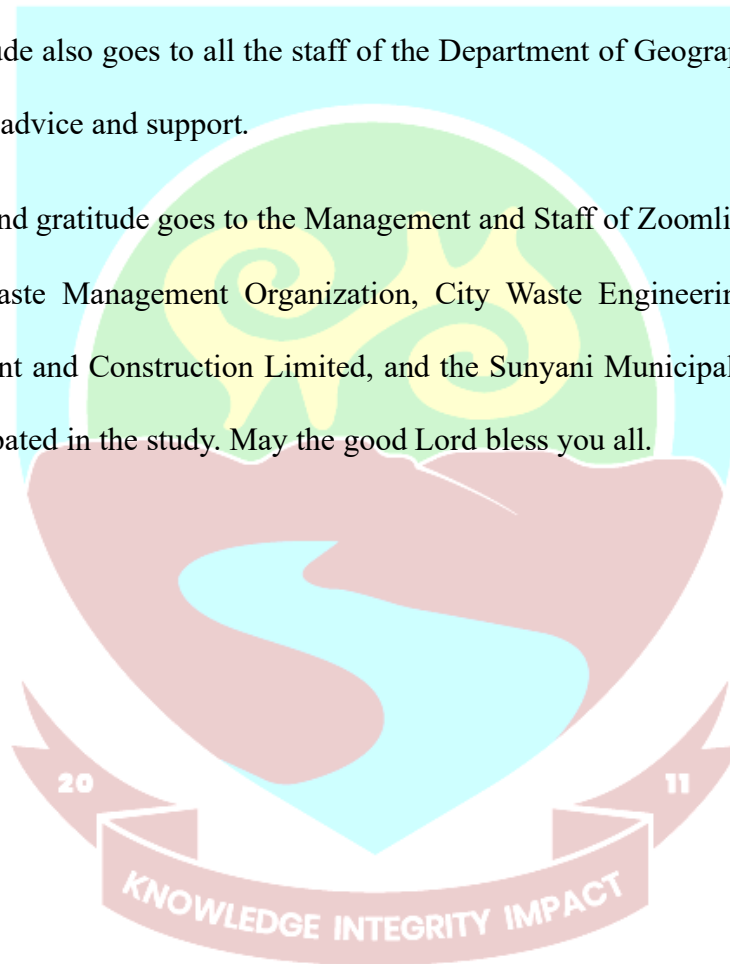


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## ABSTRACT

The collection and disposal of municipal solid waste (MSW) pose major occupational dangers to waste collection employees. Therefore, the management of MSW has both public health and environmental concerns. Waste collectors are often exposed to a myriad of occupational hazards, which are frequently overlooked. The main objective of the study was to assess the occupational hazards associated with solid waste collection in the Sunyani Municipality in the Bono Region of Ghana. The cross-sectional survey was adopted to sample 159 waste collectors from Zoomlion Ghana Limited, Sunyani Municipal Assembly, Hand in Hand Waste Management Organization, City Waste Engineering, and Derrico Waste Management and Construction Limited. Also, 5 managers from the five waste management companies were sampled and interviewed. It was found that 57.9% of the waste collectors were usually involved in the collection of medical waste which poses health hazards to the waste collectors. About 81.8% of the waste collectors indicated that they have ever encountered hazardous materials whilst collecting waste. Generally, compliance with hazard control measures among waste collectors is low with only 17.6% of the waste collectors indicated that they usually use Personal Protective Equipment (PPE). Female workers, older workers and those with less years of experience use PPE more frequently than their peers (P-values<0.05). The average cost of medical treatment for employees was GHC750 per year. The study therefore, concludes that waste collectors are exposed to several hazards and health risks in the line of their duty due to low compliance with safety measures, including the use of PPEs. The treatment of occupational-related injuries puts some financial burden on waste collectors. The study recommends that waste management companies should intensify health education among waste collectors on the hazards associated with their work and how to avoid these hazards.

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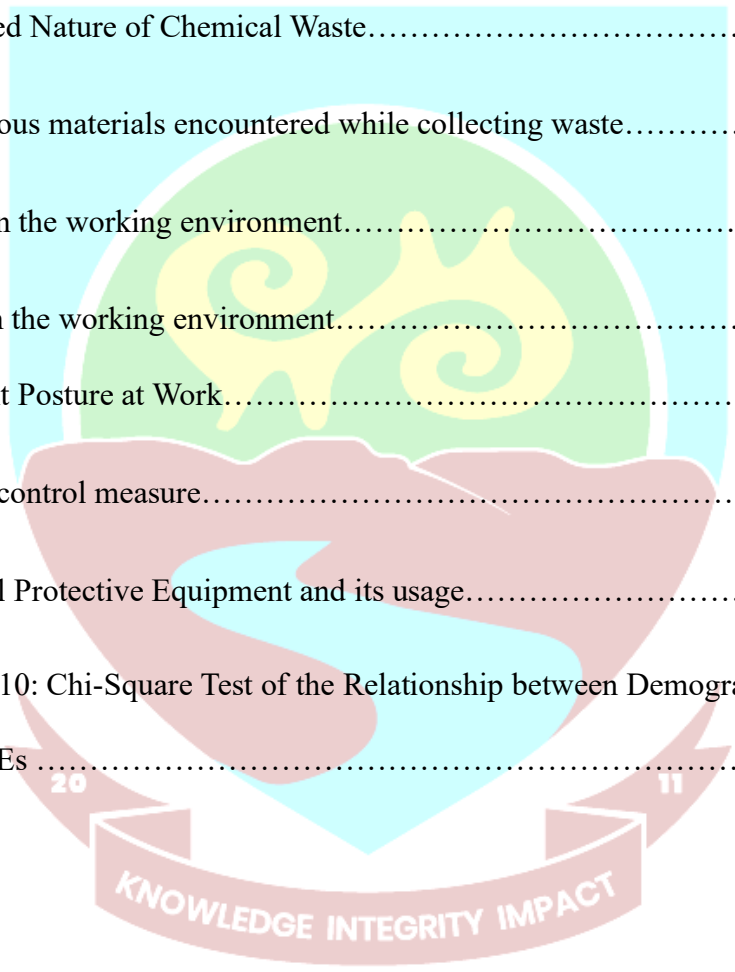
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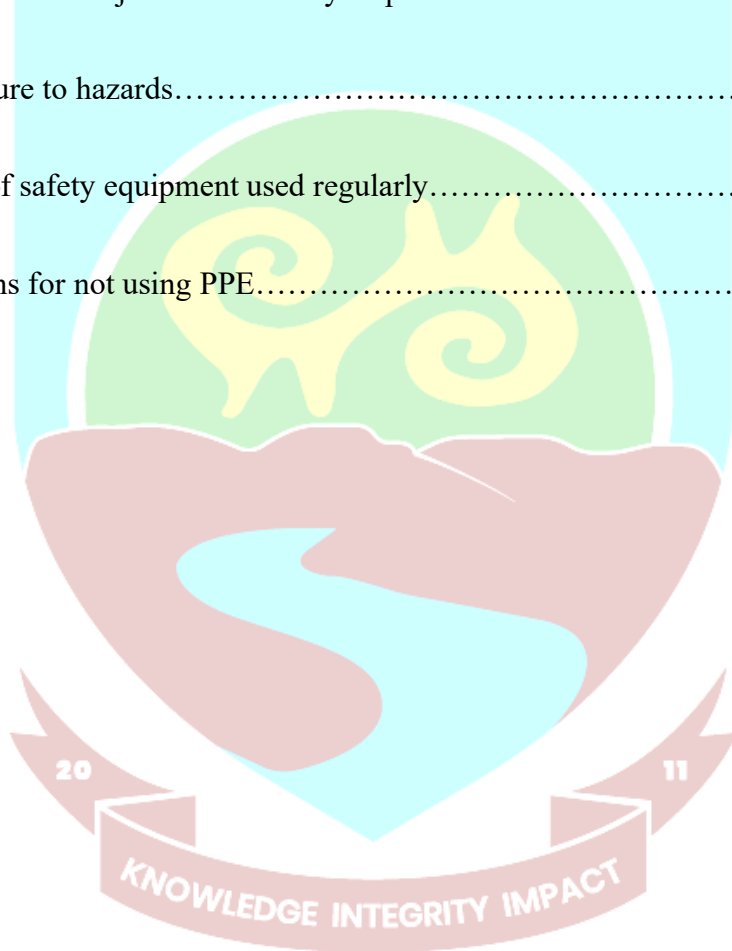
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**LIST OF ABBREVIATIONS**

- HAVS..... Hand-Arm Vibration Syndrome
- HBM..... Health Belief Model
- ILO..... International Labour Organisation
- JD-R..... Job Demands-Resources
- LMICs..... Low and Middle-Income Countries
- MSW..... Municipal Solid Waste
- PPE..... Personal Protective Equipment
- VOCs..... Volatile Organic Compounds



## OPERATIONAL DEFINITION OF TERM

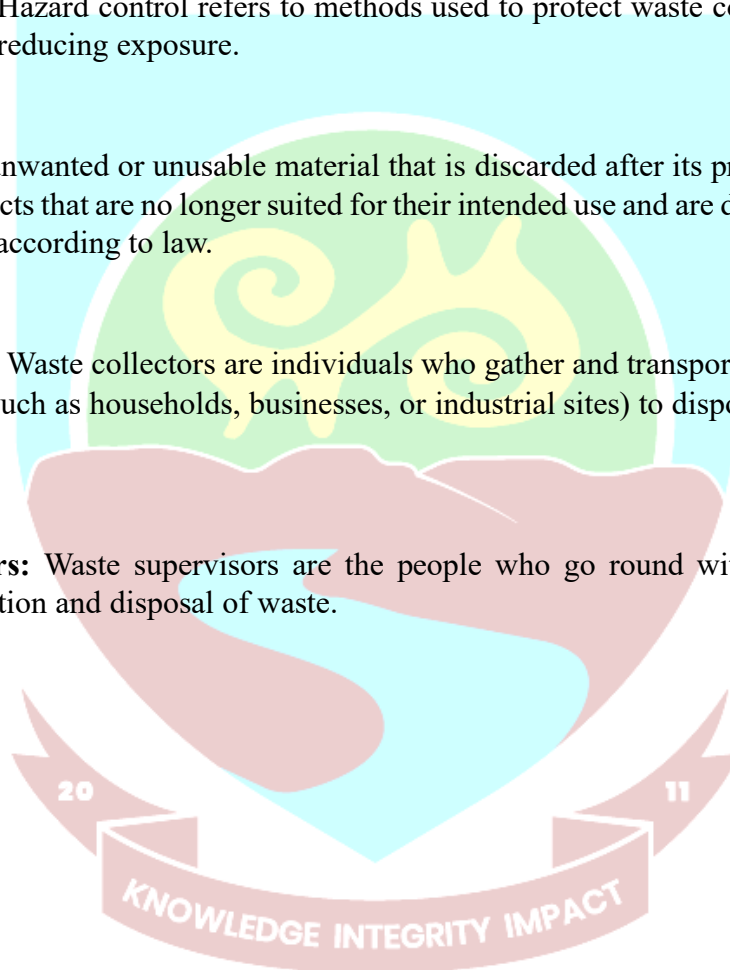
**Occupational hazards:** These are physical or health risks that waste collectors may be exposed to in the workplace. Examples include falls from heights, slips and trips, fire and explosions, working in confined spaces, and accidents related to vehicles and transportation.

**Hazard control:** Hazard control refers to methods used to protect waste collectors from hazards by eliminating or reducing exposure.

**Waste:** Waste is unwanted or unusable material that is discarded after its primary use. It includes substances or objects that are no longer suited for their intended use and are disposed of or intended to be disposed of according to law.

**Waste collectors:** Waste collectors are individuals who gather and transport waste materials from the source (such as households, businesses, or industrial sites) to disposal or recycling facilities.

**Waste supervisors:** Waste supervisors are the people who go round with waste collectors to oversee the collection and disposal of waste.



# CHAPTER ONE

## 1.0 INTRODUCTION

### 1.1 Background to the Study

The management of municipal solid waste (MSW) is an important service that plays a vital part in ensuring the health and well-being of communities by ensuring the proper and secure disposal of waste from households and commercial businesses (Agarwal et al., 2015). However, the collection and disposal of MSW can pose major occupational dangers to waste collection employees, particularly in low and middle-income countries (LMICs) where waste management infrastructure and regulations may be lacking or inadequate (Babalola et al., 2017; ILO, 2018).

Globally, solid waste collection is considered one of the six most dangerous occupations, with over 2.3 million deaths annually related to occupational diseases and injuries, of which 0.3 million are due to injuries (Van Kampen et al., 2020). The overall prevalence of occupational injuries among solid waste collectors is high, with studies reporting rates around 54.7% in Ethiopia and similar or higher rates in other developing countries (Elmubarak et al., 2021).

Due to insufficient waste collection and disposal services in many urban and peri-urban regions in Ghana, managing MSW is a significant public health and environmental concern (Alhassan et al., 2018; Boateng et al., 2016). According to Zolnikov et al. (2021), waste collection workers in Ghana are at risk of a variety of occupational hazards, including physical harm from lifting and handling heavy loads, exposure to toxic chemicals, and biological hazards.

The effective handling of MSW is a pressing concern encountered by developing countries, and

Sunyani, Ghana, is not an exception (Amaniampong 2015). The growth of urbanization and population expansion has resulted in an increase in the production of MSW, thereby posing considerable difficulties in the management of waste collection, transportation, and disposal (Kaza et al., 2018). Insufficient infrastructure and resources in developing nations, such as Ghana, contribute to poor waste management practices, leading to improper waste handling and increased exposure to occupational hazards for waste collectors (Boadi & Kuitunen, 2005).

The process of waste collection is characterized by a high degree of labor intensity and is often carried out by workers in the informal sector. These workers are frequently exposed to a range of hazards, including but not limited to physical, biological, chemical, and ergonomic risks, as noted by Sawalem et al. (2009). The laborers are susceptible to harm caused by pointed items, strenuous lifting, and vehicular mishaps, in addition to being exposed to dangerous substances and microorganisms that are present in the refuse (Gupta et al., 2015). In addition, the insufficiency of appropriate protective gear and education intensifies the job-related risks encountered by individuals who collect waste (Fobil et al., 2008).

Earlier research conducted in Ghanaian cities like Accra and Kumasi has shed light on the various work-related risks encountered by waste collectors, such as a high frequency of musculoskeletal issues, respiratory problems, and skin infections (Asampong et al., 2013; Fobil et al., 2010). However, there seem to be limited studies focusing on the work-related dangers associated with municipal solid waste collection in Sunyani (Boateng et al., 2016). As a result, this study aims to bridge the gap in understanding by examining the challenges faced by waste collectors in Sunyani, with the ultimate goal of guiding policy and initiatives to enhance their work environment and overall health and safety.

This research project aimed to examine the occupational hazards linked to municipal solid waste collection in Sunyani, Ghana, focusing on the physical, chemical, and psychosocial challenges faced by waste collection workers. By identifying the most significant dangers and formulating recommendations for enhanced working conditions and safety measures, this research can contribute to the development of efficient policies and initiatives to improve the safety and health of waste collection workers in Sunyani and other similar situations. The research directly aligns with the United Nations Sustainable Development Goals (SDGs) by addressing worker health, safety, and environmental sustainability. By identifying and recommending solutions for physical, chemical, and psychosocial hazards, the research supports SDG 3.9, which aims to reduce deaths and illnesses from hazardous chemicals and pollution. Improving occupational safety for waste collectors helps prevent injuries, diseases, and mental health issues, thereby enhancing overall well-being.

The project's focus on improving working conditions and safety measures for waste workers advances SDG 8.8, which seeks to protect labor rights and promote safe, secure working environments for all workers. Addressing occupational hazards and advocating for better policies also contributes to decent work and economic growth by reducing absenteeism, increasing productivity, and formalizing the waste sector.

## **1.2 Problem Statement**

Dealing with the waste produced by towns and cities is a major concern all around the world, especially in developing nations like Ghana (Kaza et al., 2018). Rapid urbanization and population growth have intensified this problem, necessitating effective waste collection systems. In cities like Sunyani, waste collectors play an indispensable role in maintaining public health and

environmental cleanliness (Kaza et al., 2018). However, these workers are often exposed to a myriad of occupational hazards, which are frequently overlooked. Physical risks are prevalent, including injuries from handling heavy, sharp, or unstable waste materials. These injuries can range from minor cuts and bruises to severe traumas, such as fractures or even lifethreatening accidents involving waste collection vehicles (Kaza et al., 2018).

In sub-Saharan Africa, the prevalence of work-related injuries among waste collectors is among the highest worldwide, with over 42 million work-related accidents annually (Kebede et al., 2022; Temesgen et al., 2022). Injuries commonly affect the hands, fingers, legs, knees, and toes, with types of injuries including lacerations, burns, cuts, and punctures (Kebede et al., 2022). Musculoskeletal disorders are also highly prevalent, affecting up to 65% of waste collectors in some studies, along with skin diseases (about 33%), respiratory problems, gastrointestinal infections, and eye disorders (Abrha et al., 2021).

Biological hazards pose another significant risk. Waste collectors are exposed to a variety of pathogens present in waste, leading to an increased risk of infectious diseases (García-Sánchez et al., 2019). These can include bacterial infections, viral diseases such as hepatitis, and parasitic infections, among others.

Chemical hazards involve exposure to harmful substances found in waste, including heavy metals, pesticides, and other toxic chemicals (García-Sánchez et al., 2019). Chronic exposure to these substances can lead to a range of health issues, from skin and eye irritation to more serious conditions like respiratory diseases, neurological disorders, and various forms of cancer (Harmse et al., 2016).

Ergonomic risks are also a major concern. The physically demanding nature of waste collection, involving repetitive lifting, bending, and twisting, can lead to musculoskeletal disorders. These include back pain, joint injuries, and repetitive strain injuries, which can significantly impact the workers' quality of life and ability to work.

The economic implications of these hazards are substantial (ILO, 2018). They include direct costs, such as medical expenses for treating injuries and diseases, compensation for disabilities or fatalities, and indirect costs like lost productivity due to absenteeism, retraining of new workers, and potential legal liabilities. Despite the critical role of waste collectors in maintaining public health and environmental cleanliness, their occupational safety is often neglected.

Previous studies in various Ghanaian cities have shown that waste collectors often experience work-related health issues, including muscle and joint disorders, breathing problems, and skin infections (Asampong et al., 2013; Fobil et al., 2010). All these studies found a positive relationship between waste collection and musculoskeletal disorders. However, not much research has been conducted in Sunyani, on the job risks these workers face and the safety measures in place at various waste management companies (Asampong et al., 2013). We also do not have enough information on whether waste collectors are consistently following these safety measures, which are vital for protecting their health.

Taking into account the issues mentioned, this research aims to examine the job-related dangers and risks that waste collectors face in the Sunyani Municipality of Ghana. To accomplish this, the study assesses the safety measures implemented by waste management companies in the

Municipality and find out how well waste collectors follow these guidelines. Furthermore, the research will delve into the impact of proper health and safety practices on waste collectors in Sunyani, shedding light on their overall well-being and happiness at work.

### **1.3 Objectives of the Study**

The primary aim of the research was to evaluate occupational hazards related to waste collection in the Bono Region of Ghana's Sunyani Municipality. The study outlined the following specific objectives:

The specific objectives of the study were to:

1. Evaluate the risks and occupational hazards related to waste collection in the Sunyani Municipality.
2. Assess the hazard control measures put in place by waste management companies.
3. Determine the level of compliance to hazard control measures by waste collectors.
4. Assess the economic cost of occupational-related diseases and injuries among waste collectors.

### **1.4 Research Question**

Based on the objectives of the research, the following research questions were formulated:

1. What are the occupational hazards and risks associated with waste collection in the Sunyani Municipality?
2. What hazard control measures have been put in place by waste management companies in Sunyani to mitigate the risks faced by waste collectors?

3. To what extent do waste collectors comply with the hazard control measures implemented by waste management companies in Sunyani?
4. What are the economic costs of occupational-related diseases and injuries among waste collectors in the Sunyani Municipality?

### **1.5 Significance of the Study**

The significance of this study lies in its potential to contribute to the understanding and improvement of the working conditions and health outcomes of waste collectors in the Sunyani Municipality. By comprehensively examining the occupational hazards, control measures, compliance, and the impact of health and safety practices on waste collectors, the study addresses a knowledge gap in the context of Sunyani Municipality and provides valuable insights for policymakers, waste management companies, and other stakeholders involved in the waste management sector.

The findings of this study can be instrumental in the development of evidence-based policies and interventions aimed at mitigating occupational hazards, enhancing compliance with hazard control measures, and promoting safe working practices among waste collectors. Such initiatives will contribute to a healthier and safer working environment for these essential workers, which may ultimately lead to improved well-being, job satisfaction, and productivity.

Moreover, this research has the potential to inform the design and implementation of occupational health and safety training programs tailored to the specific needs of waste collectors in Sunyani Municipality. By addressing the unique challenges faced by these workers, such programs can

foster a culture of safety and responsibility, contributing to the sustainability of the waste management sector.

This study is anticipated to make a contribution to the existing body of knowledge on occupational hazards in the waste collection sector, particularly in the context of Sunyani and other comparable urban environments in Ghana. The findings will offer valuable insights for policymakers, waste management authorities, and non-profit organizations involved in bettering the health and safety of waste collectors and promoting sustainable waste management practices in the nation.

Lastly, by emphasising the value of putting waste collectors' health and safety first, the study's findings will have wider ramifications for waste management in Ghana and other developing nations dealing with comparable issues. This will help to advance best practices in waste management and raise awareness, which will ultimately help to achieve goals related to sustainable urban development.

### **1.6 Scope of the Study**

This study is geographically confined to the Sunyani Municipality in the Bono Region of Ghana and focuses on the occupational hazards associated with solid waste collection in this area. The primary subjects are municipal solid waste collectors-workers directly involved in the collection, handling, and transportation of solid waste within the Sunyani municipality. The research employs a mixed-methods approach, combining quantitative data (injury rates, prevalence of health conditions) with qualitative insights (e.g., worker experiences, managerial perspectives) to provide a holistic understanding of occupational hazards.

## 1.7 Organization of the Study

The study is structured into five chapters.

Establishing the background, problem statement, research objectives, research questions, purpose, significance, scope, and constraints, as well as outlining the research topic and offering an overview of the study, are all presented in Chapter One. Chapter Two is the literature review, where relevant previous research related to the topic is discussed. It provides a comprehensive understanding of the current knowledge in the field and identifies gaps that this study aims to fill. Chapter Three discusses the research methods and design utilised for the study. It includes information about the population, sampling plans, techniques for gathering data, and steps involved in data processing. This chapter also covers the ethical issues and steps taken to guarantee the validity and trustworthiness of the study outcomes. The interpretation and analysis of data is covered in Chapter four. To answer the goals and study questions, the gathered data is analysed and assessed. This chapter presents the study's findings, emphasising work dangers, risk management techniques, compliance rates, and the effects of health and safety procedures on the happiness and well-being of waste collectors. Chapter Five concludes the study with a summary of the research findings, conclusions drawn from the data analysis, and recommendations based on the study results. It highlights the implications of the study for waste management policies and practices and suggests areas for future research.

## CHAPTER TWO

### 2.0 LITERATURE REVIEW

#### 2.1 Introduction

This chapter conducts an analysis of the body of research on the occupational risks related to the collection of municipal solid waste. The literature offers perspectives of the different kinds of risks that waste collectors face in the course of their daily work, including biological, chemical, physical, and ergonomic risks. It also explores the existing risk management strategies employed by waste management companies, the level of compliance with these safety measures by waste collectors, and the impact of these practices on their well-being and job satisfaction.

#### 2.2 Waste

The term "waste" refers to unwanted or useless products that arise from multiple sources including industry and agriculture as well as enterprises and households... and can be hazardous or non-hazardous depending on its location and concentration (ILO, 2018). Davies (2008:4, cited by Baabereyir, 2009) defines waste as “unwanted or unusable materials that can be liquid, solid, or gaseous in nature.” Davies goes on to say that something that some may view as waste may actually be a valuable resource for others. Davies’ concept includes a trash classification by default.

Over time, Ghana’s production of municipal solid trash has increased dramatically due to factors such as rapid urbanisation and shifting consumer behaviour (Oteng-Ababio, 2013). Ghana produces an estimated 13,000 tonnes of solid waste each day, the majority of it originates from urban areas (Oteng-Ababio, 2013). The municipality of Sunyani produces almost 500 metric

tonnes of waste each day, which poses major threats to public health and the environment, according to a report by the Sunyani Municipal Assembly (Songsore, 2014).

Organic materials comprise more than half of Ghana's generated municipal solid waste (MSW) (Oteng-Ababio, 2013). Glass makes up 3%, metals make up 5%, paper makes up 10%, and other materials including plastics make up 12% (Kumasi Metropolitan Assembly, 2014). The population's diet, which mostly consists of fresh food, and the agricultural economy both contribute to the high percentage of organic waste (Oteng-Ababio, 2012).

### **2.3 Waste Management**

Refuse reduction, recycling, decomposition, and landfilling are a few of the methods used in waste management in Ghana. Nonetheless, landfilling continues to be the most common way to dispose of trash; over 90% of waste produced in the nation ends up in dumpsites or landfills (Ebekozi et al., 2022). Recycled and composted materials make up very little of the total waste (Owusu-Sekyere et al., 2016). The rates of breakdown and recycling are still modest. Waste collectors in metropolitan areas gather and arrange valuable materials for sale to recycling facilities, such as paper, metals, and plastics (Oteng-Ababio, 2010).

The collection, transfer, and transport of waste materials, as well as their processing and ultimate disposal, are the primary elements of the solid waste management process. Handling is a crucial step in this process because it determines how the waste is handled, particularly hazardous waste, up until it is placed in storage containers.

### 2.2.1 Generation

The activities that result in materials being thrown away or collected for disposal because their owners or users deem them to be no longer valuable are referred to as waste generation (Puopiel, 2010). According to the World Bank (2018), the most important step in solid waste management is quantifying and classifying the types of waste generated. Accurate data regarding the amount of solid waste produced is essential for efficient waste management since it prevents the creation of mitigating measures. Furthermore, Puopiel (2010) reports that the quantity of municipal solid waste (MSW) produced worldwide in 2006 was 2.02 billion tonnes, a 7% yearly increase from 2003.

In 2023, global municipal solid waste (MSW) generation was approximately 2.1 billion tonnes annually. This figure is projected to rise to about 3.8 billion tonnes by 2050, representing an increase of over 75% if no urgent waste reduction actions are taken (Alves, 2024). Another estimate by the World Bank (2024) projects a growth from 2.01 billion tonnes in 2016 to around 3.4 billion tonnes by 2050, highlighting the rapid increase especially in low- and middle-income countries. Thus, the global solid waste generation is expected to nearly double by mid-century, reaching between 3.4 and 3.8 billion tonnes annually, underscoring the urgent need for improved waste management and circular economy strategies worldwide (World Bank, 2024).

According to Miezah et al. (2015), between 14 and 20 percent of waste produced is municipal solid waste. They go on to say that the amount of waste generated per person varies, with impoverished countries producing less than 0.8 kilogramme per day and OECD countries producing up to 5.3 kg per day. The researchers think that over the next ten years, rates will rise due to a variety of factors, including ineffective regulations, changing lifestyles, and a lack of knowledge.

### **2.2.2 Handling**

According to Woretaw et al. (2017), waste management consists of tasks related to disposing of wastes up until they are collected and put in storage containers or recycled back into recycling centres. According to them, the precise tasks involved in managing waste materials at the point of generation will differ based on the kinds of waste materials that are isolated for reuse and how far these materials are taken out of the waste stream. They added that depending on the kind of collection services offered, handling might be necessary to transfer the laden waste from the collection hubs to the final disposal locations.

### **2.2.3 Storage**

According to Woretaw et al. (2017), this refers to the location where the created solid waste is kept until it is collected. They contend that a number of variables, including the kind of container, its location, the impact of storage on waste components, and contamination of waste components, influence how solid waste is stored. These elements have a bigger impact on putrescible materials storage since they break down quickly and need to be gathered right away.

### **2.2.4 Collection**

Gathering waste materials and transporting them by car to a collection vehicle's destination for emptying is the process of collecting solid wastes (Mombo & Bigirwa, 2017). The collection is carried out under a variety of management agreements, from franchised private firms run under different types of contracts to municipal services. They listed drop-off locations, kerbside collection, and communal collection stations as some collection techniques.

### **2.2.5 Separation, processing and transformation**

This specific functional component of the solid waste management process, according to Woretaw et al. (2017), includes the recovery of separated materials, the separation and processing of solid waste components, and the transformation of solid wastes that are primarily generated in locations that are far from their source. Waste items that have been separated at the source are recovered using buy-back centres, drop-off locations, and curbside pickup. These wastes are typically separated and processed at disposal sites, combustion facilities, recovery centres, and transfer stations. According to Woretaw et al. (2017), the waste components are frequently sorted by size using screens, manually separated, and shred for size reduction. Ferrous metals are separated using magnets, and volume is reduced by compression and combustion.

According to Woretaw et al. (2017), transformation processes are also utilised to recover energy and conversion products and to lessen the volume and weight of wastes that need to be disposed of. Numerous chemical and biological processes are capable of transforming the organic portion of municipal solid trash. Combustion is the most often employed chemical transformation process when it comes to recovering energy in the form of heat. The most popular biological method for transforming solid waste is composting. They added that the goals to be met for waste management would determine which particular set of procedures would be chosen.

### **2.2.6 Transfer and Transport**

According to Woretaw et al. (2017), there are two main processes involved in the transfer and transport of solid waste. Transferring waste from the smaller collecting vehicle to the larger transport equipment is the first step. The trash must be transported, frequently over great distances, to a processing or disposal location in the second phase.

Usually, a transfer station is where it happens. While shipping by rail and barges is less frequent, shipping by motor vehicle is still an option. For instance, in San Francisco, collection trucks, which must navigate the city's winding streets, are comparatively small. They transport their cargoes to a transfer facility located near the city's southern edge. At the transfer station, the wastes are moved from the collection vehicles into large tractor-trailer trucks. In Ghana, solid trash is transferred to storage containers on tricycles, and then the containers are transported to the disposal sites using a similar approach.

### **2.2.7 Disposal**

The process of managing solid waste ends with disposal. Woretaw et al. (2017) state that all solid wastes wind up being dispersed or land filled, regardless of whether they are collected from houses and transported directly to a landfill, leftover wastes from recovery plants, residue from burning solid wastes, compost, or other items. This point was made by Maskey and Singh (2017) in their argument that landfills would always be required to house waste remains after it has been incinerated. According to Mombo and Bigirwa (2017), a sanitary landfill is a designed facility rather than a “dump” that is used to dispose of solid wastes on land or in the earth's mantle without endangering public health or safety by preventing rodent and insect breeding or contaminating groundwater.

### **2.3 Challenges Faced by the Waste Management Sector in Ghana**

The waste management sector in Ghana is confronted with three major challenges. These are inadequate infrastructure, inadequate awareness, and inadequate funding. These have been explained below:

*Inadequate infrastructure:* In Ghana, the waste management sector is confronted with substantial infrastructural issues, with many cities lacking appropriate waste collection, transportation, and disposal facilities (Ebekozi et al., 2022). Due to the scarcity of constructed landfills, open dumping of waste is a frequent practice, resulting in environmental deterioration and public health risks (Owusu-Sekyere et al., 2016).

*Inadequate Public Awareness:* In Ghana, there is often a lack of widespread understanding about the methods used for waste management and the importance of disposing waste properly. This could be attributed to insufficient public education or awareness campaigns on these topics (Miezah et al., 2015). As a result, waste is dumped indiscriminately in open places, sewers, and water bodies, increasing sanitation and environmental difficulties (Songsore, 2014).

*Inadequate funding:* This is a serious barrier to waste management in Ghana, with local governments unable to provide necessary resources for waste collection, transportation, and disposal (Oteng-Ababio, 2012). Inadequate financing prevents effective waste management services from being provided, continuing the environmental and health problems associated with improper waste management (Ebekozi et al., 2022).

#### **2.4 Occupational Hazards in Municipal Solid Waste Collection**

Due to their frequent interaction with municipal solid waste (MSW) and the physically demanding nature of their job, waste management personnel are exposed to a variety of occupational risks daily. According to Mattiello et al. (2015), these dangers can be generally divided into physical, chemical, biological, and ergonomic categories. This section provides a thorough discussion of each category, including the particular dangers, possible health effects, and safety precautions used by waste-collecting employees.

### **2.4.1 Physical Hazards**

Workers in the waste disposal industry face several physical dangers that might result in disease or injury. Physical hazards are characteristics or circumstances in the work environment that might cause injury to employees (Tiesman et al., 2022). Sharp items are an example of the kind of physical threat that waste collection employees experience. Injuries from needle sticks, splinters, and other sharp objects are common in the workplace (de Arajo et al., 2017). Such wounds put the worker at risk of contracting an infection or being exposed to a blood-borne pathogen (Rossouw et al., 2014). Waste management staff must also be wary of the dangers posed by vehicles. Workers can be in danger of vehicle accidents, such as being hit by moving cars or equipment and vehicle crashes (Mattiello et al., 2015).

Another physical risk in the waste collection industry is exposure to loud noise. Noise pollution from waste trucks and other equipment has been linked to hearing loss, according to a study by Basner et al. (2014). Finally, waste collectors are vulnerable to heat stress and cold stress due to their prolonged exposure to extreme temperatures while collecting trash (Zolnikov et al., 2018).

### **2.4.2 Chemical Hazards**

When a waste collector inhales, swallows, or absorbs chemicals via the skin, it can have serious consequences on their health (Mattiello et al., 2015). Workers in the waste collection industry can be exposed to volatile organic compounds (VOCs) such as benzene, toluene, and xylene, which are known to irritate the respiratory system and impact the central nervous system (Ziraba et al., 2016). Neurological diseases, renal damage, and cancer are only some of the outcomes of prolonged exposure to heavy metals including lead, cadmium, and mercury (Alavanja, Hoppin &

Kamel, 2014). Workers can be exposed to abandoned pesticides, which can have both immediate and long-term negative impacts on their health, such as skin irritation, respiratory problems, and neurotoxicity (Ncube et al., 2015).

### **2.4.3 Biological Hazards**

Biological hazards encompass the various infectious agents, such as bacteria, viruses, fungi, and parasites, that waste collection workers can be exposed to during their daily activities (Mattiello et al., 2015). These hazards can pose significant health risks, as they can lead to a wide range of diseases and complications. The following sections describe some examples of biological hazards that waste collection workers can encounter:

#### ***Pathogenic Microorganisms***

Waste collection workers are at risk of coming into contact with pathogenic microorganisms as they handle and process different types of waste materials (Ziraba et al., 2016). These microorganisms, including bacteria (*Salmonella* and *Escherichia coli*) and viruses (such as the hepatitis A virus), can cause various illnesses and infections. For instance, gastrointestinal illnesses can result from exposure to these pathogens, leading to symptoms such as abdominal pain, diarrhea, and vomiting. Respiratory infections, skin infections, and other diseases can also arise from contact with these harmful microorganisms.

#### ***Parasites***

In addition to pathogenic microorganisms, waste collection workers can also be exposed to parasites that can adversely affect their health (Rushbrook & WHO, 1999). One example of such a parasite is *Ascaris lumbricoides*, a roundworm that can cause gastrointestinal and respiratory

symptoms. When workers come into contact with waste materials contaminated with this parasite, they can inadvertently ingest its eggs, which can then hatch into larvae inside their bodies. These larvae can migrate through the body, causing symptoms such as abdominal pain, coughing, and wheezing. By being aware of the potential risks associated with biological hazards, waste collection workers can take appropriate precautions to minimize their exposure and safeguard their health.

#### **2.4.4 Ergonomic Hazards**

Ergonomic hazards refer to factors in the work environment that can lead to musculoskeletal disorders and other injuries related to ergonomics (Mattiello et al., 2015). Waste collection workers can encounter various ergonomic hazards as they perform their daily tasks, resulting in increased risk of injuries and long-term health issues. The following sections describe some examples of ergonomic hazards that waste collection workers can face.

##### ***Repetitive Movements***

Repetitive tasks, such as lifting, carrying, and sorting waste materials, are common in waste collection work (Mathiowetz, Matuska & Murph., 2015). These repetitive movements can lead to overexertion, causing musculoskeletal disorders and other injuries. Musculoskeletal diseases including sprains, strains, and back injuries are often caused by repetitive motions like lifting and carrying large items (Jerie, 2016). Over time, this continuous strain on the body can result in chronic pain, reduced mobility, and decreased work capacity.

### ***Awkward Postures***

Waste collection workers often assume awkward postures during their work activities, such as bending, twisting, or stretching (Mattiello et al., 2015). These postures can place excessive stress on muscles, joints, and ligaments, increasing the risk of musculoskeletal injuries. Maintaining such positions for extended periods can also contribute to the development of long-term health issues, including chronic pain and reduced range of motion.

### ***Vibration***

Prolonged exposure to vibration from waste collection vehicles and machinery can pose a significant ergonomic hazard for workers (Jerie, 2016). This exposure can contribute to the development of hand-arm vibration syndrome (HAVS), a condition characterized by neurological, vascular, and musculoskeletal symptoms in the hands and arms. Symptoms of HAVS can include numbness, tingling, pain, and reduced grip strength. In severe cases, the condition can lead to irreversible damage, affecting the individual's ability to perform daily activities and work-related tasks.

By being aware of the potential ergonomic hazards associated with waste collection work, both workers and employers can implement strategies to minimize these risks, such as ergonomic training, job rotation, and the use of appropriate equipment and tools. These preventive measures can contribute to a safer and healthier work environment for waste collection workers

## **2.5 Occupational Risks associated with SWM**

Occupational hazards associated with waste collection can lead to a variety of acute and chronic health risks in workers. The potential health implications resulting from exposure to hazards are discussed in the following sub-sections

### **2.3.1 Infections**

Exposure to pathogenic microorganisms and parasites can result in various infections for waste collection workers (Khan et al., 2017). These infections can manifest as gastrointestinal illnesses, respiratory infections, and hepatitis, among other diseases. Proper protective measures, such as the use of personal protective equipment, can help minimize the risk of contracting these infections.

### **2.5.2 Musculoskeletal Disorders**

Physical and ergonomic hazards can cause musculoskeletal disorders in waste collection workers, including sprains, strains, back injuries, and hand-arm vibration syndrome (HAVS) (Harmse et al., 2016). Implementing ergonomic practices, such as job rotation, proper lifting techniques, and using appropriate tools, can help reduce the risk of these disorders. Ziraba et al. (2010) found that waste collection workers were at a high risk of physical injuries due to their exposure to heavy loads, repetitive movements, and awkward postures. Additionally, workers were also exposed to ergonomic hazards such as whole-body vibration, noise, and temperature extremes. The study concluded that waste collection work was associated with a high risk of musculoskeletal disorders, including low back pain, shoulder pain, and carpal tunnel syndrome, and recommended the implementation of effective control measures to mitigate these risks.

### **2.5.3 Respiratory Issues**

Exposure to chemical and biological hazards can lead to respiratory problems for waste collection workers, such as asthma, bronchitis, and other respiratory illnesses (Mattiello et al., 2015). Ensuring adequate ventilation and wearing appropriate respiratory protection can help minimize the risk of developing these issues. A study conducted by Mattiello et al. (2015) revealed that waste collection workers were exposed to a wide range of chemical and biological hazards, including airborne contaminants, hazardous chemicals, and infectious agents. The study also identified several potential health implications of these hazards, including respiratory issues, skin irritations, and infections. The study recommended the implementation of effective control measures, including personal protective equipment, engineering controls, and administrative controls, to mitigate the risks associated with these hazards.

### **2.5.4 Neurological Disorders**

Exposure to heavy metals and certain pesticides can result in neurological disorders for waste collection workers, such as peripheral neuropathy and Parkinson's disease (Rehman et al., 2018). Workers are highly exposed to heavy metals like lead and mercury, which can cause neurological disorders like peripheral neuropathy and Parkinson's disease. Protective measures, such as the use of personal protective equipment and proper handling techniques, can help reduce the risk of exposure to these hazardous substances. Ncube et al. (2011) cite this risk.

### **2.5.5 Cancer**

Prolonged exposure to certain chemical hazards, such as benzene and heavy metals, can increase the risk of developing cancer for waste collection workers (Mattiello et al., 2015). Implementing

effective strategies to minimize exposure to these substances, such as proper waste handling procedures and protective measures, can help reduce the risk of cancer.

By understanding the potential health implications of occupational hazards in waste collection work, both workers and employers can implement preventive measures and strategies to protect workers' health and ensure a safer work environment.

## **2.6 Risk Preventive Measures**

To mitigate the risks associated with occupational hazards, waste collection workers employ a variety of preventive measures. These measures are aimed at safeguarding workers from the potential dangers they face while performing their duties.

### **2.6.1 Personal Protective Equipment (PPE)**

The use of personal protective equipment (PPE) plays a crucial role in minimizing workers' exposure to physical, chemical, and biological hazards (Mattiello et al., 2015). PPE includes items such as gloves, which protect workers' hands from cuts, punctures, and contact with harmful substances; safety boots, which shield the feet from the severe impact of injuries and provide slip resistance; protective clothing, which guards the body against harmful chemicals and contaminants; and masks, which prevents workers from inhaling hazardous particles and fumes. By wearing the appropriate PPE, waste collection workers can significantly reduce the risk of injury and illness.

### **2.6.2 Safe Work Practices**

Adherence to safe work practices is another essential preventive measure for waste collection workers (Aboelnour & Abuelela., 2019). These practices include using proper lifting techniques,

which can prevent musculoskeletal injuries caused by handling heavy loads; maintaining appropriate distances from moving vehicles, which can reduce the risk of vehicle-related accidents; and avoiding overexertion, which can help prevent injuries resulting from excessive physical strain. By following established safety protocols and guidelines, workers can minimize their exposure to potential hazards and create a safer working environment.

### **2.6.3 Training and Education**

Providing workers with adequate training and education on the identification, management, and prevention of occupational hazards is crucial for ensuring a safer working environment (Chisholm et al., 2021). This includes instruction on the proper use and maintenance of PPE, safe waste handling techniques, and the recognition and avoidance of hazardous situations. Through comprehensive training and education programs, workers can become better equipped to identify potential hazards and take appropriate measures to protect themselves and their colleagues.

**Health Promotion and Awareness:** Health promotion and awareness programs can play a vital role in educating waste collection workers about the potential risks associated with their occupation and promoting healthy behaviors that can reduce these risks (Yukalang et al., 2018). These programs can include workshops, seminars, or regular meetings focused on topics such as proper nutrition, stress management, and the importance of regular exercise to maintain physical and mental well-being (Brennan et al., 2015). By fostering a culture of health and safety, waste collection workers can be better equipped to manage the challenges of their occupation.

### **2.6.4 Monitoring and Surveillance**

Regular monitoring and surveillance of workers' health is an important component of a comprehensive preventive strategy (Mattiello et al., 2015). This process involves tracking workers'

exposure to various hazards, monitoring their health conditions, and providing appropriate medical interventions when necessary. By identifying potential health issues early, timely intervention and treatment can be initiated, thereby reducing the likelihood of long-term health complications. In addition, data collected through monitoring and surveillance efforts can inform the development and implementation of improved safety measures and protocols, further enhancing the overall safety and well-being of waste collection workers.

### **2.6.5 Collaboration and Communication**

Effective collaboration and communication among waste collection workers, employers, and relevant authorities can help identify and address occupational hazards more efficiently (Nieuwenhuijsen et al., 2018). This can involve establishing regular channels of communication, such as meetings or reporting systems, to share information about potential risks, accidents, and best practices. By fostering a collaborative environment, stakeholders can work together to develop and implement effective strategies to minimize occupational hazards and improve overall safety in the waste collection sector (García-Sánchez et al., 2019).

### **2.6.6 Legislative and Regulatory Framework**

A strong legislative and regulatory framework can support the implementation and enforcement of safety standards in the waste collection industry (Bakare et al., 2018). This can involve the development and enforcement of laws and regulations that govern workplace safety, waste handling procedures, and the provision of adequate resources and infrastructure for waste collection and management. By ensuring compliance with these standards, authorities can help create a safer working environment for waste collection workers and reduce the risks associated with occupational hazards (Sugathan et al., 2016).

## 2.7 Theoretical Reviews

Critical to the success of any research project is a thorough examination of the relevant theoretical literature. Several theoretical frameworks can be applied to the study of occupational hazards in municipal solid waste collection, allowing for a deeper understanding of the causes and consequences of these dangers on workers' health. Some examples of such theories and models include the Safety Climate Theory, the Health Belief Model, the Job Demands-Resources Model, and the Social Cognitive Theory. This research seeks to improve our knowledge of the causes of and solutions to the health risks associated with waste collection by combining these theoretical frameworks into our investigation of these hazards on the job. With this knowledge, we can create more effective interventions and strategies to make the waste collection industry a safer place to work.

### 2.7.1 Health Belief Model

A psychological framework called the Health Belief Model (HBM) focusses on people's attitudes and beliefs to forecast and explain health behaviours (Rosenstock, 1974). It is a theoretical framework for understanding and predicting health-related behaviours. As per the Health Belief Model (HBM), individuals are more inclined to embrace health-protective behaviours if they perceive themselves as susceptible to a health issue, acknowledge the seriousness of the issue, feel that a specific action can effectively reduce the likelihood of the issue, and feel that the benefits of the action exceed any possible disadvantages or expenses.

The HBM can be used to clarify why certain waste collection employees are able to utilize PPEs and adopt safer work practices while others are not. Waste collection personnel are more likely to

adopt preventative measures, such as utilizing PPE, if they believe they are sensitive to the physical, chemical, and biological risks connected with their line of work (Rosenstock, 1974).

Also, the choice of this model was motivated by Glanz, Rimer, and Viswanath (2008) who applied the HBM to understand and predict health behaviors among waste collection workers.

The study found that workers' perceptions of susceptibility, severity, benefits, and barriers influenced their use of personal protective equipment and adherence to safety protocols.

Additionally, workers are more likely to adopt protective behaviors when they are aware of the potential long-term health effects of occupational hazards, such as musculoskeletal disorders, respiratory problems, neurological disorders, and cancer (Glanz et al., 2008). Similar to this, employees are more likely to follow safety procedures if they believe doing so will protect them from risks (Glanz et al., 2008). Finally, according to Rosenstock (1974), employees are more likely to adopt safety habits when they believe the benefits exceed the costs or hassles.

Waste collection workers and employers may create health promotion and awareness programs that encourage employees to adopt safe work practices and utilize protective measures to limit the risks related to occupational hazards by implementing the HBM's guiding principles (Glanz et al., 2008). These programs could, for instance, include workshops, seminars, or regular meetings covering subjects including safe lifting practices, keeping a safe distance from moving cars, and the use of personal protective equipment. Waste collection employees may be better prepared to handle the demands of their jobs and lower the risks connected with occupational hazards by fostering a culture of safety. The HBM is based on four criteria:

***Perceived Susceptibility:*** Waste collection personnel are more likely to take preventative actions if they are aware of their susceptibility to health problems brought on by workplace risks. Workers are more proactive in taking the appropriate measures when they are aware of the possible dangers involved with their profession (Rosenstock, 1974).

***Perceived Severity:*** Waste collection personnel may take precautionary measures when they are aware of the substantial repercussions of health problems brought on by workplace risks. Increased adherence to safety precautions might result from awareness of the possible long-term health effects, such as chronic respiratory issues, musculoskeletal ailments, or even cancer Glanz, Rimer, & Viswanath, (2008).

***Perceived Benefits:*** Employees are more likely to follow safety procedures if they believe that doing so will effectively lower the risk of health problems. Examples of such actions include using PPE and adhering to safety protocols. Waste collection employees are more likely to adhere to safety regulations when they are aware of the advantages (Glanz et al., 2008).

***Perceived Barriers:*** Waste collection personnel are more likely to adopt safety practices if they believe the benefits exceed the possible hassles or expenses. Workers may first consider wearing PPE to be inconvenient or burdensome, but if they realize that the advantages of being protected against dangerous chemicals much outweigh the short-term pain, they are more inclined to wear PPE regularly (Rosenstock, 1974).

Waste collection personnel may be encouraged to adopt safe work practices and utilize protective measures to reduce the risks associated with occupational hazards by addressing these variables in health promotion and awareness programs. This strategy may help make the workplace safer and improve the general health of waste collection sector employees.

### 2.7.2 The Job Demands-Resources (JD-R) Model

The relationship between job demands, job resources, and employee well-being is explained by Bakker and Demerouti's (2007) comprehensive theoretical framework, known as the Job Demands-Resources (JD-R) Model. The physical, psychological, or social components of a job that require prolonged effort and may cause physiological or psychological strain are referred to as job demands, according to the JD-R Model. On the other hand, job resources are components of a job that help workers accomplish work objectives, reduce working pressures, and promote personal development.

The JD-R Model can assist in identifying and addressing the particular job demands and resources that affect worker performance and well-being in the context of municipal solid trash collection.

#### ***Job Demands:***

1. **Physical and ergonomic hazards:** Waste collection workers face strenuous physical tasks and ergonomic challenges, such as lifting heavy loads, repetitive movements, and awkward postures, which can lead to fatigue and musculoskeletal disorders (Ziraba et al., 2010).
2. **Chemical and biological hazards:** Workers can be exposed to hazardous chemicals and infectious agents, increasing the risk of illnesses and long-term health consequences (Mattiello et al., 2015).
3. **Workload:** The high workload and time pressure associated with waste collection can contribute to stress and burnout (Bakker & Demerouti, 2007).

## ***Job Resources***

1. Personal protective equipment (PPE): Providing workers with PPE can help reduce their exposure to occupational hazards and promote a safer work environment (Mattiello et al., 2015).
2. Training and education: Ensuring waste collection workers receive adequate training and education on hazard identification, management, and prevention can contribute to their well-being and job performance (Bakker & Demerouti, 2007).
3. Access to health care services: Facilitating access to health care services for workers can help detect and address potential health issues early, allowing for timely intervention and treatment (Mattiello et al., 2015).

According to Bakker and Demerouti (2007), the JD-R Model suggests that while sufficient job resources can promote engagement and well-being, high job demands might result in burnout. By understanding the specific job demands and resources associated with waste collection work, employers can develop targeted interventions to mitigate occupational hazards, enhance employee well-being, and improve overall work performance. This can ultimately contribute to a healthier and more productive workforce in the waste collection sector.

## **2.8 Empirical Reviews**

Empirical reviews are an essential part of any research project, as they provide a comprehensive analysis of the current literature and knowledge related to the research topic. In the context of occupational hazards in municipal solid waste collection, several empirical reviews have been conducted to identify the specific hazards associated with this occupation and to determine the potential health implications for waste collection workers. This section provides an in-depth

analysis of the empirical reviews related to this project work, including their key findings and contributions to the understanding of occupational hazards in waste collection.

**Physical Hazards:** A study by Jerie (2016) highlighted the physical hazards faced by waste disposal workers, including injuries from sharp objects, vehicle accidents, and exposure to loud noise. The study emphasized the need for safety training and the use of personal protective equipment to mitigate these risks.

**Chemical Hazards:** Ziraba et al. (2016) conducted a review focusing on the chemical hazards in waste collection. The study found that workers are often exposed to volatile organic compounds and heavy metals, which can lead to serious health issues such as respiratory problems, neurological disorders, and cancer.

**Biological Hazards:** An empirical review by Mattiello et al. (2015) discussed the biological hazards faced by waste collection workers, including exposure to pathogenic microorganisms and parasites. The study suggested that proper hygiene practices and the use of personal protective equipment can help reduce these risks.

**Ergonomic Hazards:** A study by Mathiowetz, Matuska, and Murphy (2015) focused on the ergonomic hazards in waste collection work, such as repetitive movements and awkward postures. The study recommended ergonomic training and job rotation to minimize these risks.

**Health Belief Model (HBM):** Glanz, Rimer, and Viswanath (2008) applied the HBM to understand and predict health behaviors among waste collection workers. The study found that

workers' perceptions of susceptibility, severity, benefits, and barriers influenced their use of personal protective equipment and adherence to safety protocols.

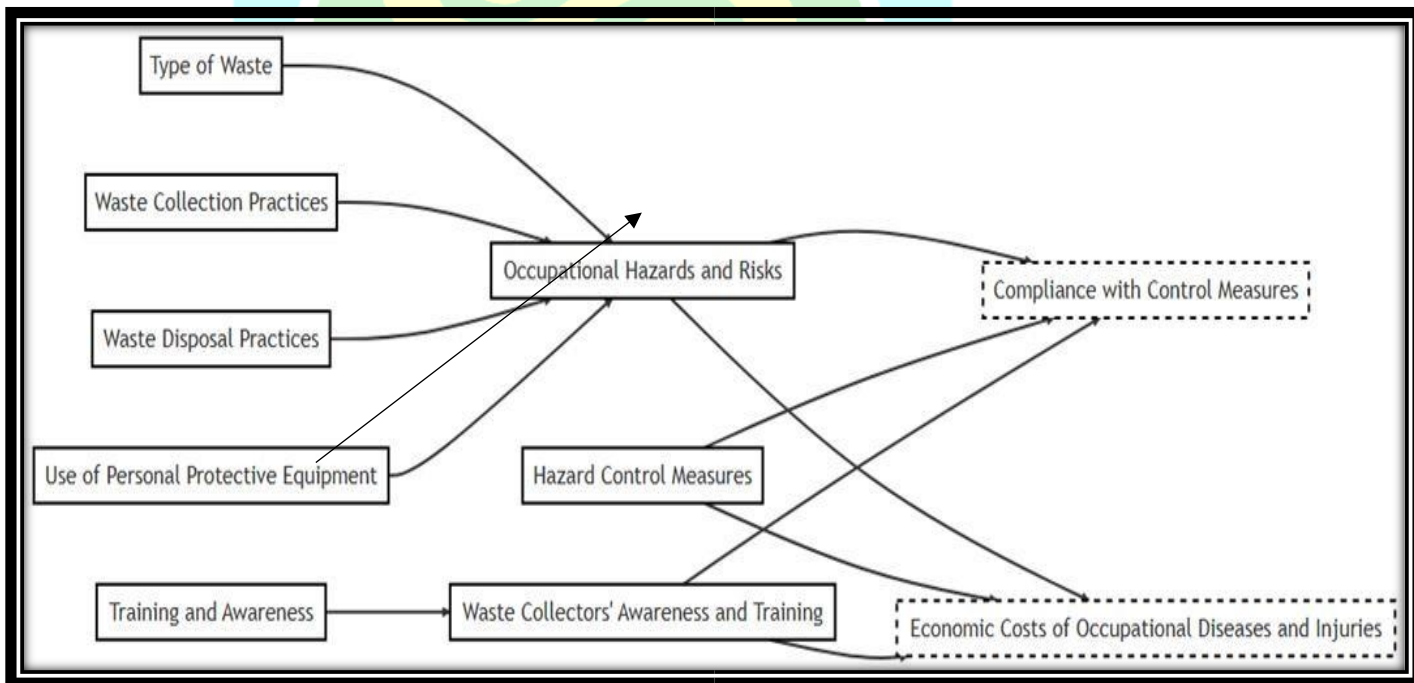
## 2.9 Conceptual Framework

The conceptual framework for this study is designed to illustrate the complex interplay between occupational hazards, hazard control measures, compliance with these measures, and the overall well-being of waste collectors.

1. **Occupational Hazards and Risks:** This refers to the potential dangers and health risks that waste collectors are exposed to in their line of work. These could include physical, chemical, biological, and ergonomic hazards. The identification and understanding of these hazards and risks are the first step in the process.
2. **Hazard Control Measures:** Once the occupational hazards and risks have been identified, appropriate control measures should be implemented by waste management companies. These measures are designed to mitigate the identified hazards and could include the use of personal protective equipment (PPE), safety training, and implementation of safer work practices.
3. **Compliance with Control Measures:** This refers to the extent to which waste collectors adhere to the implemented control measures. Factors influencing compliance could include awareness and understanding of the hazards, perceived effectiveness of the control measures, and individual attitudes and behaviors.
4. **Overall Well-being of Waste Collectors:** This is the ultimate outcome of interest and refers to the physical, mental, and social health of waste collectors. It is influenced by the

occupational hazards and risks they are exposed to, the effectiveness of the control measures, and their level of compliance with these measures.

The relationships between these components are dynamic and interrelated. The identification of occupational hazards and risks should lead to the implementation of control measures. The effectiveness of these measures in reducing hazards and improving health outcomes is, in turn, influenced by the level of compliance among waste collectors. The study intends to provide a thorough understanding of occupational hazards in Sunyani's waste collecting industry and inform the development of efficient methods to improve worker safety and well-being by looking at these elements and their interactions.



**Figure 2.1: Conceptual framework**

Different types of waste may present different hazards and risks. This includes everyday trash such as food waste, recyclables, medical waste, clothing, electronics, and appliances. Handling MSW

exposes workers to a mix of hazards including sharp objects, biological contaminants, and chemical residues (Lissah et al., 2022).

Waste collection methods vary widely, from manual hand-sorting and lifting to mechanized loading and transport. Some practices are inherently safer, while others increase risk. Manual collection and sorting often expose workers to sharp objects, heavy lifting, and repetitive strain injuries. For example, waste collectors in Mzuzu City, Malawi, reported injuries from broken glass and nails due to handling waste with bare hands or inadequate protection (Lasota et al., 2019).

The final disposal of collected waste also impacts occupational hazards. Open dumping and poorly managed landfills expose workers to biological hazards (pathogens, foul odors), chemical hazards (toxic substances), and physical hazards (sharp debris, unstable ground). Burning of waste releases toxic fumes, posing respiratory risks to workers and communities. Improper segregation and disposal of hazardous waste (e.g., medical waste, chemicals) increases exposure to infections, chemical burns, and chronic illnesses. Clogged drains and stagnant water from poor waste disposal create unhealthy environments, increasing disease risks (Zolnikov et al., 2018).

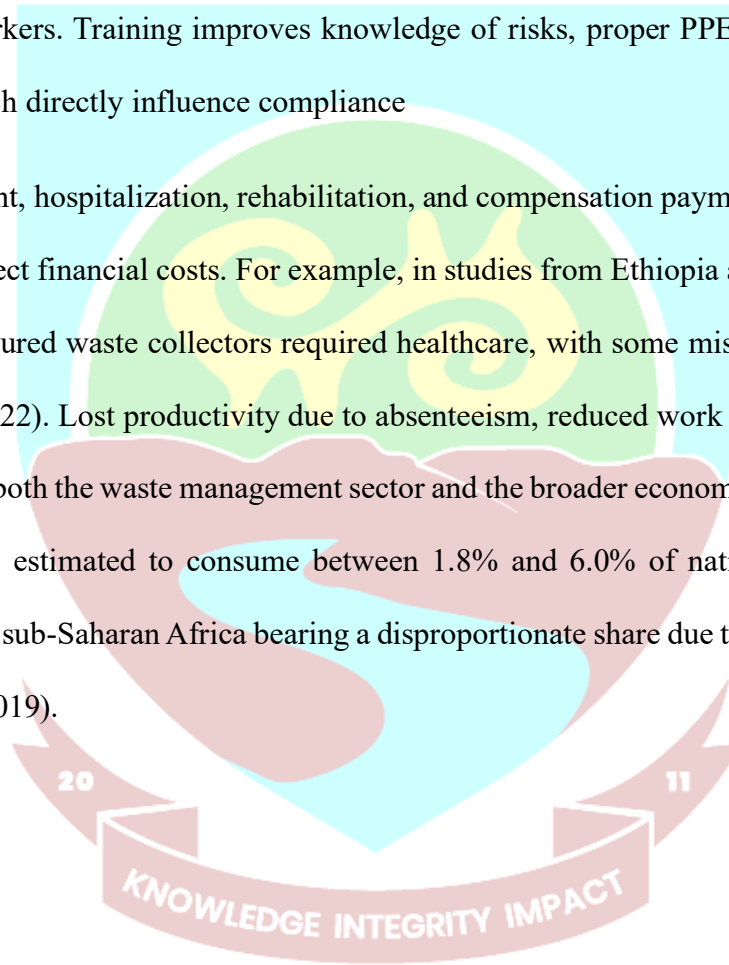
Many waste collectors recognize the protective benefits of PPE such as gloves, boots, and masks in preventing injuries and exposure to contaminants. However, inconsistent supply, poor quality, discomfort, and stigma reduce regular use (Jerie, 2016). For instance, Mzuzu City waste collectors reported irregular PPE provision and sometimes working without any protection. Field observations confirm discrepancies between PPE availability and actual use, with some workers using gloves but few wearing protective boots or masks (Zolnikov et al., 2018).

This represents the waste collectors need to have some level of knowledge and training about the hazards of their jobs and the control measures in place. Many waste collectors lack comprehensive

understanding of all risks, including chemical and psychosocial hazards, and the correct use and maintenance of PPE (Yeboah-Assiamah et al., 2019).

Waste collectors who receive formal health and safety training demonstrate significantly better adherence to hazard controls. Studies (Zolnikov et al., 2018; Kanhai et al., 2019) show that those trained before employment are about 57% less likely to experience occupational injuries compared to untrained workers. Training improves knowledge of risks, proper PPE use, and safe handling techniques, which directly influence compliance

Medical treatment, hospitalization, rehabilitation, and compensation payments for injured workers contribute to direct financial costs. For example, in studies from Ethiopia and Kenya, a significant proportion of injured waste collectors required healthcare, with some missing multiple workdays (Lissah et al., 2022). Lost productivity due to absenteeism, reduced work capacity, and premature disability affect both the waste management sector and the broader economy. Occupational injuries and diseases are estimated to consume between 1.8% and 6.0% of national GDP in emerging economies, with sub-Saharan Africa bearing a disproportionate share due to high injury prevalence (Kanhai et al., 2019).



### **CHAPTER THREE**

### 3.0 RESEARCH METHODOLOGY

#### 3.1 Introduction

The study area is described at the outset of the chapter, which also includes the research strategy, study population, and sample selection method. Also included are the data sources, data collection techniques, and data analysis methodologies.

#### 3.2 Profile of Study Area

The study was carried out in the Sunyani Municipality in the Bono Region of Ghana. The map of the Sunyani Municipality showing the sites is illustrated in Figure 3.1.

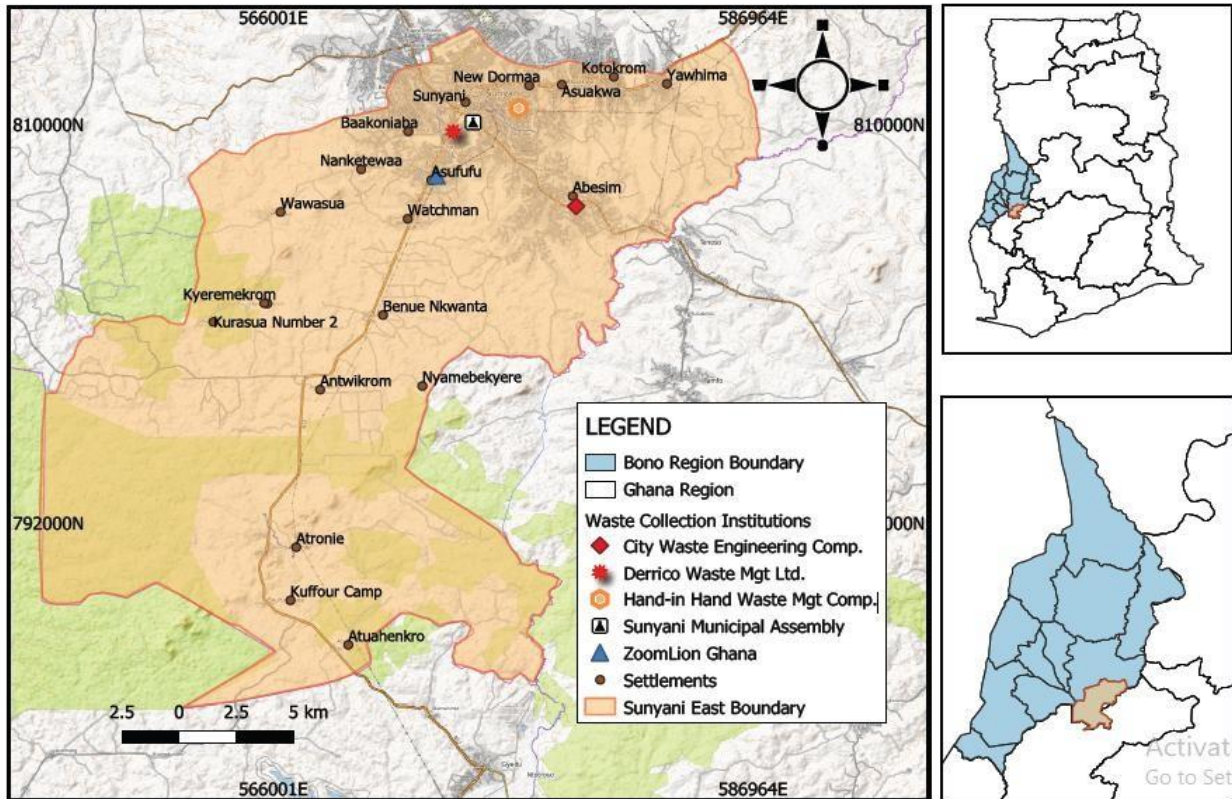


Figure 3.1: Political map of the Sunyani Municipality(2025)

Source: Design by the author

The Sunyani Municipality is 1,289 square kilometres in size and is situated in the western portion of Ghana's Bono Region (GSS, 2021). It was first established in 1989 as an ordinary district assembly and was subsequently promoted to the level of municipal district assembly in 2007 (GSS, 2021). As of 2021, the total population of the Sunyani Municipal District is approximately 193,595 people (GSS, 2021). Abesim, Adantia, Ahyiyem, Asuakwa Kotokrom, Antwikrom, Atuahenkrom, Atronie, Dumasua, Fiapre, Kobedi, Baakoniaba, New Dormaa, Nwawansua, Liberation Barracks, Sunyani, Tanom, and Yawhimakrom are among the settlements that make up the municipality. Economically, the Sunyani Municipality serves as a major market center for a large number of agricultural products like maize, cassava, plantain, yam, and cocoyam (GSS, 2021). The Sunyani Municipality, located in the Bono Region of Ghana, is home to several waste management companies that play a crucial role in maintaining the cleanliness and environmental health of the area. These companies, including Zoomlion Ghana Limited, Hand in Hand Waste Management Organization, City Waste Engineering, and Derrico Waste Management and Construction Limited, provide essential waste collection services to households, businesses, and public institutions in the municipality (GSS, 2021).

Zoomlion Ghana Limited, a prominent waste management company in the area, employs a fleet of waste collection vehicles and a team of waste collectors to ensure efficient waste collection and transportation to disposal sites (Songsore et al., 2014). Similarly, Hand in Hand Waste Management Organization, another key player in the waste management sector, utilizes tricycles for waste collection, providing an alternative and more environmentally friendly mode of waste transportation (Oteng-Ababio, 2010).

City Waste Engineering and Derrico Waste Management and Construction Limited also contribute significantly to waste management in the Sunyani Municipality. These companies provide

comprehensive waste collection services, employing waste collectors to gather and transport waste to designated disposal sites (Oteng-Ababio, 2010).

These waste management companies are integral to the Sunyani Municipality's efforts to manage solid waste effectively and mitigate the occupational hazards associated with solid waste collection. The waste collectors employed by these companies are the primary subjects of this study, as they are directly exposed to various occupational hazards in their line of work (Songsore et al., 2014).

### **3.3 Research Design**

The research design used for this study was the cross-sectional survey design. The cross-sectional survey design involved collecting data from a sample at a single point in time from a sample of the population under study. This design was deemed suitable for studying the nature of occupational hazards, assessing the hazard control measures in place, and determining the level of compliance with these measures among waste collectors in Sunyani. The primary advantage of a cross-sectional survey design was that it allowed for the collection of data from a large number of individuals in a relatively short period (Kothari, 2014). This design also enabled the identification of the current prevalence of occupational hazards and the assessment of hazard control measures.

### **3.4 Study Population**

All waste collectors employed by waste management firms in the Sunyani Municipality make up the study's population. As they collect and dispose of municipal solid trash, waste collectors are subject to a range of occupational hazards, including chemical, biological, and physical risks.

This covers all waste collectors and supervisors employed by Zoomlion Ghana Limited (ZGL),

Sunyani Municipal Assembly (SMA), Hand in Hand Waste Management Organisation (HHWMO), City Waste Engineering (CWE), and Derrico Waste Management and Construction Limited (DWMCL) in Sunyani. As at August, 2023, the waste collectors and supervisors of the five companies was of 263 employees as reported by the management on a pre-visit by the researcher.

### 3.5 Sampling and Sampling Technique

The sample for the study was calculated using the finite population adjustment factor formula proposed by Yamane (1973) where the sample size (n) is given by: 
$$n = \frac{N}{1 + N(e)^2}$$
 where N is the target

population from the five waste management companies in Sunyani was (263) and e is the

standard error (5%). Therefore,  $n = \frac{263}{1 + 263(0.05)^2} = 158.67 \approx 159$ . The sample size for the study

was 159 waste collectors from the four waste management companies and the municipal assembly.

In addition to this, 5 managers from the five institutions were sampled to participate in the study.

To determine the sample size for each company, the proportion of waste collectors and supervisors in each company was calculated relative to the total population, and this proportion was then applied to the overall sample size. The calculations were as follows:

1. For Zoomlion Ghana Limited, with 157 workers, the sample size was calculated as  $159 * (157/263)$ , resulting in a sample size of approximately 95.
2. For Hand-In-Hand Waste Management Organization, with 22 workers, the sample size was calculated as  $159 * (22/263)$ , resulting in a sample size of approximately 13.
3. For City Waste Engineering Company, with 4 workers, the sample size was calculated as  $159 * (4/263)$ , resulting in a sample size of approximately 2.

4. For Derrico Waste Management and Construction Limited, also with 4 workers, the sample size was calculated to be approximately 2.
5. For Sunyani Municipal Assembly, with 76 workers, the sample size was calculated as  $159 * (76/263)$ , resulting in a sample size of approximately 46. Based on the estimated sample size and the population of the various waste management companies, the proportional allocation method was used to estimate the sample size for the companies as indicated in Table 3.1.

**Table 3.1: Details of the sample population**

Company Name	Location	Estimated Number of Workers	Sample Size	Waste collectors	Supervisors
ZGL	Sunyani-Atronic Road, Sunyani	157	95	50	45
HHWMO	Penkwase High Tension, Sunyani	22	14	9	5
CWE	Abesim	4	2	1	1
DWMCL	Sunyani-Estate	4	2	1	1
SMA	Sunyani-Abesim Road (Adjacent Nyamaa Basic School)	76	46	21	25

**Source: Environmental Health and Sanitation Unit (2023)**

The approach of stratified random sampling was employed in the investigation. A probability sampling technique called stratified random sampling divides the population into discrete groups, or strata. Next, a weighted or proportionate sample is drawn from every stratum. By using this method, the sample is guaranteed to be representative of the population being studied, and the findings can be applied to the population as a whole (Kothari, 2014).

This technique was operationalized by obtaining a list of all waste collectors from the waste management companies operating in the Sunyani Municipality. Each company was treated as a stratum, and a proportionate number of waste collectors were selected from each company based on the company's share of the total population. Each waste collector was assigned a unique identifier, and a random number generator was used to select the sample from each stratum. The sample size for each stratum was determined based on statistical considerations and the study's objectives. The managers of the waste management companies were purposively sampled and interviewed.

### **3.6 Data Collection**

The data was collected using a structured questionnaire and interview guide. The questionnaire was based on the study objectives and included closed-ended questions. The questionnaire was structured as follows:

1. Socio-demographic characteristics: age, sex, education level, marital status, and years of experience as a waste collector.
2. Hazard control measures in place: types of measures and their effectiveness in reducing hazards and risks.
3. Occupational hazards and risks associated with waste collection: types of hazards, frequency of exposure, and use of personal protective equipment.
4. Compliance with hazard control measures: the extent of compliance with hazard control measures by waste collectors.
5. Effects of occupational health and safety practices on waste collectors: impact on health, safety, and well-being of waste collectors.

The questionnaire was pretested to ensure that it was clear, understandable, and valid. The questionnaire was pretested in a setting similar to the main study area, specifically in the neighboring municipality of Berekum. This area was chosen due to its similar waste management practices and demographic characteristics to Sunyani. A sample of 30 waste collectors, not included in the main study, were selected to participate in the pretest. This process allowed for the evaluation of the questionnaire's clarity, understandability, and validity. Feedback from the pretest participants led to necessary modifications in the questionnaire to ensure that the questions were comprehensible and relevant to the study's objectives

The data collection process involved contacting the waste management companies operating in Sunyani and obtaining permission to access their waste collectors. The selected waste collectors were then contacted and informed about the objectives of the study and their informed consent and voluntary participation were sought.

Primary data was collected using questionnaires (administered to waste collectors) and interview guides to collect data from managers and regulators. Secondary sources of data for the study included reports, records, and other relevant documents from the waste management companies operating in Sunyani. These documents may provide information on the hazard control measures in place, compliance with these measures, and the effects of occupational health and safety practices on waste collectors.

### **3.7 Data Analysis**

The Statistical Package for Social Sciences (SPSS) version 25.0 was used for the analysis of the gathered data. The data were summarised using descriptive statistics including means, frequencies, and standard deviations. The effects of occupational health and safety procedures on waste

collectors as well as predictors of compliance with hazard management measures were investigated using inferential statistics like chi-square tests and logistic regression analysis. To assess compliance, the questionnaire contained questions that sought information on criteria such as the condition and cleanliness of collection vehicles, adherence to collection schedules, crew performance, and compliance with health and safety protocols, including proper use of personal protective equipment (PPE) Qualitative data was analysed using thematic analysis where codes were used to represent respondents as “Waste Manager 1, Waste Manager 2,...Waste Manager 5.

### **3.8 Ethical considerations**

Before any data was collected, each participant gave written informed consent, which was followed by assurances of confidentiality, that participation was voluntary, and that they could leave the study at any time without facing any repercussions. All participants were also informed about the study’s procedures, potential risks, and benefits. Personal identifiers were not included in the data collection tools to ensure anonymity. All data collected were stored securely and only accessible to the research team. The study respected the autonomy and dignity of all participants.

The rights, privacy, and personal beliefs of the participants were respected throughout the study.



## CHAPTER FOUR

### 4.0 RESULTS AND DISCUSSION

#### 4.1 Introduction

This chapter presents the results obtained from the field through the administration of questionnaires and interviews. It is discussed in sections namely, socio-demographic characteristics, occupational hazards and risks associated with waste collection, the hazard control measures put in place by waste management companies, level of compliance to hazard control measures by waste collectors, and economic cost of occupational related diseases and injuries among waste collectors.

#### 4.1 Socio-Demographic Characteristics of Respondents

This section presents the socio-demographic characteristics of the respondents. This includes age, sex, educational background, monthly income, role in the company, and working experience. The study involved 82 waste collectors and 77 supervisors from whom quantitative data was collected, and 5 managers from whom qualitative data was collected.

**Table 4.1: Socio-Demographic Characteristics**

Characteristic	Waste collectors		Supervisors	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
<b>Gender</b>				
Male	47	57.3	62	80.5
Female	35	42.7	15	19.5
<b>Age group</b>				
18-24 years	35	42.7	0	0.0
25-34 years	33	40.2	32	41.6
35-44 years	12	14.6	35	45.5
45-54 years	2	2.4	10	12.9
<b>Educational level</b>				
Primary	32	39.0	0	0.0
Secondary	40	48.8	34	44.2
Vocational/technical	10	12.2	36	46.7
Undergraduate	0	0.0	7	9.1
<b>Marital status</b>				
Single	42	51.2	59	76.6
Married	20	24.4	18	23.4
Divorced	15	18.3	0	0.0
Widowed	5	6.1	0	0.0
<b>Religion</b>				
Christianity	39	47.6	43	55.8
Islam	19	23.2	34	44.2
Traditional African Religion	24	29.2	0	0.0
<b>Average monthly income</b>				
Less than 1,000	65	79.3	18	23.4
1,000-2,000	17	20.7	59	76.6
<b>Working experience</b>				
1-5 years	18	22.0	12	15.6
6-10 years	19	23.2	9	11.7
11-15 years	32	39.0	45	58.4
More than 15 years	13	15.8	11	14.3

<b>Number of dependents</b>				
None	14	17.1	6	7.8
1-2	31	37.8	25	32.5
3-4	17	20.7	29	37.7
5 or more	20	24.4	17	22.1
<b>Employment status</b>				
Full-time	37	45.1	53	68.8
Part-time	19	23.2	8	10.4
Temporary	3	3.7	1	1.3
Casual	23	2.8	15	19.5

*Source: Authors' Fieldwork, 2023*

The results presented in Table 4.1 show that the majority of the waste collectors 47(57.3%) and supervisors 62(80.5%) were males. Most 35(42.7%) of the waste collectors were 25 to 34 years old, implying a predominantly youthful activity. Again, the results show that 40(48.8%) of the waste collectors had attained secondary education whilst 36(46.7%) of the supervisors had attained vocational/technical education. This means that the majority of the respondents had attained second-cycle education. The majority of waste collectors 42(51.2%) and supervisors 59(76.6%) were single. It was also found that the monthly income of the majority 65(79.3%) of the waste collectors was less than GHC 1,000. This amount is higher than the 2023 minimum wage of GHC14.88/day and it can be said that the majority of the waste collectors earn above the minimum wage in Ghana. However, 59(76.6%) of the supervisors had a monthly salary ranging from GHC1,000 to GHC2,000. The average monthly salary of the supervisors was GHC 1, 500. Furthermore, 39% of the waste collectors had worked for 11-15 years and 15.8% had worked for more than 15 years. Also, 58.4% of supervisors had worked for 11-15 years and 14.3% had worked for more than 15 years. This suggests that the majority of the study participants had acquired a lot of experience when it comes to waste collection and also can relate to the hazards they face in the

discharge of their duty. The majority of both waste collectors 37(45.1%) and managers 53(68.8%) were full-time employees of the waste management companies.

#### 4.2 Occupational Hazards and Risks Associated with Waste Collection

To understand the work environment of respondents and their perceptions about it, respondents were asked whether their work environments were safe or not. It was interesting to find 106(66.7%) indicating that their work environment is unsafe. This according to respondents is because of the occupational hazards they are usually exposed to in the line of their duties.

Based on the assertion that the work environment was not safe; it was necessary to determine the type of hazards waste collectors were exposed to. The study revealed that many hazards made the work environment of respondents unsafe for them.

**Table 4.2: Types of waste collected**

Waste	Yes Frequency (%)	No Frequency (%)
Household waste (e.g., food scraps, packaging)	159(100.0%)	0(0.0%)
Industrial waste (e.g., manufacturing byproducts)	32(20.1%)	127(79.9%)
Hazardous waste (e.g., chemicals, batteries)	130(81.8%)	29(18.2%)
Medical waste (e.g., used syringes, bandages)	92(57.9%)	67(42.1%)
Electronic waste (e.g., old computers, mobile phones)	144(90.6%)	15(9.4%)
Construction and demolition waste (e.g., concrete, wood)	43(27.0%)	116(73.0%)
Green waste (e.g., leaves, grass clippings)	143(89.9%)	16(10.1%)
Scrap metal	137(86.2%)	22(13.8%)
Glass waste	91(57.2%)	68(42.8%)
Paper and cardboard waste	103(64.8%)	56(35.2%)
Plastic waste	159(100.0%)	0(0.0%)

*Source: Author's Fieldwork, 2023*

The results in Table 4.2 show that 159(100.0%) of the waste collectors collect household waste, 130(81.8%) collect hazardous waste, 92(57.9%) collect medical waste, 144(90.6%) collect electronic waste, 143(89.9%) collect green waste, 137(86.2%) collect scrap metals, 91(57.2%) of them collect glass waste, majority 103(64.8%) collect paper and cardboard waste, and all 159(100.0%) of them collect plastic waste. This means that the waste collectors are always involved in the collection of a variety of waste from different locations, including waste from hospitals and clinics. This agrees with Ziraba et al. (2016) who also asserted that waste collection workers risk coming into contact with pathogenic microorganisms as they handle and process different types of waste materials.

All these types of waste are sources of hazards that pose a threat to the health of waste collectors. According to Hassan et al. (2022), these hazardous materials can include a wide range of substances, such as chemicals, toxins, flammable materials, and even radioactive waste. Dealing with these materials requires specialized training, equipment, and disposal procedures to ensure the safety of both the collectors and the surrounding community. According to Chisholm et al. (2021), providing workers with adequate training and education on the identification, management, and prevention of occupational hazards is crucial for ensuring a safer working environment.

The filed data revealed that one of the most common sources of hazardous materials in waste collection were household and industrial chemicals. These can include paints, solvents, cleaning agents, and pesticides. When not disposed of properly, these substances can contaminate the environment, posing health risks to humans and wildlife. Additionally, they can leach into soil and water supplies, potentially causing long-term damage. Medical waste is another significant concern. This category includes used needles, syringes, and other medical instruments, as well as potentially infectious materials. Mishandling of medical waste can lead to the spread of diseases

and infections, making it crucial for waste collectors to have proper training and equipment for its safe disposal. This confirms the assertion by Agarwal et al. (2015) that household, hospital, and industrial wastes are the major sources of hazards and require proper handling.

When electronics and electrical waste are not disposed of correctly, chemical substances can leach into the environment, posing a threat to soil, water, and air quality. Proper recycling and disposal methods are essential to mitigate these risks (Jerie, 2016).

#### 4.2.1 Perceived Nature of Chemical Waste

The study sought to assess the nature of poisonous waste handled by waste collectors. The data presented in Table 4.3 shows that 124(78.0%) of the respondents indicated that the chemicals they work with are moderately poisonous.

**Table 4.3: Perceived Nature of Chemical Waste**

	Frequency	Percentage (%)
Moderately poisonous	124	78.0
Highly poisonous	20	12.6
Slightly poisonous	15	9.4
<b>Total</b>	<b>159</b>	<b>100.0</b>

*Source: Authors' Fieldwork, 2023*

Although waste collectors perceive these chemicals to be moderately poisonous, they can still have health implications for waste collectors. Some of these poisonous chemicals include DDT, pesticides, weedicides, batteries, carcinogens from smoke at dump sites, etc. DDT is a chemical that is highly poisonous as compared to pesticides, which are moderately poisonous.

#### 4.2.2 Types of Hazardous Materials and Their Effects

The study further sought to assess the type of hazardous materials that waste collectors usually encounter at work. The data presented in Table 4.4 indicate that 63(53.1%) reported that they

encountered biological, chemical, and physical hazards. These are the most common hazards that form part of waste, and it is not surprising that the waste collectors encounter these hazards. All the respondents (159) indicated that the hazards they are exposed to in the work environment are severe, and this could have implications for their health. The respondents opined that the hazards they were exposed to were severe and could have implications on their health. That is, there was a level of severity regarding the hazards that these waste collectors encountered during waste collection. The majority (90.6%) of the respondents asserted that they had suffered injuries or health issues due to the hazards. As long as waste collectors are exposed to hazards, injuries, and health issues related to these hazards are unavoidable. Waste collectors are constantly sorting through items and during this time, they can encounter hazardous exposures, such as heavy metals, sharp materials, or even infectious diseases (Zolnikov et al., 2018).

**Table 4.4: Hazardous materials encountered while collecting waste**

<u>Hazardous materials</u>	<u>Frequency Percentage (%)</u>	
Biological hazard	11	8.5
Chemical hazard	19	14.6
Biological/chemical/physical hazards	63	53.1
All hazards	37	28.5
<b>How severe these hazards were</b>		
Very severe	57	43.8
Severe	73	56.2
<b>Whether respondents have ever suffered injuries or health issues</b>		
No	15	9.4
Yes	144	90.6

*Source: Authors' Fieldwork, 2023*

Of those who indicated that they had ever encountered hazardous materials whilst collecting waste, 63(53.1%) indicated that they encountered biological, chemical, and physical hazards (Table 4.4). These are the most common hazards that form part of waste and it is not surprising that the waste collectors encounter these hazards. This agrees with a study conducted by Mattiello et al. (2015), which also revealed that waste collection workers were exposed to a wide range of chemical and biological hazards, including airborne contaminants, hazardous chemicals, and infectious agents.

The managers who were interviewed also asserted that waste collectors are always exposed to several environmental hazards that pose health risks for these waste collectors. Some of these include toxic chemicals, broken glasses, syringes from hospitals, and other sharp objects that are usually included in waste.

A manager commented that:

*“Waste collectors are exposed to environmental hazards from where they collect the waste daily. The exposure puts them at risk of several health conditions such as cancers and respiratory diseases.”* (Waste manager 1, 2023)

This suggests that there is no doubt that waste collectors are always exposed to several hazards in their work environment.

#### **4.2.3 Perception of Respondents on Work Environment**

The frequency distribution presented in Table 4.5 shows that there are differences among respondents of different demographic characteristics and how they perceive the safety of the working environment.

**Table 4.5: Safety in the working environment**

Respondent's characteristics	Total n(%)	Very safe n (%)	Safe n (%)	Unsafe n (%)
<i>Age</i>				
18-24 years	35(22.0%)	0(0.0%)	4(2.5%)	31(19.5%)
25-34 years	65(40.9%)	0(0.0%)	20(12.6%)	45(28.3%)
35-44 years	40(25.2%)	15(9.4%)	5(3.1%)	20(12.6%)
45-54 years	19(11.9%)	9(5.7%)	0(0.0%)	10(6.3%)
Total	159(100.0%)	35(15.1%)	65(18.2%)	106(66.7%)
<i>Gender</i>				
Male	109(68.6%)	24(15.1%)	14(8.8%)	71(44.7%)
Female	50(31.4%)	0(0.0%)	15(9.4%)	35(22.0%)
Total	159(100.0%)	24(15.1%)	29(18.2%)	106(66.7%)
<i>Role in Company</i>				
Waste collector	116(73.0%)	24(15.1%)	9(5.7%)	32(52.2%)
Safety officer	43(27.0%)	0(0.0%)	20(12.6%)	23(14.5%)
Total	159(100.0%)	24(15.1%)	29(18.2%)	106(66.7%)
<i>Education</i>				
Primary	32(20.1%)	00(0.0%)	0(0.0%)	32(20.1%)
Secondary	88(55.3%)	24(15.1%)	14(8.8%)	50(31.4%)
Vocational	32 (20.1%)	0(0.0%)	15(9.4%)	17(10.7%)
Undergraduate	7(4.4%)	00(0.0%)	0(0.0%)	7(4.4%)
Total	159(100.0%)	24(15.1%)	85(18.2%)	106(66.7%)
<i>Work experience</i>				
1-5 years	26(16.4%)	0(0.0%)	15(9.4%)	11(6.9%)
6-10 years	28(17.6%)	9(5.7%)	4(2.5%)	15(9.4%)
11-15 years	81(50.9%)	0(0.0%)	5(3.1%)	76(47.8%)
More than 15 years	24(15.1%)	15(9.4%)	5(3.1%)	4(2.5%)
Total	159(100.0%)	24(15.1%)	29(18.2%)	106(66.7%)

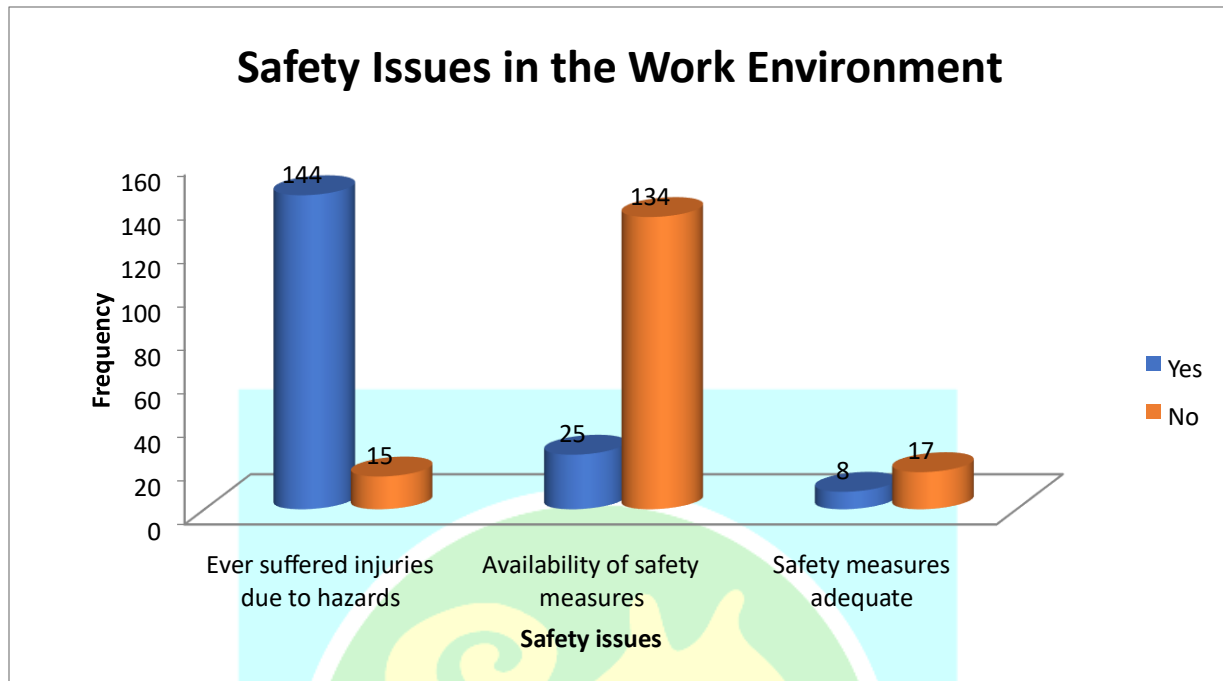
Source: Authors' Fieldwork, 2023

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The results indicate that the majority 106(66.7%) of them feel that the work environment is unsafe. The segregated results show differences in how the different age groups, genders, role of the respondent in the company, level of education, and work experience perceive the safety of the work environment (Table 4.5). For example, more percentage 24(15.1%) of males perceive the work environment to be very safe as compared with 0.0% of women. Also, most 76(47.8%) of those who have worked for 11 to 15 years perceive the work environment to be unsafe as compared with those who have worked for less than 11 years. Also, the role of the individual, their level of education, and working experience showed differences in how they perceive the safety of their working environment. Those employees who are safety officers or supervisors will feel safer than the waste collectors. One of the factors that make waste collectors feel unsafe is the hazards they encounter in the work environment. This agrees with Tiesman et al. (2022) who state that the sight of physical hazards by waste collectors makes the work environment unsafe for them. Physical hazards are characteristics or circumstances in the work environment that might cause injury to employees.

#### **4.2.4 Safety Issues and Work-Related Injuries**

In assessing the safety issues at work, the researcher found out whether respondents have ever suffered injuries from work-related hazards, whether there are safety measures and if safety measures are available, what is the adequacy. The results presented in Figure 4.1 show that there are no safety measures for the majority of the waste collectors and where safety measures are available, they are not enough.



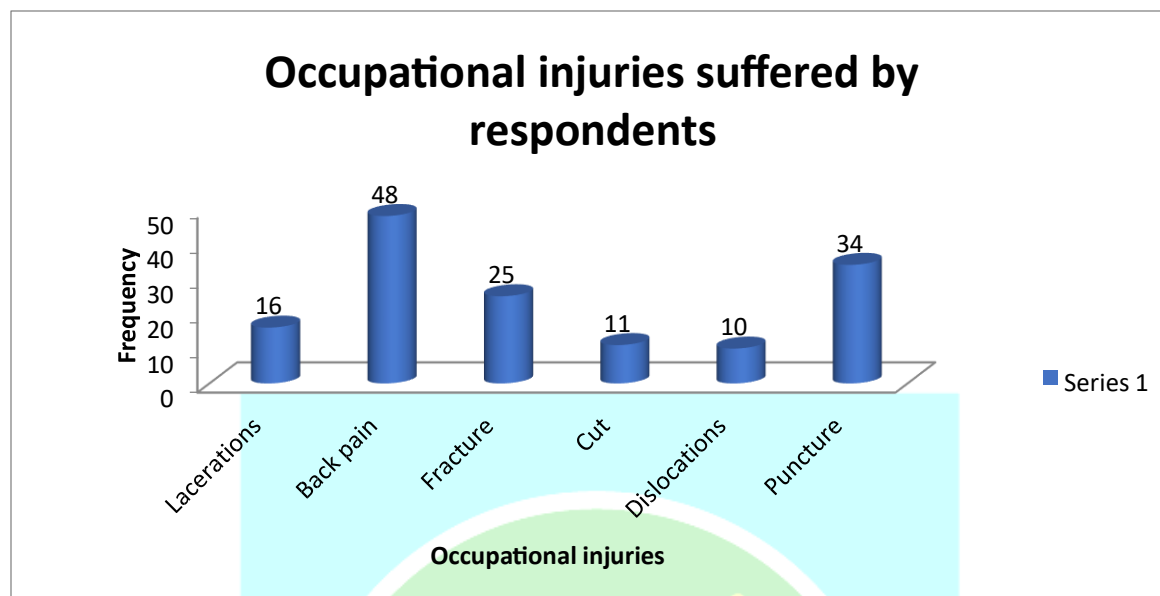
**Figure 4.1: Safety Issues in the Work Environment**

*Source: Authors' Fieldwork, 2023*

From Figure 4.1, 144(90.6%) of the respondents indicated that they have ever suffered injuries due to work hazards. Also, 134(84.3%) indicated that safety measures are not available in the workplace. Of those who indicated that safety measures are available, 17(68.0%) indicated that the safety measures are not adequate. A study by Jerie (2016) highlighted the physical hazards faced by waste disposal workers, causing various degrees of injuries to the waste collectors. The study further indicates that PPEs are usually not adequate for the waste collectors to protect themselves from these hazards.

#### **4.2.5 Types of Occupational Injuries Suffered by Respondents**

Respondents were also asked about the type of occupational injuries they suffer from as a result of their work. The data presented in Figure 4.2 reveal that back pain and punctures are the common injuries that waste collectors usually suffer.



**Figure 4.2: Occupational injuries suffered by respondents**

*Source: Authors' Fieldwork, 2023*

The results reveal that 48(33.3%) of the waste collectors suffer from back pain and 34(23.6%) usually suffer from punctures. The prevalence of musculoskeletal disorders (MSDs) among waste collectors is a significant concern. This confirms a study by Bulduk (2019) on municipal solid waste collectors in Ankara, Turkey, the upper back pain rate was 89.1% among the collectors, with 47.9% reporting upper back pain in the last 12 months. Low back pain was found to be a common musculoskeletal disorder among waste workers, with a lifetime prevalence of over 80%. These findings highlight the high prevalence of musculoskeletal disorders, particularly back pain, among waste collectors, emphasizing the need for interventions to improve their working conditions and reduce the risk of such disorders.

#### **4.2.6 Sources of Noise in the Working Environment**

The study assessed the perception of waste collectors regarding noise in their work environment. From Table 4.6, most waste collectors are exposed to sound from the work environment. They are

exposed to noise for at least an hour, with some waste collectors being exposed to noise for 4 to 6 hours daily.

From Table 4.6, 84(52.78%) of the respondents indicated that they were not exposed to noise whilst 75(47.0%) said they were exposed to noise. Of those respondents who indicated that they are exposed to noise, the 47(62.7%) of them indicated that machines and/or vehicles are the source of noise. Waste collectors usually use trucks to collect waste and the movement is mostly through streets therefore noise from moving vehicles, including their trucks affects them. Also, 40(53.3%) of the respondents indicated that they are usually exposed to noise for about 1 hour to 3 hours a day. Of the 75 respondents who said they were exposed to noise, 53(70.7%) of them indicated that the noise does affect their hearing.

**Table 4.6: Noise in the working environment**

<b>Exposure to noise at work</b>	<b>Frequency</b>	<b>Percentage (%)</b>
<b>Exposure to noise</b>		
Yes	75	47.2
No	84	52.8
<b>Source of noise</b>		
Striking of metals	28	37.3
Machines/vehicles	47	62.7
<b>Number of hours exposed to noise</b>		
Less than 1 hour	7	9.3
1hr-3hrs	40	53.3

4hrs-6hrs	28	37.3
<b>Whether the noise affects hearing</b>		
No	22	29.3
Yes	53	70.7

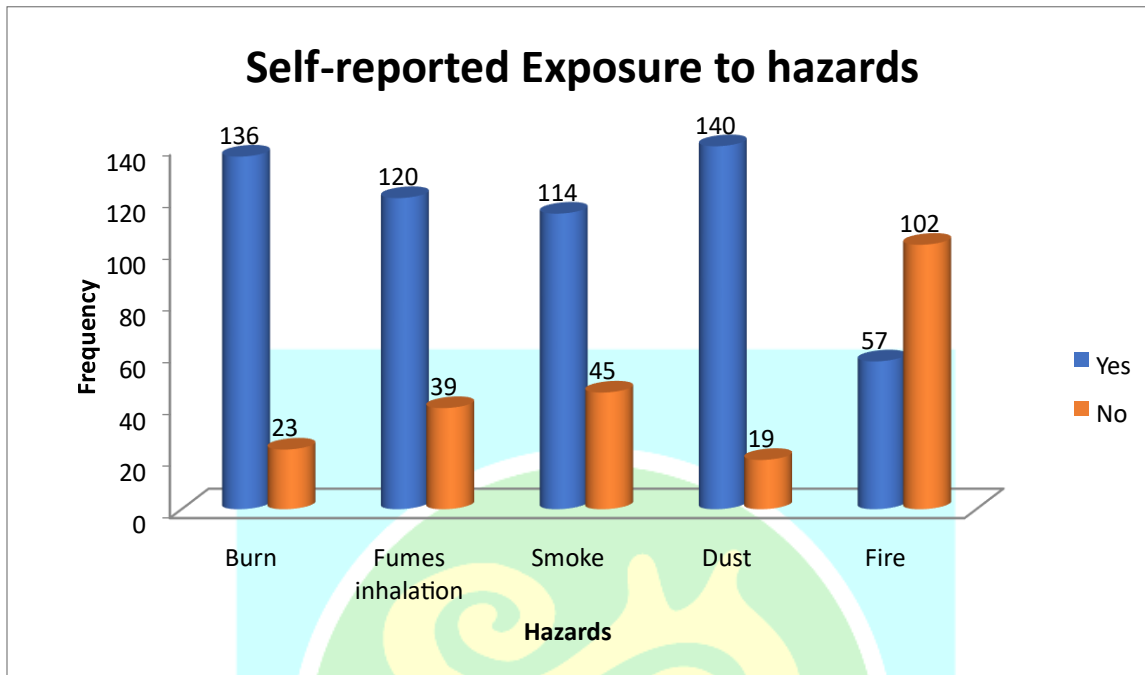
*Source: Authors' Fieldwork, 2023*

If the noise is intense, this period of exposure can cause hearing problems. Waste collectors usually use trucks to collect waste and the movement is mostly through streets therefore noise from moving vehicles, including their trucks affects them. Another physical risk in the waste collection industry is exposure to loud noise. A study by Jerie (2016) highlighted the physical hazards faced by waste disposal workers, including injuries from sharp objects, vehicle accidents, and exposure to loud noise.

The researcher assessed the exposure of waste collectors to various hazards in their work environment. The waste collectors whether they are exposed to burns, fumes, smoke, dust, and fire. The results in Figure 4.3 indicate that apart from fire, the majority of the waste collectors are exposed to burns, fumes, smoke, and dust.

#### **4.2.7 Types of Hazards Waste Collectors are frequently exposed to**

From Figure 4.3, 136(85.5%) of the respondents indicated that they are exposed to burns from some chemicals. Also, 120(75.5%) of them indicated that they are exposed to fumes. Sometimes in waste collection, there are discarded chemical containers that can produce fumes upon bursting. Also, rotten items can produce fumes to which the waste collectors are exposed. Again, 114(71.7%) of them said they are usually exposed to smoke. Smoke was seen from the waste collection site or at the dump sites where the waste is disposed as observed by the researcher. So, with their daily activities of waste collection and disposal, they are exposed to smoke. Furthermore, an overwhelming majority, 140(88.8%) of them, indicated that they are usually exposed to dust.



**Figure 4.3: Self-Reported Exposure to Hazards**

*Source: Authors' Fieldwork, 2023*

The roads leading to dump sites are not tarred and besides that, most of the inner-city roads are dusty, exposing waste collectors to dust every day in the line of their duties, especially during the dry season. According to Mattiello et al. (2015), the exposure of waste collectors to these hazards is as a result of a lack of safety procedures, including the use of PPEs.

#### 4.2.8 Usual Posture at Work

In assessing the ergonomic hazards among the waste collectors, the study sought to find out the usual posture of waste collectors at work and the effects of this posture on the waste collectors. The results presented in Table 4.7 highlight the working posture of waste collectors, which includes standing, bending, sitting, and squatting.

**Table 4.7: Frequent Posture at Work**

Usual Posture at Work	Frequency	Percentage (%)
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<b>Working posture</b>		
Standing	34	21.4
Bending	83	52.2
Sitting	23	14.5
Squatting	19	11.9
<b>Whether Posture causes pain</b>		
Yes	118	74.2
No	41	25.8

*Source: Authors' Fieldwork, 2023*

From Table 4.7 above, 83(52.2%) of the respondents indicated that they perform their duties by bending. The results further indicate that 118(74.2%) of the respondents indicated that their posture at work causes pain. Apart from sitting, which may cause little pain, all the other working postures indicated by the respondents cause pain Markova et al, 2024. Waste collection always involves bending as waste collectors need to bend to collect waste or pick up the waste bins to empty them into their trucks. This has many health implications, such as musculoskeletal disorders among the waste collectors. This is consistent with the findings of Mattiello et al. (2015), who show that the physically taxing nature of waste collection might result in musculoskeletal issues due to repeated lifting, bending, and twisting.

#### **4.3 Hazard control measures put in place by waste management companies**

It was revealed in the interview section that the waste management companies have put in place several measures to control hazards among the waste collectors. Hazard control is a systematic program involving all necessary steps to protect workers from exposure to hazards such as chemicals, materials, or other dangerous conditions. It includes training, procedures to monitor worker exposure and health, and selecting appropriate control methods based on risk assessments tailored to the specific workplace. The goal is to reduce or eliminate hazards through methods like engineering controls, administrative controls, or personal protective equipment, and to monitor

these controls for effectiveness. In the context of waste collection, hazard control is critically important because waste, especially hazardous waste, can pose significant risks to human health and the environment.

A respondent commented that:

*“In my company, waste collectors are required to conduct a pre-use inspection of their vehicles at the start of each shift. This includes checking brakes, lights, fluid levels, and safety equipment like first aid kits and fire extinguishers.”* (Waste manager 4, 2023) Another also stated that:

*“We instruct our collectors to collect waste from one side of the road at a time and to always stay visible to traffic. When reversing, truck drivers must perform a complete visual check and ensure they have visual contact with co-workers.”* (Waste manager 1, 2023) Furthermore, a respondent commented that:

*“Proper lifting techniques are emphasized in my company to prevent musculoskeletal injuries. Collectors are trained to use their legs for lifting, avoid twisting, and to utilize mechanical aids whenever possible. There are also clear procedures for reporting accidents to ensure that all incidents are documented and addressed promptly.”* (Waste manager 6, 2023)

These findings indicate that the waste management companies have in place measures to control hazards that are associated with waste collection.

It was also revealed that waste collectors are trained and equipped with the knowledge and skills required to prevent hazards in the line of their duties.

A respondent stated that:

*“Regular training sessions are conducted to educate waste collectors about potential hazards, safe work practices, and the importance of using PPE. This training includes handling hazardous materials and emergency procedures.”* (Waste manager 3, 2023) The respondent further stated that:

*“Health monitoring is recommended to identify any issues early, particularly for those exposed to hazardous materials. Vaccinations against diseases like tetanus are also encouraged.”* (Waste manager 3, 2023) Another respondent commented that:

*“Waste collectors in the company are mandated to wear appropriate PPE, which includes gloves to protect against cuts and punctures, reflective vests for visibility in traffic, Steel Toed Boots to protect feet from heavy objects, and safety glasses to prevent eye injuries from debris.”* (Waste manager 1, 2023)

A participant from the environmental department of the Municipal Assembly stated that:

*“We conduct mandatory workshops that cover topics such as hazard recognition, safe waste handling practices, and emergency response procedures. These workshops ensure that waste collectors are well-informed about the risks they may encounter and how to mitigate them. Waste collectors of the various waste management companies are also encouraged to participate in certification programs that focus on occupational health and safety, waste management practices, and environmental regulations. This not only enhances their skills but also promotes a culture of safety.”* (Environmental Officer, 2023)

Training and development are significant in every organisation to ensure that employees stay up to date with operational procedures and emerging trends. The statements from the participants are

indications that waste management companies take training and development as key components of their Human Resource Management.

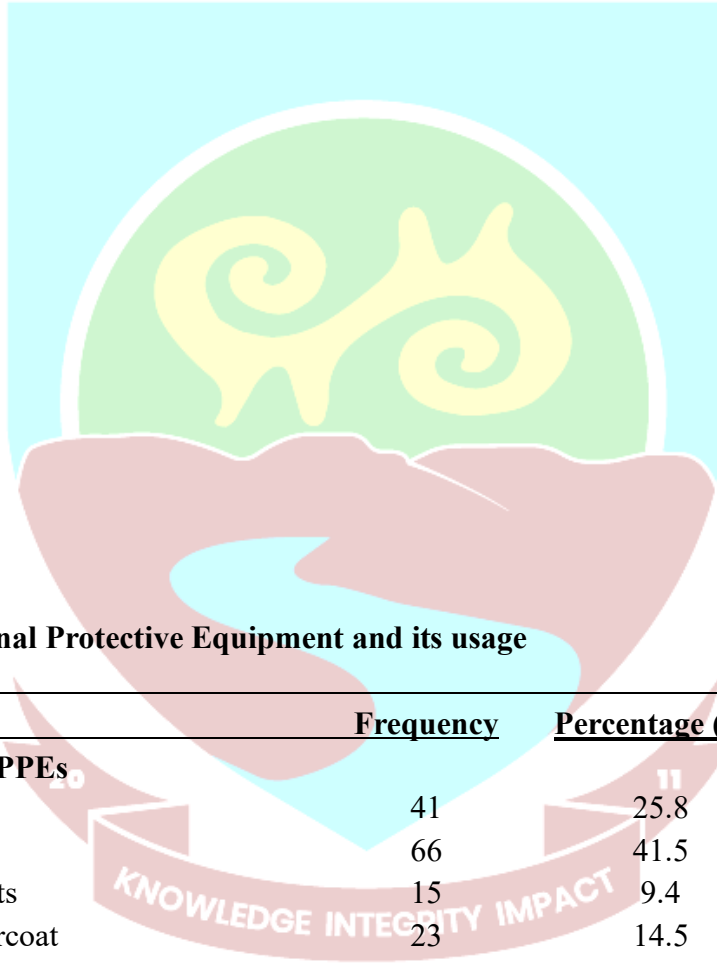
**Table 4.8: Hazard control measure**

Institution	Hazard control measures	Comment
Zoomlion Limited Ghana	PPEs	<i>“Waste collectors in the company are mandated to wear appropriate PPE.”</i>
Hand-In-Hand Waste Management Organization	Inspection of vehicles	<i>“In my company, waste collectors are required to conduct a pre-use inspection of their vehicles at the start of each shift.”</i>
City Waste Engineering Company	Training	<i>“Regular training sessions are conducted to educate waste collectors about potential hazards, safe work practices, and the</i>
		<i>importance of using PPE.”</i>
Derrico Waste Management and Construction Limited	Health screening	<i>“Health monitoring is recommended to identify any issues early, particularly for those exposed to hazardous materials.</i>
Sunyani Municipal Assembly	Workshops	<i>“We conduct mandatory workshops that cover topics such as hazard recognition, safe waste handling practices, and emergency response procedures.”</i>

Source: Authors' Fieldwork, 2023

#### 4.4 Level of Compliance with Hazard Control Measures by Waste Collectors

This sub-section presents the results on the level of compliance with hazard control measures by waste collectors in waste management companies. The views of the waste collectors and managers are presented.



**Table 4.9: Personal Protective Equipment and its usage**

	<u>Frequency</u>	<u>Percentage (%)</u>
<b>Available PPEs</b>		
Goggles	41	25.8
Gloves	66	41.5
Safety boots	15	9.4
Safety overcoat	23	14.5
All	14	8.8
<b>Provider of Personal Protective Equipment</b>		
Employers	92	57.9
Self	13	8.2
Government	54	34.0
<b>Trained on PPE use</b>		
No	78	49.1

Yes	81	50.9
<b>Adequacy of PPEs</b>		
No	137	86.2
Yes	22	13.8
<b>Frequency of use of PPEs</b>		
Always	28	17.6
Often	34	21.4
Sometimes	69	43.4
Rarely	28	17.6

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*Source: Authors' Fieldwork, 2023*

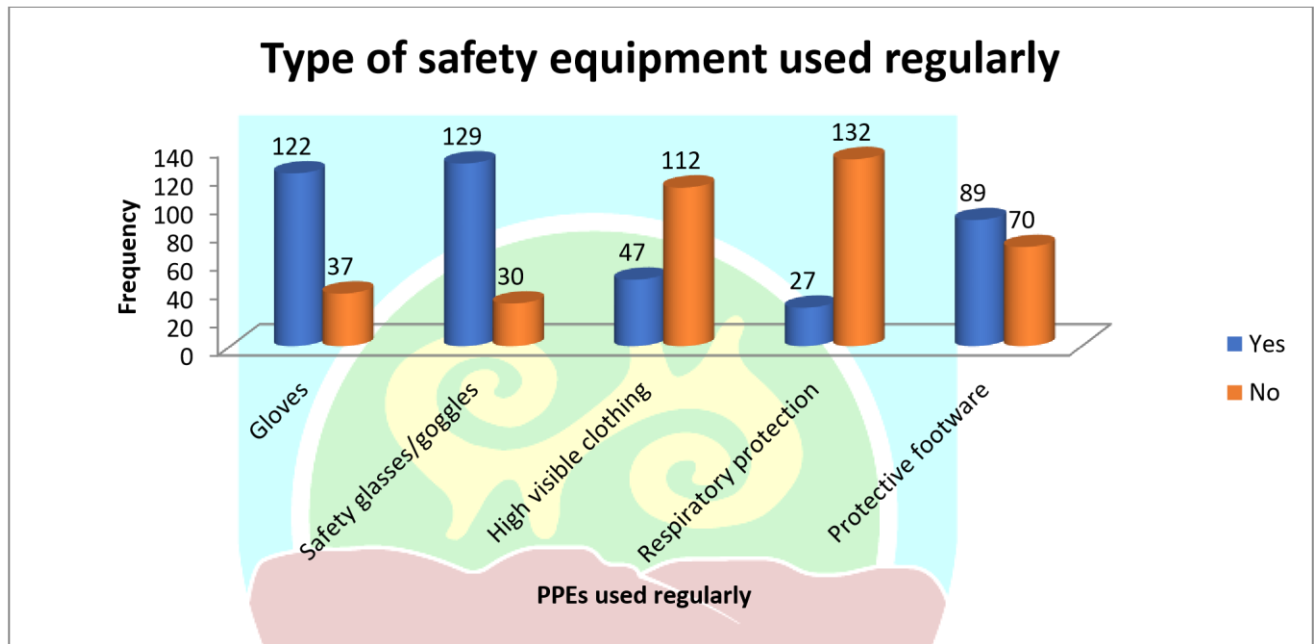
Table 4.9 revealed that 66(41.5%) of the respondents indicated that gloves are available at their workplace. Because waste collection has to do with the use of hands, gloves are the most common personal protective equipment available for waste collectors. These were usually provided by the employer as indicated by 92(57.9%) of the respondents. In the state-owned institutions, the government provides these PPE to the waste collectors although the waste collectors sometimes get some by themselves. In private companies such as Zoomlion Ghana, the company provides PPE to the employees. PPEs are very important in reducing occupational injuries among waste collectors. This agrees with Mattiello et al. (2015) who also state that by wearing the appropriate PPE, waste collection workers can significantly reduce the risk of injury and illness.

The study revealed that compliance was low as only 28(17.6%) of the respondents use PPEs always. Waste collectors' noncompliance with the use of Personal Protective Equipment (PPE) is a serious problem that has broad effects on the public's health as well as the workers' well-being. Hazards to a waste collector's health include physical damage, exposure to toxic substances, and the possibility of catching infections from polluted materials.

#### 4.4.1 Safety equipment used regularly

The respondents were asked to indicate the type of equipment that they regularly use during work.

Figure 4.4 presents the data on the responses from the respondents. It was revealed that hand gloves and protective glasses or goggles are mostly used by waste collectors.



**Figure 4.4: Type of safety equipment used regularly**

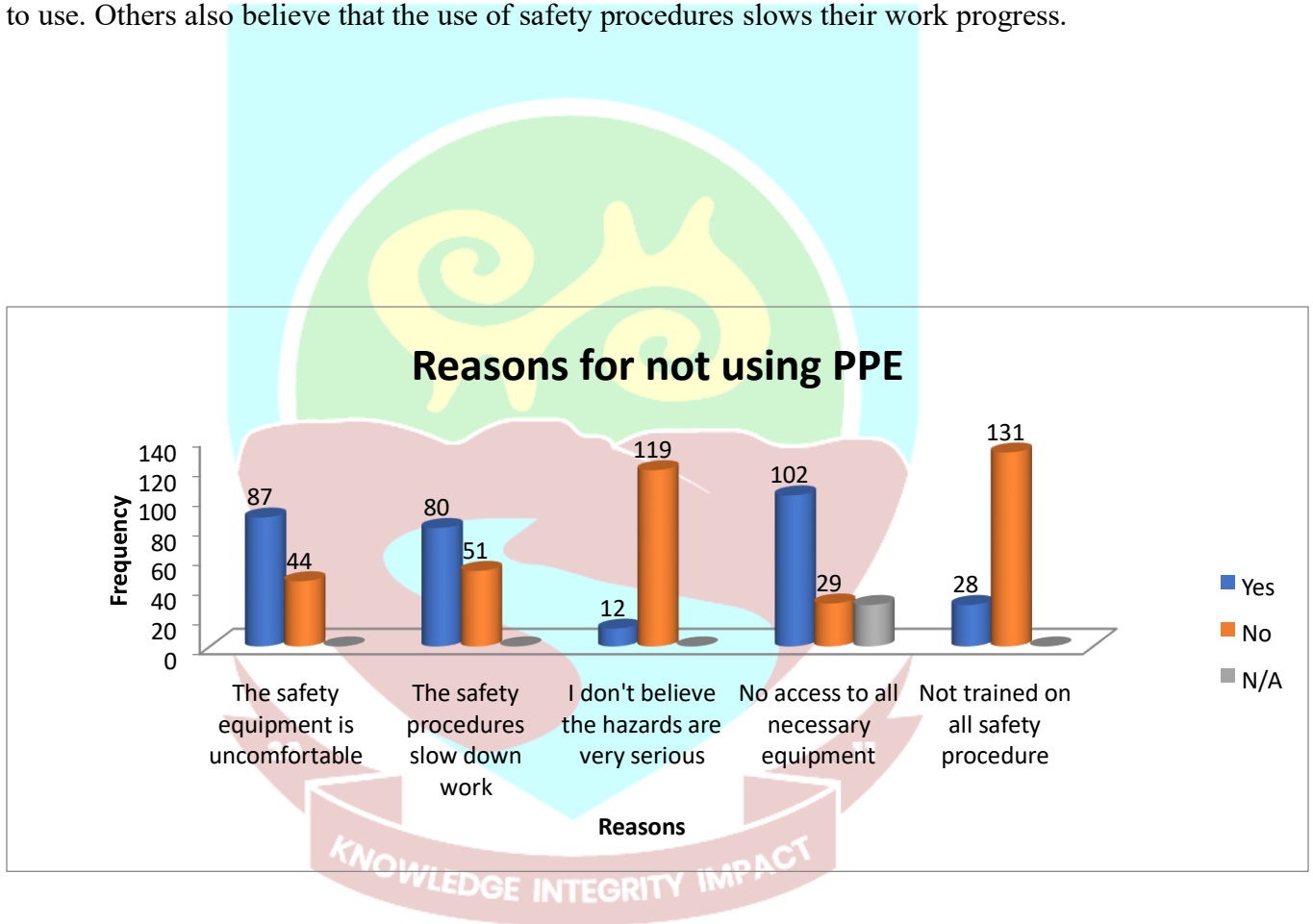
*Source: Authors' Fieldwork, 2023*

The results in Figure 4.4 indicate that 122(76.7%) of the respondents use gloves regularly as compared with 37(23.3%) who do not use them regularly. Also, 129(81.1%) of them use safety glasses or goggles regularly as compared with 30(18.9%) who do not use them regularly. Again, 89(56.0%) use protective footwear regularly as compared with 70(44.0%) who do not use them regularly. This may be because this protective equipment is common among all waste collectors, and that is the reason why most of them use this equipment regularly. However, the majority, 112(70.4%) of them do not use highly visible clothing and an overwhelming majority 132(83.0%) do not use respiratory protection. This is because this equipment is not common to the waste

collectors in the company. Generally, the use of personal protective equipment among waste collectors is low due to the inadequacy of the PPE at the workplace.

#### 4.4.2 Reasons for not using PPE

Figure 4.5 presents the data on the reason for non-compliance regarding the use of PPEs among waste collectors. The data reveals that waste collectors feel that the equipment is not comfortable to use. Others also believe that the use of safety procedures slows their work progress.



**Figure 4.5: Reasons for not using PPE**

*Source: Authors' Fieldwork, 2023*

The respondents were asked to state the reasons why they do not always follow safety procedures. According to, 87(54.7%) of respondents, the safety equipment is uncomfortable.

Also, 80(50.3%) of them indicated that the safety procedures slow down the pace of work and 102(64.2%) of them indicated that they do not have access to all the safety equipment. Most people usually feel uncomfortable using PPE such as helmet, protective cloth, and safety boots as they feel that this equipment is heavy on them. This suggests that waste collectors are not aware of the long-term potential effects of their exposure to hazards for not using PPEs. According to the Health Belief Model, people are more likely to adopt health-protective behaviours if they believe that they are vulnerable to a health problem (Glanz et al., 2008).

The manager revealed that although the PPE is not usually enough, they make efforts to provide the basic PPEs for their employees to use. They however indicated that employees do not fully comply with all the safety procedures that the companies put in place to control hazards.

A manager from one of the waste management companies commented that:

*“PPE is available but the use of it has to do with behavior. Some employees just don’t want to put on safety clothing. When they pick their gloves and safety boots, they don’t care about any other PPE.”* (A manager of Zoomlion Ghana Limited, 2023)

Another manager commented that:

*“Our people hardly comply with our safety procedures. Until a worker suffers some injuries, he doesn’t see the need for using the basic PPE and following simple instructions.”* (A manager of City Waste Engineering, 2023)

This suggests that the waste collectors do not generally like the use of some PPEs during work and this exposes them to hazards.

Table 4.10 presents a Chi-Square analysis of the relationship between socio-demographic characteristics of the study participants and the frequent use of PPEs. The data shows a linear trend in infrequent use of PPEs among the respondents.

**Table 4.10: Chi-Square Test of the Relationship between Demographic Variables and frequent use of PPEs**

Demographic characteristics	Compliant		$\chi^2$	P-value
	Yes	No		
<b>Age</b>				
18-24 years	35	10(28.6%) 25(71.4%)	10.168	<b>.003</b>
25-34 years	65	21(32.3%) 44(67.7%)		
35-44 years	47	18(38.3%) 29(61.7%)		
45-54 years	12	10(47.6%) 2(16.7%)		
<b>Gender</b>				
Male	109	20(18.3%) 89(81.7%)	13.141	<b>0.014</b>
Female	50	33(66.0%) (24.0%)		
<b>Level of Education</b>				
Primary	32	8(25.0%) 24(75.0%)	9.158	.117
Secondary	74	15(20.0%) 59(80.0%)		
Vocational/technical	46	10(21.7%) 36(78.3%)		
Undergraduate	7	6(85.7%) 1(14.3%)		
<b>Working experience</b>				
1-5 years	30	11(36.7%) 19(63.3%)	8.087	<b>.002</b>
6-10 years	28	13(46.4%) 15(53.6%)		
11-15 years	77	10(13.0%) 67(87.0%)		
More than 15 years	24	5(20.8%) 19(79.2%)		
<b>Employment status</b>				
Full-time	90	21(23.3%) 69(76.7%)	12.347	.241
Part-time	27	9(33.3%) 18(66.6%)		

Temporary	4	1(25.0%)	3(75.0%)
Casual	38	6(15.8%)	32(84.2%)

*Source: Authors' Fieldwork, 2023*

The data presented in Table 4.10 show that there are significant differences in the age categories and the frequent use of PPEs ( $\chi^2 = 10.16$ , P-value = 0.003). This suggests that as older workers use PPEs more frequently than younger workers during work. This aligns with the findings by Dong et al. (2025) that older workers, being more vulnerable to injury and illness, require and tend to use PPE more consistently to maintain safety on the job. However, some studies suggest older age can be linked to lower PPE use in certain contexts, possibly due to discomfort or lack of tailored equipment.

Also, there was significant difference in PPEs use among gender ( $\chi^2 = 13.14$ , P-value = 0.014). Female workers use PPEs more frequently than male workers. This is notable given the widespread issue of PPE being designed primarily for men, often resulting in ill-fitting equipment for women that can discourage use or reduce effectiveness (Hancock, 2024). Hancock (2024) found that despite women's higher reported usage, many face challenges such as discomfort and lack of suitable sizes, which can impact safety and compliance.

Again, there are significant differences in the years of working experience and the frequent use of PPEs ( $\chi^2 = 8.087$ , P-value = 0.002). Those who have worked for more years do not use PPEs frequently as compared with those who have worked for less years. This may reflect complacency or perceived invulnerability among more experienced workers, a known barrier to PPE use (Lombardi et al., 2009).

#### **4.5 Economic Cost of Occupational-Related Diseases and Injuries among Waste Collectors**

This sub-section presents the results on the economic cost of occupational injuries among waste

collectors. It looks at how frequently waste collectors seek medical treatment for occupational-related injuries in a year and the amount of money spent on the treatment.

The study revealed that the mean cost of medical treatment for occupational-related diseases was GHC 750.00 for each treatment they undergo for an injury. This suggests that if a worker suffers an injury twice a year, the total cost will be GHC1,500.00. This cost of medical treatment of GHC750.00 sheds light on a likely financial burden faced by waste collectors due to occupational injuries. The financial strain of medical expenses can have far-reaching effects on the livelihoods of waste collectors and their families. It may lead to difficulties in meeting other basic needs, such as housing, food, and education. Depending on the severity of the injuries as stated in Figure 4.2, waste collectors may face long-term health issues that require ongoing medical care and may even lead to disabilities that affect their ability to continue working in the same capacity.

The managers also confirmed that the economic cost of occupational-related diseases and injuries among waste collectors is a burden to both waste collectors and the companies. They stated that the company also loses productivity when an employee is injured.

A manager commented that:

*“Both the company and the employee suffer the economic cost. You see if an employee is injured, he won’t be working but we have to pay him and even help with some medical bills. This generally affects our revenue and productivity.”* (A Manager of Head in Hand Waste Management, 2023)

Another commented that:

*“Some employees may end up spending all he has earned for a particular month on treatment due to an injury. The company will also spend on the employee in the case of a work-related injury.” (A Manager, Derrico Waste Management, 2023)*

This suggests that occupational-related injuries and illness can significantly affect the finances of the employee directly and indirectly. According to Eskezia et al. (2016), one of the most significant indirect costs of an occupational injury is the loss of income. If the injury prevents the employee from working, they may experience a reduction or complete cessation of their regular wages or salary. This can have a significant impact on their financial stability. Occupational injuries can have a profound psychological impact on employees. The injuries may cause them to feel stressed, anxious, depressed, or perhaps develop post-traumatic stress disorder (PTSD). The employee’s general quality of life and capacity to carry out everyday tasks may be impacted by these mental health impacts. The physical pain and suffering endured as a result of the injury can be significant. This can lead to a decreased quality of life and may require ongoing medical treatment, rehabilitation, or pain management. Severe occupational injuries may lead to temporary or permanent disabilities, which can significantly impact the employee’s ability to perform basic tasks, participate in recreational activities, or pursue future career opportunities (Abrha et al., 2021). Depending on the nature of the injury, employees may face challenges in finding new employment or may need to transition to a different career path. This can have longterm implications for their earning potential and job satisfaction.

The economic cost of occupational-related injuries among waste collectors is a significant concern. A study in Northern Ethiopia found that the main determinant factors for days away from work injuries among waste collectors were personal protective equipment (PPE) utilization and monthly

salary (Eskezia et al., 2016). Another study in the Amhara region of Northwest Ethiopia reported an annual prevalence of at least one occupational injury among solid waste workers to be 34.3% (ILO, 2012). The economic burden of hazardous working conditions for waste collectors was estimated to be about 1% of GDP in 2010 (Abrha et al., 2021). These findings highlight the importance of addressing occupational injuries among waste collectors to mitigate the economic costs associated with such incidents.

Furthermore, work-related injuries are the second-highest national healthcare cost aggregate, only surpassed by cardiovascular illness, at an estimated \$250 billion (Varacallo & Knoblauch, 2023).

## **CHAPTER FIVE**

### **5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS**

#### **5.1 Introduction**

This chapter presents the summary of the major findings of the study, the conclusions drawn from the findings, and some recommendations.

#### **5.2 Summary of Findings**

The study found that waste collectors are exposed to several hazards and health risks in the line of their duty. The results show that all 159(100.0%) of the waste collectors collect household waste, majority 130(81.8%) collect hazardous waste, most 92(57.9%) collect medical waste, majority 144(90.6%) of them collect electronic waste, majority 143(89.9%) collect green waste, majority 137(86.2%) collect scrap metals, most 91(57.2%) of them collect glass waste, majority 103(64.8%) collect paper and cardboard waste, and all 159(100.0%) of them collect plastic waste.

The study also found that 106(66.7%) of waste collectors feel their work environment is unsafe. Looking at the categories of waste collected daily by these waste collectors, it is obvious that they are exposed to many hazards that make their work environment unsafe for them. This means that

the employers are not providing workers with adequate training and education to identify and manage occupational hazards.

About 130(81.8%) of the waste collectors have ever encountered hazardous materials whilst collecting waste. It can be said that at almost every waste collection site, waste collectors encounter hazardous materials, except safety officers who may not visit waste collection centers. Of those who indicated that they have ever encountered hazardous materials whilst collecting waste, 63(53.1%) of them encountered biological, chemical and physical hazards.

The results also show that more males (67.0%) feel that the working environment is unsafe as compared with females (33.3%). Also, the role of the individual, their level of education, and working experience showed significant differences in how they perceive the safety of their working environment. Those employees who are safety officers or supervisors will feel safer than the waste collectors. One of the factors that make the waste collectors feel unsafe is the hazards they encounter in the work environment.

Majority 124(78.0%) of the waste collectors work with chemicals that are moderately poisonous. Majority of them are exposed to burns, fumes inhalation, smoke, and dust. Most of the waste collectors perform their duties bending and this posture at work causes pain.

Generally, compliance with hazard control measures among waste collectors is low. Most 66(41.5%) of the respondents indicated that gloves are available at their workplace. The results show that more than half 81(50.9%) of the waste collectors have been trained in the use of PPE. However, the majority of them do not use PPE always as they stated that they sometimes use personal protective equipment with few 28(17.6%) using the always. The reasons why they do not always follow safety procedures are that the safety equipment is uncomfortable and that safety procedures slow down the pace of work.

Gloves, safety glasses or goggles, and safety footwear are the safety equipment that are mostly used by waste collectors. About 122(76.7%) of the respondents use gloves regularly as compared with 37(23.3%) who do not use them regularly. Also, 129(81.1%) of them use safety glasses or goggles regularly as compared with 30(18.9%) who do not use them regularly.

The study further revealed that 43.4% of the waste collectors have ever sought medical treatment for health-related injuries and out of this, 47.8% of them seek medical treatment once a year. The average cost of medical treatment was GHC750 per year. The Chi-Square analysis also revealed significant difference in the age categories and the frequent use of PPEs ( $\chi^2 = 10.16$ , P-value = 0.003). Also, there was significant difference in PPEs use among gender ( $\chi^2 = 13.14$ , P-value = 0.014). Female workers use PPEs more frequently than male workers. Again, there are significant differences in the years of working experience and the frequent use of PPEs ( $\chi^2 = 8.087$ , P-value = 0.002). Those who have worked for more years do not use PPEs frequently as compared with those who have worked for less years.

### 5.3 Conclusion

The study concludes that waste collectors are exposed to several hazards and health risks in the line of their duty. Waste collectors mainly collect household waste, hazardous waste, medical waste, electronic waste, green waste, scrap metals, glass waste, paper and cardboard waste, and plastic waste. The environment of waste collectors in the Sunyani Municipality is unsafe, they are exposed to many hazards which make their work environment unsafe for them. Most of the waste collectors in the Sunyani Municipality have ever encountered biological, chemical, and physical hazards whilst collecting waste. There are statistically significant differences between age groups, sex, and the role of an employee and how they perceive the safety of their working environment. Waste collectors see the working to be unsafe whilst the safety officers and supervisors perceive

the working environment to be safe. Waste collectors are exposed to burns, fumes inhalation, smoke, and dust. Most of the waste collectors perform their duties bending and this posture at work causes musculoskeletal disorders among the waste collectors.

Waste management companies have several measures that they put in place to ensure the control of hazards among waste collectors. These include the provision of PPEs, educating waste collectors on safety procedure, and training and development programs.

Generally, compliance with hazard control measures among waste collectors is low. Protective equipment is available at their workplace. But this equipment is barely used by the waste collectors. The reasons why they do not always follow safety procedures are that the safety equipment is uncomfortable and that safety procedures slow down the pace of work. Gloves, safety glasses or goggles, and safety footwear are the safety equipment that are mostly used by waste collectors.

Female workers, older workers and those with less years of experience use PPE more frequently than their peers. For women, providing PPE designed for female body types is critical to improve comfort, fit, and safety, reducing the risk of accidents caused by ill-fitting gear.

Most of the waste collectors have ever sought medical treatment for health-related injuries at least once a year, and the average cost of medical treatment was GHC750. Those who earn more are mostly the supervisors and are not involved in more hazardous areas that are more likely to cause occupational injuries. It can be implied that other factors such as the degree and severity of the injury determine the cost of treatment.

## 5.4 Limitations of the Study

While this study aimed to provide valuable insights into the occupational hazards associated with solid waste collection in Sunyani Municipality, Ghana, it is important to acknowledge certain limitations that affected the research outcomes:

The researcher encountered limitations in resources, such as restricted financial support and temporal constraints, that impacted the size of the sample, the techniques employed for data collection, and the comprehensiveness of the analysis.

During the study period, the occupational hazards and safety practices in the waste collection sector influenced by various external factors, including but not limited to changing waste management regulations, economic fluctuations, and public health, crises constrained the capacity to establish causal relationships from the outcomes of the research.

## 5.5 Recommendations

Based on the findings, the following recommendations are made:

- In light of the level of exposure of waste collectors to occupational hazards, waste management companies should organise frequent medical screening for waste collectors so that health conditions among them can be detected early to avoid complications.
- Also, waste management companies should intensify health education among waste collectors on the hazards associated with their work and how to avoid risks associated with the hazards.
- To ensure that waste collectors comply with safety procedures, waste management companies should put in place strong and strict measures to ensure that waste collectors comply with the safety procedures that the company has put in place. This will compel

waste collectors to adhere to the procedures and get used to the wearing of personal protective equipment.

- Looking at the low income of the waste collectors and the cost of medical treatment, the waste management companies need to establish some funds to take care of the medical expenses of employees in times of work-related injuries.
- Future research should assess the prevalence of particular health conditions among waste collectors in the Sunyani Municipality.

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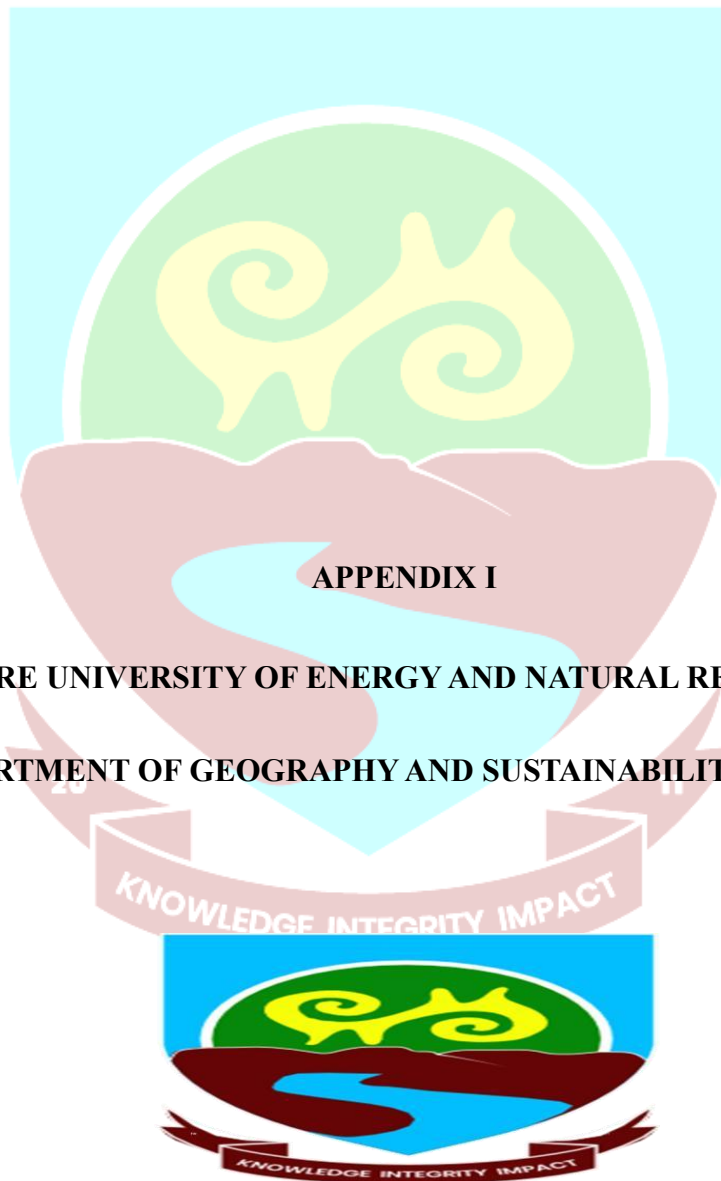
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**APPENDIX I**

**QUESTIONNAIRE UNIVERSITY OF ENERGY AND NATURAL RESOURCES, SUNYANI**

**DEPARTMENT OF GEOGRAPHY AND SUSTAINABILITY SCIENCE**

# OCCUPATIONAL HAZARDS ASSOCIATED WITH MUNICIPAL SOLID WASTE COLLECTION IN SUNYANI, GHANA

**Dear Participant,**

This is a study to understand the hazards and risks associated with waste collection, the control measures put in place, the level of compliance to these measures, and the economic cost of occupational-related diseases and Injuries among Waste Collectors

Your participation in this study is voluntary. If you choose to participate, please answer all questions as honestly as possible. Your responses will be kept confidential and will be used for research purposes only. The questionnaire should take approximately 10-15 minutes to complete.

Your input is very valuable to me and will help improve safety practices in waste collection. If you have any questions about the survey or our research, please feel free to ask.

Thank you for your time and cooperation.

Subject's Signature..... Date.....

Subject's Thumbprint (If the subject cannot write):

.....Date.....

## SECTION A: Socio-demographic Characteristics

1. Age:  Under 18     18-24 years     25-34 years     35-44 years     45-54 years     55 and above
2. Gender:  Male     Female
3. What is your role within the waste management company?  Waste collector     Safety officer     Other (please specify).....
4. Education:  Primary     Secondary     Tertiary     No formal education
5. Marital Status:  Single     Married
6. Religion:  Christianity     Islam     Traditional African Religion

Other (Please specify).....

- 7. Income (GHS) per month): .....
- 8. Number of Dependents:  None     1 – 2     3 – 4     5 or more
- 9. Employment Status:  Full-time     Part-time     Temporary     Casual
- 10. Number of Years of Work Experience:  Less than 1 year     1 - 5 years     6 - 10 years     11 - 15 years     More than 15 years

**SECTION B: Occupational Hazards and Risks Associated with Waste Collection**

1. What type of waste do you handle? (tick as many as applicable)

Waste	Tick (✓)
Household waste (e.g., food scraps, packaging)	
Industrial waste (e.g., manufacturing byproducts)	
Hazardous waste (e.g., chemicals, batteries)	
Medical waste (e.g., used syringes, bandages)	
Electronic waste (e.g., old computers, mobile phones)	
Construction and demolition waste (e.g., concrete, wood)	
Green waste (e.g., leaves, grass clippings)	
Scrap metal	
Glass waste	
Paper and cardboard waste	
Plastic waste	

- 2. How safe is your work environment?  Very safe     Safe     Unsafe
- 3. Have you encountered any hazardous materials while collecting waste?  Yes     No
- 4. Which of the following types of hazardous materials have you encountered while collecting waste? (Select all that apply):  Biological hazards     Chemical hazards     Physical hazards     Radiological hazards
- 5. How would you rate the overall severity of the hazards you face in your work?  Very severe     Severe     Moderate     Mild     Not severe at all

6. How often do you encounter these hazards?  Always  Often  Sometimes  Rarely  Never
7. Have you or any colleagues suffered injuries or health issues due to these hazards?  Yes  No
8. Are there safety measures currently in place to protect you from these hazards?  Yes  No
9. Do you feel these safety measures adequately address the hazards?  Yes  No

**Health hazards**

10. Do you have break periods for lunch?  Yes  No
11. If yes, how many hours of break do you observe?  Below 15 mins  Between 15 and 30 mins  Between 30 and 45 mins.  Between 45 and 1 hour
12. Where do you have your lunch? .....
13. Do you wash your hands before eating?  Yes  No
14. Do you observe public holidays?  Yes  No
15. What kind of health hazards are you exposed to?
16. How many hours of sleep do you observe daily? .....

**Physical Hazards**

- Noise: 16. Are you exposed to noise?  Yes  No
17. If yes, what is the source of the noise?  Machines/vehicles  Striking of metals  Others (please specify).....
18. Is the noise at your workplace  Very loud  Loud  Moderate  Low
19. How many hours are you exposed to this type of noise? ..... 20. Does the noise affect your hearing?  Yes  No

**Chemical Hazards**

21. What type of chemicals do you use?  
.....  
.....
22. In your opinion, are these chemicals poisonous?

23. If yes, how do you know the chemicals are poisonous?

.....

24. Please do you read labels on chemicals before use?  Yes  No 25. Are you

exposed to i. burns  Yes  No ii. Fumes inhalation? [  
] Yes [] No

iii. Smoke?  Yes  No

iv. Dust?  Yes  No

v. Fire?  Yes  No

26. In what way are you exposed

i. burns: ..... ii.

Fumes/Smoke: .....

iii. Dust: .....

iv Fire: .....

**Ergonomic Hazards**

27. What is your usual posture at work?  Standing  Bending  Sitting  Squatting

28. Is your posture comfortable?  Yes  No

29. Does your posture cause any pain in the body?  Yes  No

30. If yes, which part of your body is affected?

.....

.....

**Psycho-Social Hazards**

31. Are you satisfied with your work?  Yes  No

32. If No, why?.....

33. How safe is your work environment?  Very safe  Safe  Unsafe

34. Please explain your response:

.....

.....

.....

### SECTION C: Level of Compliance with Hazard Control Measures by Waste Collectors

1. Which of the following Personal Protective Equipment do you have at your workplace?

Goggles                       Nose mask                       Gloves                       Safety Boots                        
Ear Protectors                       Safety overcoat                       Masks                       Others (Please specify)

2. Who provides the Personal Protective Equipment?  Employer                       Self                     

Government                       Others (*Please specify*).....

3. Are you trained in the use of Personal Protective Equipment?  Yes                       No

4. Do you think the protective devices are enough?  Yes                       No

5. Do you use Personal Protective Equipment?  Yes                       No

6. If No, why?

.....  
.....

7. If yes, how often do you use the provided safety equipment or follow safety procedures?

Always                       Often                       Sometimes                       Rarely                       N/A

8. If you do not always use the provided safety equipment or follow safety procedures, why not?

(Select all that apply)

- The safety equipment is uncomfortable or hard to use
- The safety procedures slow down my work
- I don't believe the hazards are very serious
- I don't have access to all necessary safety equipment
- I haven't been trained in all safety procedures
- Other (please specify)

9. Which of the following types of safety equipment do you use regularly? (Select all that apply)

- Gloves
- Safety glasses or goggles
- High visibility clothing
- Respiratory protection
- Protective footwear

Other (please specify)

10. Are there safety procedures that you find difficult to follow or understand?  Yes  No

11. If Yes, please specify.....

**SECTION D: Economic Cost of Occupational-Related Diseases and Injuries among Waste Collectors**

1. Have you ever been injured on the job?  Yes  No
2. Do you believe that better compliance with safety measures could reduce the occurrence of injuries or health issues?  Yes  No
3. Have you experienced any health issues that you believe are related to your job?  Yes  No
4. If yes, have these health issues affected your ability to work?  Significantly  Somewhat  Not at all
5. In the past 12 months, how many workdays have you missed due to work-related health issues or injuries?  None  1-5 days  6-10 days  More than 10 days
6. Do you believe that these health issues or injuries could have been prevented with better safety measures or compliance?  Yes  No
7. Do you feel that your work environment prioritizes your health and safety?  Yes, definitely  Somewhat  Not really  Not at all
8. Have you ever had to seek medical treatment due to an injury or illness related to your work?  Yes  No
9. If yes, how often in the past year have you sought medical treatment for work-related injuries or illnesses?  Once  2-3 times  4-5 times  More than 5 times
10. Approximately how much have you spent on medical treatment for work-related injuries or illnesses in the past year? (GHS). Please indicate all in the table below:

<b>Injury</b>	<b>Medical Costs</b>	<b>Transportation/ Nonmedical Costs</b>



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Subject's Signature..... Date.....

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## SECTION A: Socio-demographic Characteristics

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12. Gender: Male [ ] Female [ ]

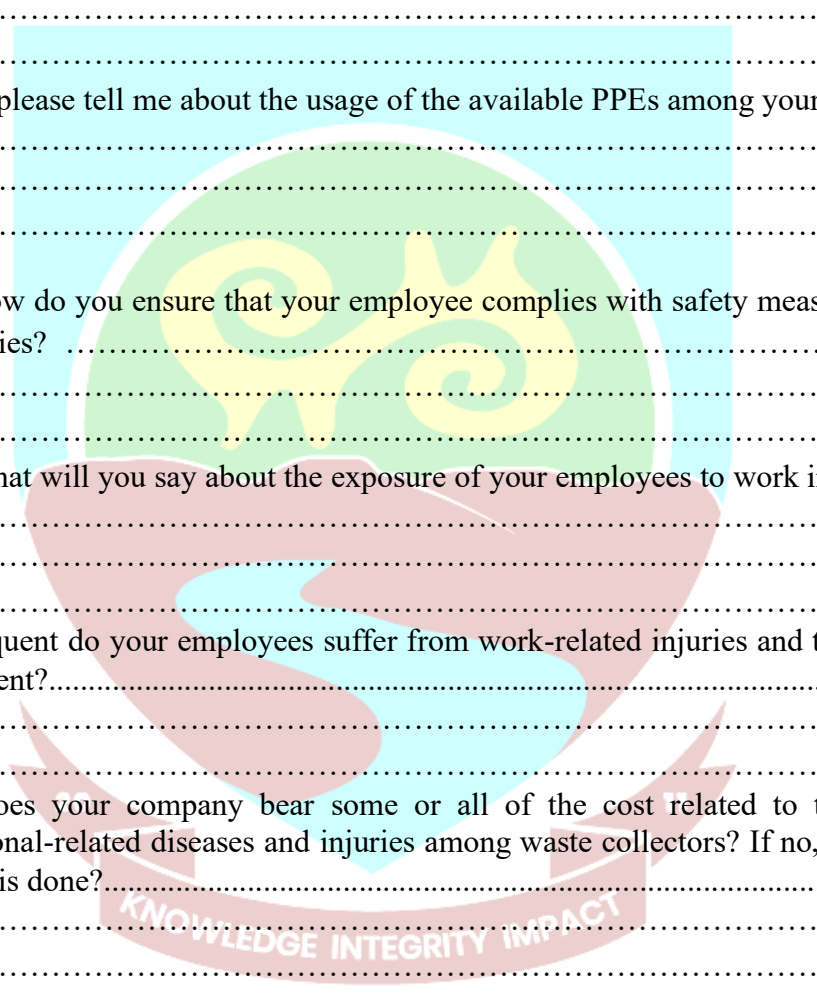
13. What is your role within the waste management company?.....

14. Education: Primary [ ] Secondary [ ] Vocational/Technical [ ] Undergraduate [ ]

Postgraduate [ ] Other (Please specify).....

**SECTION B: Occupation health and safety hazards, level of compliance, and the economic cost of hazards**

1. Please what do you do to reduce occupational Hazards and Risks Associated with Waste Collection?.....  
.....  
.....
2. Please what will you say about the provision of PPEs for your employees?  
.....  
.....
3. Can you please tell me about the usage of the available PPEs among your employees? ...  
.....  
.....
4. Please how do you ensure that your employee complies with safety measures in line with their duties? .....  
.....  
.....
5. Please what will you say about the exposure of your employees to work injuries? ...  
.....  
.....
6. How frequent do your employees suffer from work-related injuries and the cost involved in treatment?.....  
.....  
.....
7. Please does your company bear some or all of the cost related to the treatment of occupational-related diseases and injuries among waste collectors? If no, why, and if yes, how is this done?.....  
.....  
.....



THANK YOU



## PICTURES FROM DUMP SITES



Plate 1: A road leading to a dump site at Sunyani



Plate 2: Dusty road during dry seasons Baakoniaba



Plate 3: Smoke from a dump site behind Adomako (GETFUND ROAD)

.....  
.....

