**PRESBYTERIAN UNIVERSITY COLLEGE, GHANA**

**FACULTY OF DEVELOPMENT STUDIES**

**DEPARTMENT OF ENVIRONMENTAL AND NATURAL RESOURCES MANAGEMENT**

# INDISCRIMINATE DISPOSAL OF WASTE IN AMAMOMA

**BY**

**GIDEON BLEUSI SOGBEY**

**SEPTEMBER 2019**

PRESBYTERIAN UNIVERSITY COLLEGE, GHANA

FACULTY OF DEVELOPMENT STUDIES

DEPARTMENT OF ENVIRONMENTAL AND NATURAL RESOURCES MANAGEMENT

# INDISCRIMINATE DISPOSAL OF WASTE IN AMAMOMA

A project work Dissertation submitted to the Department of Environmental and Natural Resources of the faculty of Development Studies, Presbyterian University College, Ghana in partial fulfillment of the requirements for the award of Master of Science degree in Environmental Health and Sanitation

BY

GIDEON BLEUSI SOGBEY

SEPTEMBER 2019

# DECLARATION

## Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this University or elsewhere.

Candidate's Signature…….Date……

Name: …….

## Supervisor's Declaration

I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of dissertation laid down by the Presbyterian University College, Ghana.

Supervisor's Signature……Date……...

Name: ……

## ABSTRACT

Waste generation is an integral aspect of human existence that is unavoidable. It is a product of resource use process that has the capacity of abusing the environment and constitute a threat to public health if not well managed. Therefore, waste generated through human activities needs to be properly managed through concrete efforts to maintain a healthy and sustainable environment. The volume of solid waste generated does not measure the degree to which the environment will be polluted. Thus, if the waste can be evacuated and disposed of satisfactorily, and as fast as it is generated, there would be no accumulation and hence no abuse or pollution of the environment. It is when evacuation perpetually lags behind the rate of generation that solid waste becomes an environmental nuisance. This study assesses the effect of indiscriminate solid waste disposal and environmental issues associated with the management of solid waste in Amamoma community, a suburb of Cape Coast Metropolitan Assembly. Primary data were used for the study. Primary data were acquired through structured questionnaires administered to a sample of 91 respondents which was randomly selected from the study area. The major environmental issues resulting from improper disposal and poor management of solid waste in Amamoma are physical nuisance of the waste to the environment, harbourage of rodents and vermin, breeding of houseflies and other vectors. Therefore, this paper recommends that a strong legislation with severe penalty be put in place and there should be a continuous public enlightenment/education on the danger of indiscriminate waste to the general public. It is also recommended that available market be created for these waste that can be recycled.

## ACKNOWLEDGEMENTS

I wish to thank the Almighty God for his care, blessings and grace that has enabled me to get this far.

I now wish to acknowledge the tremendous contributions that various institutions and individuals have rendered in order to make this academic dream a reality.

I acknowledge the Management of Presbyterian University College, Department of Environmental and Natural Resources Management for rendering me this opportunity to pursue a Degree of Masters in Environmental Health and Sanitation. I pray the team spirit exhibited last forever. I appreciate the entire Management and staff of Zoomlion Ghana Limited for their support and encourage to during my studies.

Special thanks to my supervisor, Mrs. Doris Fiasogbor, for the patience, guidance, support, encouragement and inspiration that I got from her during my research and the preparation of this report.

I wish to highly extend my appreciation to my wife Mrs. Rebecca Amonoo-Sogbey, my kids Giovanni Klenam Sogbey and Ellissa Seyram Sogbey for their firm support, tolerance and encouragement that heightened my working optimism. To my mother Mrs. Rose Sogbey, my lovely Brothers and sisters for encouragement and prayers.

The interaction with my course mates in the 2018-2019 class were also a good recipe for academic prosperity and excellence.

I salute all the institutions and individuals that I may have omitted. Thank you all!!!

## DEDICATION

This project is dedicated to the Executive Chairman of Jospong Group of Companies, Dr. Joseph Siaw Agyepong, who has been of a great encouragement during the period of study. Through his support, encouragement and facilitation I gathered the momentum that drove my mind to pursue this course.

# TABLE OF CONTENTS

DECLARATION ii

ABSTRACT iii

ACKNOWLEDGEMENTS iv

DEDICATION v

CHAPTER ONE

INTRODUCTION 1

1.1 Background of study 1

1.2 Statement of Problem 2

1.3 Research Questions 2

1.4 Main and Specific Objectives 3

1.5 Significance of the study 3

1.6 Scope and limitations of the study 4

CHAPTER TWO

REVIEW OF RELATED LITERATURE 5

2.0 Introduction 5

2.1 History of waste management 5-7

2.2 Waste 8

2.3 Solid waste 9

2.3.1 Municipal Wastes 9

2.3.2 Industrial Wastes 10

2.3.3Hazardous Wastes 10

2.4 Goals of an effective solid waste management system 10-11

2.5 fundamental principles of waste management 12

2.6 Functional elements of a waste management system: 12

2.7. 1 Solid waste generation 13

2.7.2 Storage and Processing 14

2.7.3 Collection 14

2.7.4 Transfer and Transport 15

2.7.5 Processing and Recovery 15

2.7.6 Disposal 15-16

2.7.8 Solid-waste treatment and disposal 17

2.7.9 Incineration 17

2.8 Composting 18-19

2.8.1 Sanitary landfill 20

2.8.2 Recycling 20-21

2.8.3 Problems of managing solid waste 22

2.8.4 Technical constraints 22

2.8.5 Financial constraints 22

2.8.6 Institutional constraints 23

2.8.7 Impacts of solid waste on human health and environment (animals and aquatics life) 23-24

2.8.8 Solid waste management in Ghana 25

2.8.9 Solid waste generation 25

2.9 Solid waste collection 26

2.9.1 Solid waste disposal 27

2.9.2 Problems of waste management 28

2.9.3 Sustainable Development Goals and Solid Waste Management 29

2.9.4 Highlight of the 17 Sustainable Development Goals 30

2.9.5 SDGs in the Context of Waste Management 31-34

CHAPTER THREE

RESEARCH METHODOLOGY 35

3.1 Study Area 35

3.2 Research Design 36

3.3 Study Population 37

3.4 Sampling Procedure 37

3.5 Data Collection Techniques and Tools 37

3.6 Data / Analysis 38

3.7 Ethical Consideration 38

3.8 Assumptions 39

CHAPTER FOUR

RESULTS AND DISCUSSION 40

4.0 Introduction 40

4.1 Social characteristics of respondents 40-41

4.2 Waste Management 42

4.3 Waste Generation: 43

4.4 Types of waste Product generated 43-44

4.5 Waste Disposal Method 45-47

4.7 Willingness to pay for refuse Management 48

4.8 Distance to dump site 49-50

4.9 Management of waste 51-58

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION 59

5.1 Introduction 59

5.2 Overview of the Study 59

5.3 Summary of findings 60-61

5.4 Conclusion 62

5.5 Recommendation 62-64

REFERENCES 65

APPENDIX 68

# LIST OF TABLES

Table 2.1: Methods of Waste Disposal showing merits and demerits 16

Table 2.2: SDGs and goal explanation/relevance 30

Table 4.1: Socio demographic data of respondents 41

Table 2: Generation of Solid waste 43

Table 4.3: reasons for using the various waste disposal methods 47

Table 4.4: Average charges for waste disposal 49

Table 4.5: time spent to get to skip/ Bin 50

Table 4.6: Waste management Company responsible for collecting waste for disposal 51

Table 4.7: Reasons for Indiscriminate Waste Disposal 56

Table 4.8: Types of sickness residents normally suffered from. 58

Table 4.9: Effects of improper waste disposal on the environment 58

## LIST OF FIGURES

Figure 1: types of waste generated 44

Figure 2: place of waste disposal 46

Figure 3: Do you pay for dumping waste? 47

Figure 4: Reasons for refusal to pay for waste services 48

Figure 5: convenient time to dump waste 51

Figure 6: waste collection frequency 52

Figure 7: linkages between indiscriminate waste disposal and health 55

Figure 9: Health Status of Respondents 57

# CHAPTER ONE

# INTRODUCTION

## 1.1 Background of study

Solid waste management is in crisis in many cities globally because of population growth and expansion. Increase in population due to rural-urban migration and under development of rural areas contributes immensely to urbanization. Solid waste is wastes generated from the daily activities of man and animal that requires being disposed of. The rate of indiscriminate dumping of refuse in an urban environment is an eyesore to sustainable city development. It has effects on the environmental quality and negative effects on the health status of inhabitants. Improper disposal and management of solid waste result into various types of pollution that contaminate the urban landscape (Alam & Ahmade, 2013; Mbu, 2015). This can be attributed to high population and demand for food, shelter and other commodities used daily by different household.

As the global population progresses towards 8.5 billion by 2030, the amount of urban solid waste is budding even faster than the rate of urbanization (World Bank, 2012). Ten years ago there were 2.9 billion global urban residents who generated about 0.64 kg of municipal solid waste per person per day (0.68 billion tonnes per year). With an exponential global urban population explosion, these amounts have increased to about 3 billion urban residents globally, generating 1.2 kg per person per day (1.3 billion tonnes per year). An increasing population, changing consumption patterns, economic development, improving household incomes, growing urbanization and industrialization have resulted in increased urban waste-generation. In Ghana, solid waste is a precursor to several environmental and health challenges, ranging from clogged drainage and sewers, waterborne diseases like typhoid, cholera and diarrhea, increased upper respiratory diseases from open burning of

the garbage, to malaria. Waste management has over time been the first-instance responsibility of local authorities but the scenario is changing with the realization that they, on their own, are not capable of effectively and efficiently managing waste.

## 1.2 Statement of Problem

The Problem of Indiscriminate dumping of Solid Waste in the world at large has become extremely large and a dangerous issues in the society.

The situation in Amamoma is a sorry sight to bear. Indiscriminate dumping of Solid Waste is can be found in all environments. Its consequences cannot be over emphasized. Open space, Major Street, Land, abandoned buildings and waterways have been converted into refuse dumps sites by dwellers. These activities have lead to environmental degradation, air pollution, land pollution and harmful environment. Those who live close to area where dump sites are located suffer as a result of these problems.

From the aforementioned above, this study aimed at assessing the effect of indiscriminate solid waste disposal in Amamoma and make necessary recommendations on waste disposal and management practices to prevent further deterioration of the environment and the negative effects on the human population in Amamoma

## 1.3 Research Questions

1. What methods of solid waste management are in practice within Amamoma Community?
2. What factors contribute to crude solid domestic waste management?
3. What are the consequences of improper solid domestic waste management?

4. What suggestions could be offered to improve upon solid domestic waste management within the Amamoma Community?

## 1.4 Main and Specific Objectives

***Main Objective***

The aim of this study is to examine the factors contributing to indiscriminate disposal of waste in Amamoma and suggest possible measures to tackle the problem**.**

**Specific Objectives**

1. To assess methods of solid waste management that is in practice within Amamoma Community.
2. To assess factors contributing to crude solid waste management.
3. To analyze the effects of indiscriminate waste disposal in amamoma
4. To make recommendations for effective management of solid waste in Amamoma

## 1.5 Significance of the study

The study would provide assess into the effect of indiscriminate waste disposal Amamoma. The study would present a comprehensive assessment of the methods of solid domestic waste management in the Amamoma and appropriate recommendations for improving solid domestic waste management in the metropolis could be made. The relevance of the appropriate recommendations and suggestions made in the research to the various officers of health and stakeholders will stimulate and encourage the policy makers at the Metropolitan and Regional levels to formulate comprehensive strategies to improve upon the current improper solid domestic waste management in the metropolis and beyond.

The findings would also serve as a baseline information on which policy makers can resort in designing course of action or inaction to improve solid waste management. The study would serve as a literature to future researchers, organizations and governments who might take up similar projects.

### 1.6 Scope and limitations of the study

Geographically, the research will cover Amamoma community in the Cape Coast Metropolis in the Central Region of Ghana.

**Scope:**

The study is focused on the effects of indiscriminate disposal of waste on the environment and the health of people in Amamoma. This will include looking at the processes of waste disposal, the effect on the environment as well as the people and suggestions in addressing and improving of solid waste management related issues in the community.

# CHAPTER TWO

# REVIEW OF RELATED LITERATURE

## 2.0 Introduction

This chapter provides review of literature on solid waste management. It looks at the key concepts, processes and problems of waste management. It also focuses on the impact of improper solid waste management on the environment as well as human health. This chapter gives a better understanding of solid waste management.

## 2.1 History of waste management

In ancient cities, wastes were thrown onto unpaved streets and roadways, where they were left to accumulate. It was not until 320 BCE in Athens that the first known law forbidding this practice was established. At that time a system for waste removal began to evolve in Greece and in the Greek-dominated cities of the eastern Mediterranean. In ancient Rome, property owners were responsible for cleaning the streets fronting their property. But organized waste collection was associated only with state-sponsored events such as parades. Disposal methods were very crude, involving open pits located just outside the city walls. As populations increased, efforts were made to transport waste farther out from the cities. (Nathanson, 2014).

After the fall of Rome, waste collection and municipal sanitation began a decline that lasted throughout the middle Ages. Near the end of the 14th century, scavengers were given the task of carting waste to dumps outside city walls. But this was not the case in smaller towns, where most people still threw waste into the streets. It was not until 1714 that every city in England was required to have an official scavenger. Toward the end of the 18th century in America, municipal collection of garbage begun in Boston, New York

City, and Philadelphia. Waste disposal methods were still very crude, however. Garbage collected in Philadelphia, for example, was simply dumped into the Delaware River downstream from the city. (Nathanson, 2014).

A technological approach to solid-waste management began to develop in the latter part of the 19th century. Watertight garbage cans were first introduced in the United States, and sturdier vehicles were used to collect and transport wastes. A significant development in solid-waste treatment and disposal practices was marked by the construction of the first refuse incinerator in England in 1874. By the beginning of the 20th century, 15 percent of major American cities were incinerating solid waste. Even then, however, most of the largest cities were still using primitive disposal methods such as open dumping on land or in water. (Nathanson, 2014).

Technological advances continued during the first half of the 20th century, including the development of garbage grinders, compaction trucks, and pneumatic collection systems. By mid- century, however, it had become evident that open dumping and improper incineration of solid waste were causing problems of pollution and jeopardizing public health. As a result, sanitary landfills were developed to replace the practice of open dumping and to reduce the reliance on waste incineration. In many countries waste was divided into two categories, hazardous and nonhazardous, and separate regulations were developed for their disposal. Landfills were designed and operated in a manner that minimized risks to public health and the environment. New refuse incinerators were designed to recover heat energy from the waste and were provided with extensive air pollution control devices to satisfy stringent standards of air quality. Modern solid-waste management plants in most developed countries now emphasize the practice of

recycling and waste reduction at the source rather than incineration and land disposal.(Nathanson, 2014).

In Europe, currently 16 tonnes of material per person per year is used, of which 6 tonnes become waste. Although the management of that waste continues to improve in the EU, the European economy currently still loses a significant amount of potential 'secondary raw materials' such as metals, wood, glass, paper, plastics present waste streams. In 2010, total waste production in the EU amounted to 2.5 billion tons. From this total only a limited (albeit increasing) share (36%) was recycled, with the rest was landfilled or burned, of which some 600 million tons could be recycled or reused. (Malinauskaite, 2017)

Just in terms of household waste alone, each person in Europe is currently producing, on average, half a tonne of such waste. Only 40 % of it is reused or recycled and in some countries more than 80% still goes to the landfill (Environmental Data Centre on Waste, Eurostat 2018).

Turning waste into a resource is one key to a circular economy. The objectives and targets set in European legislation have been key drivers to improve waste management, stimulate innovation in recycling, limit the use of landfilling, and create incentives to change consumer behaviour. If we re-manufacture, reuse and recycle, and if one industry's waste becomes another's raw material, we can move to a more circular economy where waste is eliminated and resources are used in an efficient and sustainable way. (Waste reduction on recycling forum press release 2016).

Improved waste management also helps to reduce health and environmental problems, reduce greenhouse gas emissions (directly by cutting emissions from landfills and indirectly by recycling materials which would otherwise be extracted and processed), and avoid negative impacts at local level such as landscape deterioration due to landfilling,

local water and air pollution, as well as littering. landfill (Environmental Data Centre on Waste, Eurostat 2018).

The European Union's approach to waste management is based on the "waste hierarchy" which sets the following priority order when shaping waste policy and managing waste at the operational level: prevention, (preparing for) reuse, recycling, recovery and, as the least preferred option, disposal (which includes landfilling and incineration without energy recovery). Landfill (Environmental Data Centre on Waste, Eurostat 2018).

In line with this, the 7th Environment Action Programme sets the following priority objectives for waste policy in the EU:

- To reduce the amount of waste generated;
- To maximize recycling and re-use;
- To limit incineration to non-recyclable materials;
- To phase out landfilling to non-recyclable and non-recoverable waste;
- To ensure full implementation of the waste policy targets in all member states.

**2.2 Waste**

Waste is the useless, unwanted and discarded material resulting from day to day activities in the community (Ashish R. Mishra 2012, cited in International journal of research in Advent Technology 2014)

The Resource Conservation and Recovery Act (1976) of USA defines solid waste as “any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility, and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities”.

Generally waste is considered to be something which poses a significantly different threat to human health or environment, partly because of the manner in which it may be disposed of and partly because the holder no longer has the same sense of obligation in relation to it. Waste therefore, is something which falls out of the normal commercial circle or utility. It is any substance which constitutes a scrap material, an effluent or other unwanted surplus substance arising from the application of any process. It includes all those solid and semisolid materials which are thrown away by a community (Garg and Garg, 2013).

## 2.3 Solid waste

Solid wastes are the wastes arising from human and animal activities that are normally solid and are discarded as useless or unwanted. The management of these waste materials is the fundamental concern of the activities encompassed in solid waste management (Khitoliya, 2014). According to Santra (2013), Solid waste management (SWM) may be seen as the control of generation, storage, collection, transfer and transport, processing and disposal of solid wastes in a manner that is in accordance with the best principles of public health, economics, engineering, conservation, aesthetics, and other environmental considerations, and that is also responsive to public attitudes.

This classification is based on source, physical and chemical composition of solid wastes. These are:

### 2.3.1 Municipal Wastes

The main components of municipal waste are food wastes, rubbish, ashes and residues, demolition and construction wastes, special wastes and treatment plant wastes. Wastes such as street sweepings, roadside litter, catch basin debris, dead animals and abandoned

vehicles are classified as special wastes. The solid and semi-solid wastes from water, waste water and industrial waste treatment facilities are included in treatment plant wastes.

### 2.3.2 Industrial Wastes

Industrial wastes are those wastes arising from industrial activities.

### 2.3.3 Hazardous Wastes

These are wastes that pose a substantial danger immediately or over a period of time to human, plant or animal life. A waste is classified as hazardous if it exhibits any of the following characteristics: ignitability, corrosivity, reactivity and toxicity (Khitoliya, 2014).

## 2.4 Goals of an effective solid waste management system

The primary objective of solid waste management is to remove discarded materials from inhabited places in a timely manner to prevent the spread of diseases, to minimize the likelihood of fires, and to reduce aesthetic assaults arising from putrefying organic matter. The goals of SWM can be summarized as follows:

-To protect environmental health through reduction of pollution, aesthetic insult to the environment, contamination of surface and ground water.

-To promote the quality of the urban environment.

-To support the efficiency and productivity of the economy.

-To generate employment and income.

- To ameliorate the effect of climate change by significantly reducing the emission of greenhouse gases (Mbina and Edem, 2015).

To achieve these goals, it is necessary to establish sustainable system of SWM. The principles of sustainable waste management strategies are to:

- Minimize waste generation.

- Maximize waste recycling and reuse.
- Ensure a safe and environmentally sound disposal of waste.

| SOURCE | TYPICAL LOCATION | TYPES OF SOLID |
|---|---|---|
| **Residential** | Single-family and multifamily dwellings, low-medium, and high-rise apartments. | **Food wastes, rubbish, ashes, special wastes** |
| **Commercial/Municipal** | Stores, restaurants, markets, office buildings, hotels, motels, print shops, auto repair shops, medical facilities and institutions | **Food wastes, rubbish, ashes, demolition and construction** |
| **Industrial** | Construction, fabrication, light and heavy manufacturing, refineries, chemical plants, lumbering, mining, Demolition | **Food wastes, rubbish, ashes, demolition and construction wastes, special wastes, occasionally hazardous wastes** |
| **Open areas** | Streets, alleys, parks, vacant plots, playgrounds, beaches, highway and recreational areas. | **Special wastes, rubbish** |
| **Treatment plant site** | Water, wastes water, and industrial treatment processes. | **Treatment plant wastes, principally composed of residual sludge** |
| **Agricultural** | **Field and row crops,** | **Spoiled food wastes,** |

Source: Tchobanoglous et al 1993 p.52-53.

## 2.5 fundamental principles of waste management

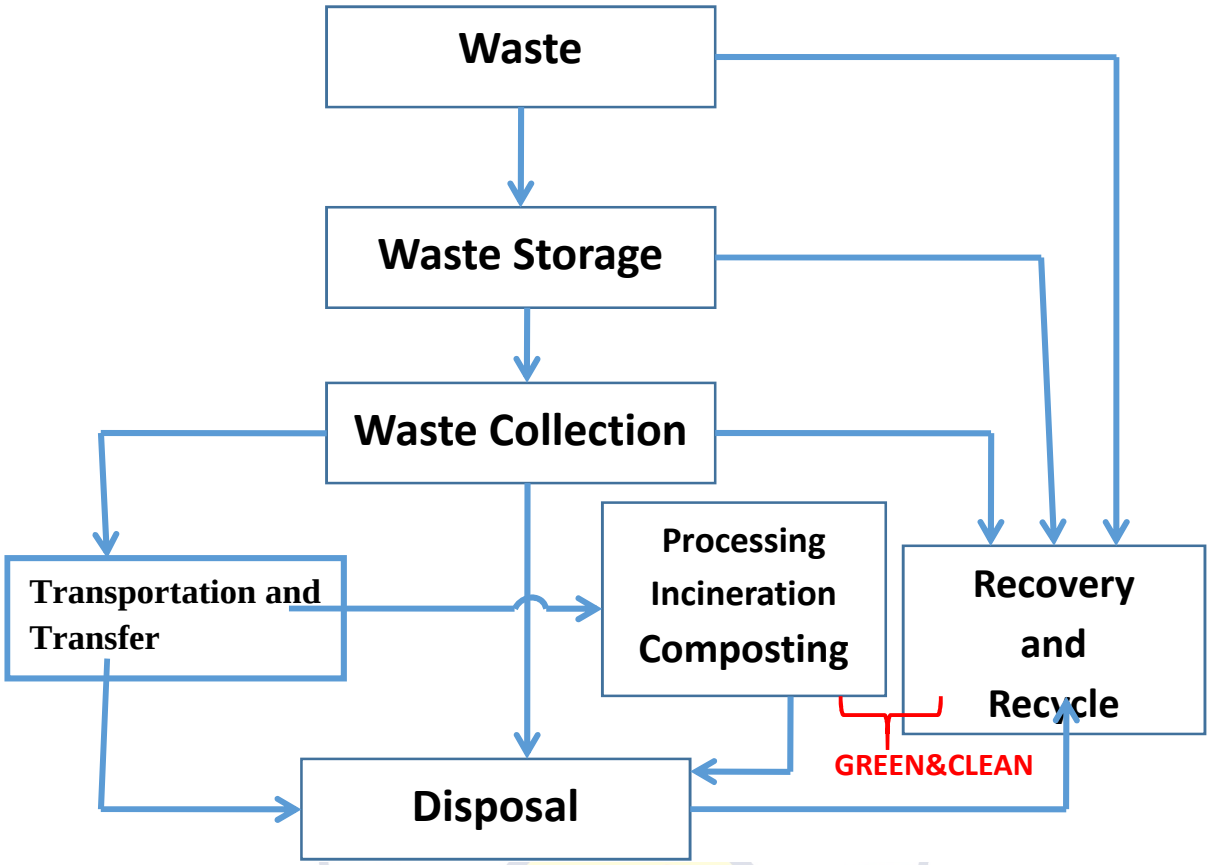
According to R. Khitoliya,2015. The fundamental principle of waste management is encapsulated in 3R, i.e. reduction, recovery, and recycling. Source reduction of waste can serve several purposes. These may include product reuse, toxicity reduction, increased product life time, decreased consumption and reduced materials volume use. Recycling is perhaps the most widely recognized form of source reduction involving the process of separating, collecting, processing, marketing and ultimately using a material that would have otherwise been discarded. Recovery entails the diversion of materials that would have been sent to the waste stream back into continuous usage.

## 2.6 Functional elements of a waste management system:

Waste management system activities are grouped into six functional elements:

1. Waste generation.
2. On-site handling, storage and processing.
3. Collection.
4. Transfer and transport.
5. Processing and recovery.
6. Disposal.

The interrelationship between these functional elements is as shown below




Typical Solid Waste Management System: Functional Elements Source: Santra, (2013)

**2.7. 1 Solid waste generation**

Generation of solid waste is the stage at which materials become valueless to the original owner and since they have no use for them and require them no longer, they wish to get rid of them either by throwing away or gathering them together for disposal. Solid wastes include all solid or semisolid material that has no longer considered of sufficient value to be retained. Items which may be valueless to one individual may not necessarily be valueless to another. The quantity and general composition of the waste material that is generated is of critical importance in the design and operation of solid waste management. According to Khitoliya (2015), the quantity and general composition of waste material that

is generated is of critical importance in the design and operation of solid waste management systems.

### 2.7.2 Storage and Processing

Storage is a system for keeping materials after they have been discarded prior to collection and final disposal. These activities are associated with the handling, storage and processing of solid waste at the point of generation. Handling refers to the activities associated with the handling of solid wastes until they are placed in the containers used for their storage before collection. It may involve moving loaded containers to the collection point and returning the empty containers to the point where they are stored between collections. Processing methods involve recovering usable materials from solid wastes, to reduce its volume or to alter its physical form. The factors that must be considered in the on-site storage of solid wastes include: the type of container to be used, the container location, public health and aesthetics and collection methods to be used.

### 2.7.3 Collection

This includes activities concerned with the collection of solid wastes at specific locations. Collection involves the logistical organization to guarantee that bin containers will not overfill for the spillage of wastes. The correct bin container size and service frequency is a must to prevent overspill or excessive smell. According to Khitoliya (2015), there are two types of collection systems based on their mode of operation. These are: hauled-container systems and stationary-container system.

In hauled-container system, the containers used for the storage of wastes are hauled to the processing, transfer or disposal site. The containers are emptied and returned to either their original location or some other location. In stationary-container system, the containers used

for the storage of wastes remain at the point of waste generation, except when moved for collection. Collection vehicles empty these containers when full.

### 2.7.4 Transfer and Transport

These activities involve the transfer of wastes from the collection points to the vehicles and then transport of wastes to the disposal sites. Health and environmental safety are taken into consideration during the transportation of solid waste. Motor vehicles used to transport solid wastes on highways should satisfy the following requirements: the vehicles must transport wastes at minimum cost; waste must be covered during the haul operation; vehicles must be designed for highway traffic; vehicle capacity must be such that allowable weight limits are not exceeded; methods used for unloading must be simple and dependable (Khitoliya, 2015).

### 2.7.5 Processing and Recovery

This involves methods and facilities that are used to recover the wastes for recycling and other treatments, to reduce volume or to alter physical form of waste. The most common on-site processing operations include manual sorting, compaction and incineration.

### 2.7.6 Disposal

The final step is the disposal of solid wastes to a landfill site. Solid wastes are mostly generated in the urban areas and hence, solid waste disposal is primarily an urban problem. Huge amounts of wastes are produced by different activities, which need to be properly handled.

**Table 2.1: Methods of Waste Disposal showing merits and demerits**

| Method of Disposal | Merits | Demerits |
|---|---|---|
| 1. Landfill | Easy operation; useful resources recovered; very reduced pollution; easy reclamation of low-lying areas. | Require large area; chances of water contamination if not properly constructed; high initial cost |
| 2. Open land dumping | Easy to operate; easy for segregation by rag pickers; low cost | Environmental pollution risk is high; large area required; risk of disease outbreak; contributes high GHG |
| 3. Burning/Incineration | Operation is easy; reduced waste volume; energy recovery-steam used to drive turbine to generate electricity or directly used for heating | Air pollution problem |
| 4. Processing & bioconversion into compost/biogas/biomethanol | High useful ecofriendly process; drives green economy | High initial cost |

Source: Santra (2013)

### 2.7.8 Solid-waste treatment and disposal

Once collected, municipal solid waste may be treated in order to reduce the total volume and weight of material that requires final disposal. Treatment changes the form of the waste and makes it easier to handle. It can also serve to recover certain materials, as well as heat energy, for recycling or reuse (Nathanson, 2014).

### 2.7.9 Incineration

Burning is a very effective method of reducing the volume and weight of solid waste. In modern incinerators the waste is burned inside a properly designed furnace under very carefully controlled conditions. The combustible portion of the waste combines with oxygen, releasing mostly carbon dioxide, water vapour, and heat. Incineration can reduce the volume of uncompacted waste by more than 90 percent, leaving an inert residue of ash, glass, metal, and other solid materials called bottom ash. The gaseous by-products of incomplete combustion, along with finely divided particulate material called fly ash, are carried along in the incinerator airstream. Fly ash includes cinders, dust, and soot. In order to remove fly ash and gaseous by- products before they are exhausted into the atmosphere, modern incinerators must be equipped with extensive emission control devices. Such devices include fabric baghouse filters, acid gas scrubbers, and electrostatic precipitators. Bottom ash and fly ash are usually combined and disposed of in a landfill. If the ash is found to contain toxic metals, it must be managed as a hazardous waste (Nathanson, 2014).

Municipal solid-waste incinerators are designed to receive and burn a continuous supply of refuse. A deep refuse storage pit, or tipping area, provides enough space for about one day of waste storage. The refuse is lifted from the pit by a crane equipped with a bucket or grapple device. It is then deposited into a hopper and chute above the furnace and released onto a charging grate or stoker. The grate shakes and moves waste through the furnace,

allowing air to circulate around the burning material. Modern incinerators are usually built with a rectangular furnace, although rotary kiln furnaces and vertical circular furnaces are available. Furnaces are constructed of refractory bricks that can withstand the high combustion temperatures (Nathanson, 2014).

Combustion in a furnace occurs in two stages: primary and secondary. In primary combustion, moisture is driven off, and the waste is ignited and volatilized. In secondary combustion, the remaining unburned gases and particulates are oxidized, eliminating odours and reducing the amount of fly ash in the exhaust. When the refuse is very moist, auxiliary gas or fuel oil is sometimes burned to start the primary combustion (Nathanson, 2014).

In order to provide enough oxygen for both primary and secondary combustion, air must be thoroughly mixed with the burning refuse. Air is supplied from openings beneath the grates or is admitted to the area above. The relative amounts of this underfire air and overfire air must be determined by the plant operator to achieve good combustion efficiency. A continuous flow of air can be maintained by a natural draft in a tall chimney or by mechanical forced-draft fans (Nathanson, 2014).

## 2.8 Composting

Another method of treating municipal solid waste is composting, a biological process in which the organic portion of refuse is allowed to decompose under carefully controlled conditions. Microbes metabolize the organic waste material and reduce its volume by as much as 50 percent. The stabilized product is called compost or humus. It resembles potting soil in texture and odour and may be used as a soil conditioner or mulch (Nathanson, 2014).

According to Nathanson (2014), Composting offers a method of processing and recycling both garbage and sewage sludge in one operation. As more stringent environmental rules and siting constraints limit the use of solid- waste incineration and landfill options, the application of composting is likely to increase. The steps involved in the process include sorting and separating, size reduction, and digestion of the refuse.

The decomposable materials in refuse are isolated from glass, metal, and other inorganic items through sorting and separating operations. These are carried out mechanically, using differences in such physical characteristics of the refuse as size, density, and magnetic properties. Shredding or pulverizing reduces the size of the waste articles, resulting in a uniform mass of material. It is accomplished with hammer mills and rotary shredders (Nathanson, 2014).

Pulverized waste is ready for composting either by the open windrow method or in an enclosed mechanical facility. Windrows are long, low mounds of refuse. They are turned or mixed every few days to provide air for the microbes digesting the organics. Depending on moisture conditions, it may take five to eight weeks for complete digestion of the waste. Because of the metabolic action of aerobic bacteria, temperatures in an active compost pile reach about 65 °C (150 °F), killing pathogenic organisms that may be in the waste material.( Curley,2010)

Open windrow composting requires relatively large land areas. Enclosed mechanical composting facilities can reduce land requirements by about 85 percent. Mechanical composting systems employ one or more closed tanks or digesters equipped with rotating vanes that mix and aerate the shredded waste. Complete digestion of the waste takes about one week. (Curley, 2010)

Digested compost must be processed before it can be used as a mulch or soil conditioner. Processing includes drying, screening, and granulating or pelletizing. These steps improve the market value of the compost, which is the most serious constraint to the success of composting as a waste management option. Agricultural demand for digested compost is usually low because of the high cost of transporting it and because of competition with inorganic chemical fertilizers (Curley, 2010)

### 2.8.1 Sanitary landfill

Land disposal is the most common management strategy for municipal solid waste. Refuse can be safely deposited in a sanitary landfill, a disposal site that is carefully selected, designed, constructed, and operated to protect the environment and public health (Lachner, 2015)

One of the most important factors relating to landfilling is that the buried waste never comes in contact with surface water or groundwater. Engineering design requirements include a minimum distance between the bottom of the landfill and the seasonally high groundwater table. Most new landfills are required to have an impermeable liner or barrier at the bottom, as well as a system of groundwater-monitoring wells. Completed landfill sections must be capped with an impermeable cover to keep precipitation or surface runoff away from the buried waste. Bottom and cap liners may be made of flexible plastic membranes, layers of clay soil, or a combination of both (USEPA,2017)

### 2.8.2 Recycling

Separating, recovering, and reusing components of solid waste that may still have economic value is called recycling. One type of recycling is the recovery and reuse of heat energy, a practice discussed separately in Incineration. Composting can also be considered a recycling process, since it reclaims the organic parts of solid waste for reuse as mulch or

soil conditioner. Still other waste materials have potential for reuse. These include paper, metal, glass, plastic, and rubber, and their recovery is discussed here (USEPA,2017).

Before any material can be recycled, it must be separated from the raw waste and sorted. Separation can be accomplished at the source of the waste or at a central processing facility. Source separation, also called curbside separation, is done by individual citizens who collect newspapers, bottles, cans, and garbage separately and place them at the curb for collection. Many communities allow "commingling" of nonpaper recyclables (glass, metal, and plastic). In either case, municipal collection of source-separated refuse is more expensive than ordinary refuse collection (Curley, 2010)

According to Nathanson (2019), In lieu of source separation, recyclable materials can be separated from garbage at centralized mechanical processing plants. Experience has shown that the quality of recyclables recovered from such facilities is lowered by contamination with moist garbage and broken glass. The best practice, as now recognized, is to have citizens separate refuse into a limited number of categories, including newspaper; magazines and other wastepaper; commingled metals, glass, and plastics; and garbage and other non-recyclables. The newspaper, other paper wastes, and commingled recyclables are collected separately from the other refuse and are processed at a centralized materials recovery facility (MRF). A modern MRF can process about 300 tons of recyclable wastes per day.

Rubber is sometimes reclaimed from solid waste and shredded, reformed, and remolded in a process called revulcanization, but it is usually not as strong as the original material. Shredded rubber can be used as an additive in asphalt pavements, and discarded tires may be employed as swings and other recreational structures for use by children in "tire playgrounds." In general, the most difficult problem associated with the recycling of any

solid-waste material is finding applications and suitable markets. Recycling by itself will not solve the growing problem of solid-waste management and disposal. There will always be some unusable and completely valueless solid residue requiring final disposal (Nathanson, 2014)

### 2.8.3 Problems of managing solid waste

According to Ogawa (2005), a typical solid waste management system in a developing country displays an array of problems, including low collection coverage and irregular collection services, crude open dumping and burning without air and water pollution control. He classified these challenges into technical, financial, institutional and social constraints.

### 2.8.4 Technical constraints

Technical knowledge on how to manage solid waste has been a problem in most developing countries. According to Ogawa (2005), there are inadequate human resources at the national and local levels with technical expertise for the management of solid waste in most developing countries. The inadequacy of human resource with the technical expertise has made management of solid waste very difficult.

### 2.8.5 Financial constraints

According to Ogawa (2005), solid waste management in developing counties is given low, except the capital and large cities. Most governments in developing countries provide limited funds to the solid waste management sector which makes the services required for protection of public health and the environment not be attained. They usually try to supplement the weak financial support from local government with user's service charge. The willingness to pay for the services by the users is also ineffective making solid waste management very challenging.

### 2.8.6 Institutional constraints

Ogawa (2005), points to the fact that, some agencies at the national level must be involved at least partially in solid waste management but because there is no clear functions defining their relation in solid waste management and also no committees designated to coordinate their projects as well as activities. Thus, indicated that;

*".....The lack of coordination among the relevant agencies often results in different agencies becoming the national counterpart to different external support agencies for different solid waste management collaborative projects without being aware of what other national agencies are doing. This leads to duplication of efforts, wasting of resources, and unsustainability of overall solid waste management programmes. The lack of effective legislation for solid waste management, which is a norm in most developing countries, is partially responsible for the roles/functions of the relevant national agencies not being clearly defined and the lack of co-ordination among them" (Ogawa, 2005: p-2)*

### 2.8.7 Impacts of solid waste on human health and environment (animals and aquatics life)

There are potential risks to environment and health from improper handling of solid wastes. Direct health risks concern mainly the workers in this field, who need to be protected, as far as possible, from contact with wastes. There are also specific risks in handling wastes from hospitals and clinics. For the general public, the main risks to health are indirect and arise from the breeding of disease vectors, primarily flies and rats. (Pervez & Kafeel, 2013).

According to uncontrolled hazardous wastes from industries mixing up with municipal wastes, create potential risks to human health. Traffic accidents can result from toxic spilled wastes. There is specific danger of concentration of heavy metals in the food chain,

a problem that illustrates the relationship between municipal solid wastes and liquid industrial effluents containing heavy metals discharged to a drainage/sewerage system and /or open dumping sites of municipal solid wastes and the wastes discharged thereby maintains a vicious cycle including these other types of problem

- Chemical poisoning through chemical inhalation
- Uncollected waste can obstruct the storm water runoff resulting in flood
- Low birth weight
- Cancer
- Congenital malformations
- Neurological disease
- Nausea and vomiting
- Mercury toxicity from eating fish with high levels of mercury
- Plastic found in oceans ingested by birds
- Resulted in high algal population in rivers and sea
- Degrades water and soil quality

The decomposition of waste into constituent chemicals is a common source of local environmental pollution. This problem is especially acute in developing nations. Very few existing landfills in the world's poorest countries would meet environmental standards accepted in industrialized nations, and with limited budgets there are likely to be few sites rigorously evaluated prior to use in the future. The problem is again compounded by the issues associated with rapid urbanization. A major environmental concern is gas release by decomposing garbage. Methane is a by-product of the anaerobic respiration of bacteria, and these bacteria thrive in landfills with high amounts of moisture. Methane concentrations can reach up to 50% of the composition of landfill gas at maximum

anaerobic decomposition (Cointreau-Levine, 1997 in pervez & kafeel, 2013). A second problem with these gasses is their contribution to the enhanced greenhouse gas effect and climate change. Liquid leachate management varies throughout the landfills of the developing world. Leachate poses a threat to local surface and ground water systems. The use of dense clay deposits at the bottom of waste pits, coupled with plastic sheeting-type liners to prevent infiltration into the surrounding soil, is generally regarded as the optimum strategy to contain excess liquid. In this way, waste is encouraged to evaporate rather than infiltrate (pervez & kafeel, 2013).

### 2.8.8 Solid waste management in Ghana

Over the years, solid waste disposal in Ghana has become a major challenge to Metropolitan, Municipal and District Assemblies. As a result of urbanization and increasing densities, Metropolitan Assemblies find it difficult to deal with the large quantities of solid waste generated. This is due to the fact that, people resort to indiscriminate dumping as the only means to managing their domestic solid waste thus resulting in littering and heaping of waste (Puopiel, 2010).

### 2.8.9 Solid waste generation

According to Anomanyo (2004) about 1800 tons of municipal solid wastes were generated per day in the Accra Metropolis and the average waste generated per capita per day was estimated at 0.5 tons. He attributed this to the rate of population growth in the Metropolis which stood at 3.5 percent. Waste from domestic sources include, food waste, garden waste, sweepings, ash, packaging materials, textiles and electric and electronic waste with organic waste being the major component. This constituted about 65 percent.

## 2.9 Solid waste collection

According to Tsiboe & Marbel (2004), there are basically three methods of household waste collection in Accra:

- Waste Management Department (WMD) curbside collection by trucks directly outside each house. According to them, this collection method was provided weekly in the high- income residential areas like Roman Ridge, Airport and Cantonment by compactor trucks.
- WMD collected from communal containers to which people must bring their own waste. These were restricted to low-income areas like Niima and amounted to some 200 communal containers. Households that could not afford the house to house collection service took their waste to any of these 200 communal containers and from which the WMD collected the waste and disposed of it at the landfill site (Stephens et al 1994: 25) cited in Tsiboe and Marbell (2004).
- Door-to-door collection services in middle-income areas like Labadi.

According to Anomanyo (2004), for the purpose of effective collection, the city was demarcated into two districts.

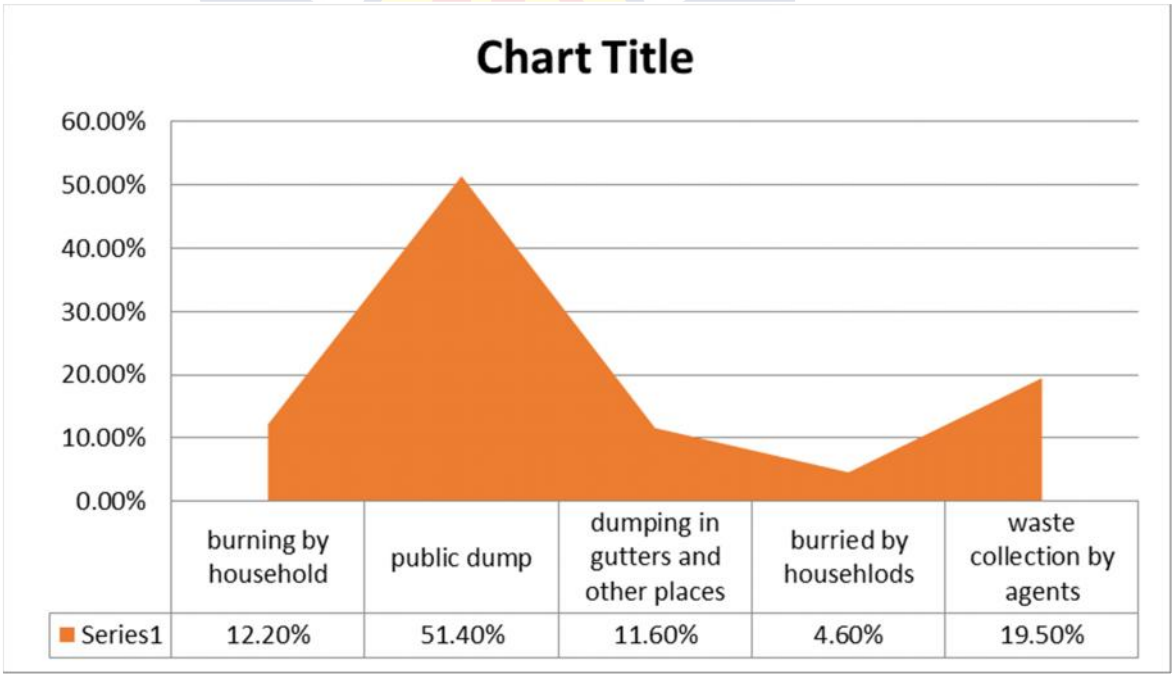
According to him solid waste collection in the city was carried out both on franchise bases, a house-to-house collection was done in high income areas and the contractors charged the households some fees with weekly collection frequency. These areas are well planned residential areas with access roads described as first and second class areas and include areas as Airport residential area and Cantoments.

On contract bases, waste contractors were paid by AMA to perform both block and communal container collection. Block collection occurs in the middle-income residential areas including Dansoman, Adabraka, Kaneshie and other parts of Accra. Central

communal skip collection occurs in low income high population density and deprived residential areas such as James Town, Nima and other parts of Accra where houses were not well planned with poor or even no access roads. Market places were also covered with this arrangement. Residents deposited their waste in such communal containers and the frequency of collection was at least once daily. Waste generators here did not pay user charges. He added that despite the strategies put in place for the collection of waste in Accra, maximum waste collection was not achieved. Between 65 and 75 percent of waste was collected per day.

### 2.9.1 Solid waste disposal

According to Anomanyo (2004), waste disposal from households in Accra Metropolitan Assembly took different forms. These are represented in the figure below



It can thus be ascertained that out of the about 1800 tons of waste generated, only 19.5 percent was collected. Anomanyo (2004), further added that between 1991 and late 2001, the Accra Metropolitan Assembly's solid waste was deposited at Mallam, a suburb of Accra. This dumping at the Mallam site however was stopped in late 2001 as the dump capacity had been exceeded and objections from nearby residents. Waste dumping was therefore shifted to Djanman which unfortunately could not last as it was filled to capacity in just three months. These abandoned Mallam and Djanman sites were mountains of dumps and since they were neither landfills nor were there controls to their spread and emissions, they are of great concern as a result of their threat to human health, leachate and landfill gas formation. According to him the dump site was an old stone quarry at Oblogo in the McCarthy Hills of Accra. Before it begun to be used in early 2002 there was an installation of clay lining. The site had no engineered containment of leachate. Accra Metropolitan Assembly was only able to compact the waste to guarantee some level of proper dumping and hence "this site was considered a controlled dump rather than a properly engineered landfill" (Anomanyo, 2004). He further added that since the formal systems of solid waste disposal could not cope with the ever-increasing volume of solid waste being generated in Accra, the public itself employs various means of waste disposal. Waste was thus disposed of indiscriminately especially in watercourses and drainage channels and also through burning. (Puopiel, 2010)

### 2.9.2 Problems of waste management

In Ghana, Boadi and Kuitunen (2004) pointed out some of the problems affecting solid waste management. These include: weak institutional capacity and lack of resources; both human and capital. They also indicated that, home collection of waste is limited to high and, some middle income areas while the poor are left to contend with the problem on their

own. This leads to indiscriminate disposal of waste in surface drains, canals and streams, creating unsanitary and unsightly environments in many parts of the city. According to Puopiel, 2010, the main challenges facing solid waste management in developing countries and for that matter Ghana include: inadequate funds to support waste management, inadequate equipment to support waste storage, collection and disposal, low collection coverage and irregular collection services, crude open dumping and burning without air and water pollution control.

### 2.9.3 Sustainable Development Goals and Solid Waste Management

***The Concept of Sustainable Development Goals (SDGs)***

At the United Nations Millennium Summit in 2000, world leaders adopted the Millennium Development Goals (MDGs). These eight goals committed the international community to achieving a variety of specified development targets by the year 2015, mainly aimed at removing the worst manifestations of poverty in developing countries. Over the past fifteen years, governments and UN agencies have devoted significant attention and finance towards the achievement of these goals, with varying degrees of success. The term for implementing the MDGs comes to an end in September 2015. To maintain the momentum of the MDGs process after its completion, Sustainable Development Goals (SDGs) were proposed in 2012 at the United Nations Conference on Sustainable Development (Rio+20). The UN General Assembly subsequently set up a process involving extensive consultation worldwide, to lead to the adoption of SDGs, which would guide international action towards sustainable development from 2015 to 2030. Unlike the MDGs, the SDGs are intended to be universal in scope, and applicable to the concerns of both developing and developed countries.

One of the great strengths of the SDG framework in its current formulation is its recognition of the intimate links between human well-being, economic prosperity and a healthy environment. In its adoption, it must send out a clear message that restoring and maintaining the health of the natural resource base is a necessary condition for eradicating poverty and sustaining economic progress for all.

### 2.9.4 Highlight of the 17 Sustainable Development Goals

**Table 2.2: SDGs and goal explanation/relevance**

| | |
|---|---|
| Goal 1 | End poverty in all its forms everywhere |
| Goal 2 | End hunger, achieve food security and improved nutrition and promote sustainable agriculture |
| Goal 3 | Ensure healthy lives and promote well-being for all at all ages |
| Goal 4 | Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all |
| Goal 5 | Achieve gender equality and empower all women and girls |
| Goal 6 | Ensure availability and sustainable management of water and sanitation for all |
| Goal 7 | Ensure access to affordable, reliable, sustainable and modern energy for all |
| Goal 8 | Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all |
| Goal 9 | Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation |
| Goal 10 | Reduce inequality within and among countries |

Table 2 cont'd

| | |
|---|---|
| Goal 11 | Make cities and human settlements inclusive, safe, resilient and sustainable |
| Goal 12 | Ensure sustainable consumption and production patterns |
| Goal 13 | Take urgent action to combat climate change and its impacts* |
| Goal 14 | Conserve and sustainably use the oceans, seas and marine resources for sustainable development |
| Goal 15 | Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss |
| Goal 16 | Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels |
| Goal 17 | Strengthen the means of implementation and revitalize the global partnership for sustainable development |

Source: Global Waste Management Outlook, 2015

### 2.9.5 SDGs in the Context of Waste Management

After exhaustive global consultations, the world, under the umbrella of United Nations gathered in New York in September, 2015 to sign the outcome which resulted in the 17 global goals for sustainable development otherwise known as "Sustainable Development Goals (SDGs)." The SDGs which succeed the Millennium Development Goals (MDGs) will run till 2030. It aims at creating prosperity for people in a safe planet. Achieving goals 3, 7, 11 and 13 of SDGs which include good health and wellbeing, affordable and clean

energy, sustainable cities and communities and climate action respectively will depend on our effective waste management practices going forward.

Human population is more than 7 billion we're producing waste every day. A staggering half of that waste isn't collected, treated or safely disposed of, and it is causing a global waste crisis.

The Sustainable Development Goals (SDGs) cannot be met unless waste management is addressed as a priority. Failing economic models treat resources as if they were infinite (**SDG 12**) and consumption patterns favour the disposable.

Three-quarters of the vastest open dumps in the world are on the coast, leaching hazardous materials into our oceans. It's unlikely that there is a single beach in the world that doesn't carry the residues of plastic fishing nets, cigarette butts and plastic straws (**SDG 14**). Chemicals seep from immense quantities of dumped waste, poisoning groundwater, streams and rivers. Life on land (**SDG 15**) can only be healthy when waste is properly managed.

Waste is polluting the air we breathe as well. When people have no waste management services, they can only dump waste in the open – or burn it. Open burning of waste is sadly commonplace. The health impacts of open burning are catastrophic (**SDG 3**). Added to this is the climate change impact of methane and CO2 from poorly managed waste: within ten years dumpsites could be responsible for up to a tenth of manmade greenhouse gases (**SDG 13**).

If man-kind wants clean water and sanitation (**SDG 6**), we need to be looking at waste. It's a key vector of disease, and provides abundant breeding grounds for mosquitoes. Women in particular can benefit hugely from improved waste management, through independent

earning opportunities (**SDG 5**) and protecting their families from sickness caused by open dumping and burning.

Food waste, from farm to fork and post-consumer, needs to be cut dramatically. Waste from the manufacture of food products can be fed to animals, and inedible remains converted into biogas and clean renewable energy (**SDG 7**).

**SDG 1** aims for No Poverty. 1% of the global urban population make their living from recovering recyclable materials from waste (**SDG 8**). These informal waste champions provide a valuable and often no-cost service, and it is important that we recognise their role in urban sanitation and resource efficiency (**SDG 10**). Fair wages and basic employment rights for all waste workers are fundamental to equal, inclusive and sustainable communities.

The rewards of waste management far outweigh the cost. For our communities to prosper as healthy and resilient places to live, governments must urgently invest. Even the poor choose to pay for waste management (or participate in it) when they see its benefits. Producer Responsibility schemes and crucially – fiscal transparency – can help ensure everyone pays their fair share to keep the planet clean (**SDG 16**).

The formal waste management sector, employing another 20 million globally, is a current hotbed of inspiration and innovation (**SDG 9**). Attracting millennials, entrepreneurs and industry heavyweights, waste management provides excellent opportunities in science, technology and engineering, humanities, business studies and IT (**SDG 4**), and is a powerful catalyst for economic growth (**SDG 8**). The feedstock for an industry based on waste is plentiful.

Sustainable waste management provides ideal opportunities to collaborate and work in partnership (**SDG 17**) – the wealthy and the poor, the formal and informal, communities,

business, governments and the international donor community. Indeed, it is only *when* we work together that the most logical and valuable answers arise. As we have seen, waste crosses so many other aspects of society. Positive outcomes rely on us joining these dots.

In summary, we can achieve the Global Goals – and we'll do it much more effectively once we recognize waste management as a powerful driver of sustainable development.

# CHAPTER THREE

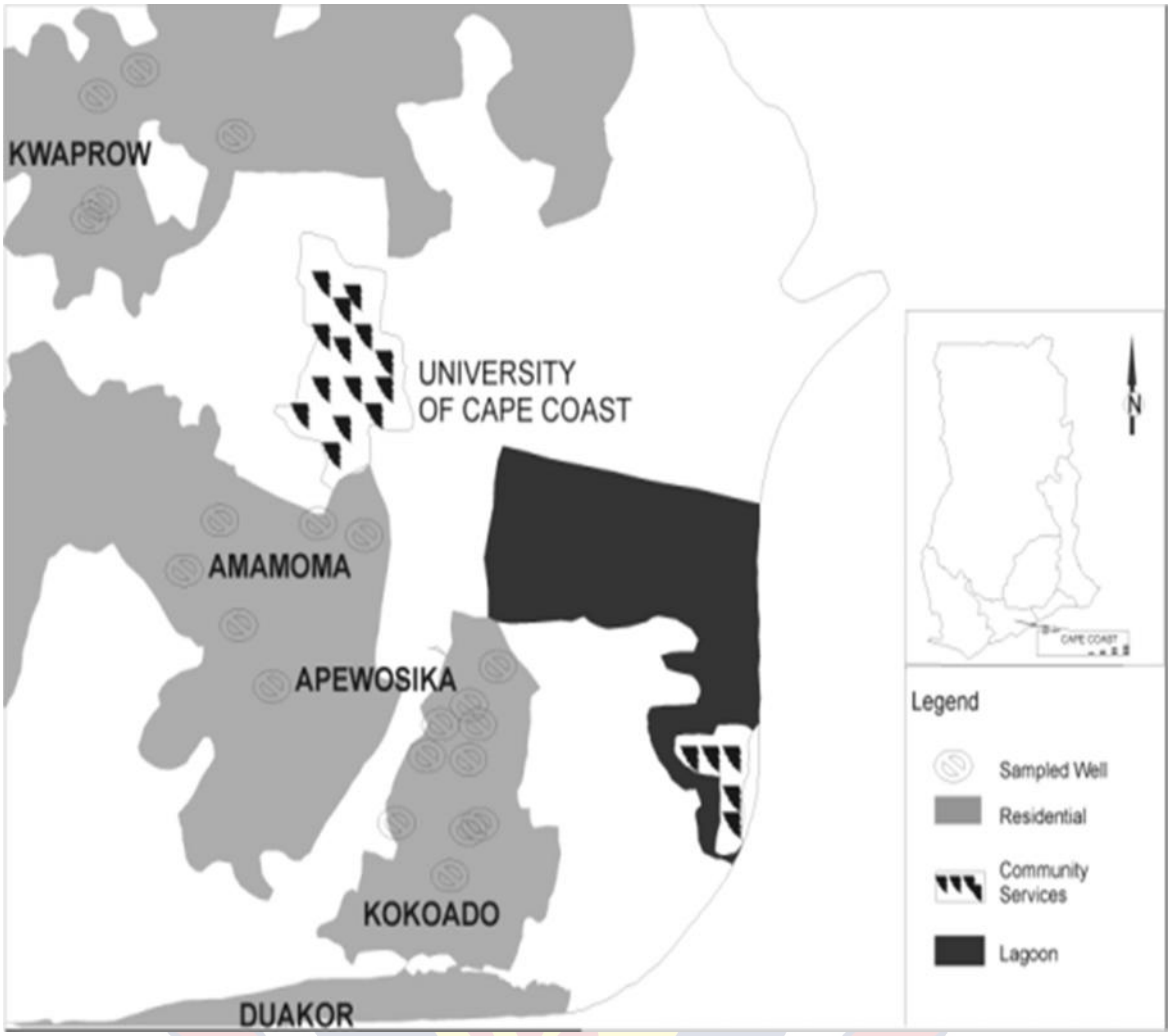
# RESEARCH METHODOLOGY

## 3.1 Study Area

Amamoma is a community under the Cape Coast Metropolitan Assembly in the Central Region of Ghana.

The town has a population ranging from 280 to 1000 with fluctuation dependent on students residency during academic semesters. (Ghana Districts,2013).

The major economic activity within the community is hostel or room rental for non-resident students of the University of Cape Coast. The community lies closer to the wetlands or flood prone areas of Northern Cape Coast. Access to the community is mainly by feeder road and there are no commercial vehicles that ply the route hence residents have to walk long distances to the University Taxi Rank at North Campus for vehicular transport to their destinations. Drainage system within the community is totally absent resulting in residents resorting to dugout wells to empty their domestic waste effluents.




Source: https://en.wikipedia.org/wiki/Cape_Coast_Metropolitan_Assembly

### 3.2 Research Design

The study was descriptive in nature and used quantitative method for data collection. This consisted of a survey using a questionnaire. The study used purposive sampling techniques in selecting the study area and the respondents. The Amamoma Community was purposely selected because it the most cosmopolitan part of the metropolis. The questionnaire had two main sections that collected information on: (1) household and demographic characteristics; (2) domestic waste disposal practices. Sections of the questionnaire were developed based on the objectives of the study and review of available literature.

### 3.3 Study Population

The study population involved households in Amamoma community.

### 3.4 Sampling Procedure

Simple random sampling was used to select respondents in order to avoid bias which gave a fair chance to every respondent within the community.

Furthermore, a mathematical method was used to determine the sample size for the survey. A sample size of **96** of was obtained. This figure was retrieved from the statistics below;

$X=n/ (1+n (e)^2)$

(Taro, 1970)

X=Sample size, n=total population, e=level of error

which is 10%

$=2500/ (1+2500(0.1^2)$

$=2500/ (1+995(0.01))$

$=2500/ (1+25)$

$=2500/ (26)$

$=96.1538462$

### 3.5 Data Collection Techniques and Tools

The main data collection tool was a semi-structured questionnaire. The main issues that were addressed in the design of the questionnaire included the respondents' educational background, socioeconomic and cultural backgrounds, knowledge level on solid waste management, attitude and behaviour towards sanitation programmes, types of receptacles used to collect solid domestic waste, frequency of emptying storage

receptacles, method of refuse disposal, proximity to dump site and availability of community storage receptacles

The questions were both closed and open-ended. Interviews and observation as regard how the respondents collect, store and finally dispose of their solid domestic refuse were employed to find out more relevant facts about how solid domestic refuse is managed in the study area.

Collection of data was done from June to July, 2019. Since most of the respondents were uneducated, their responses were recorded in English after the questions had been interpreted in the local language to them. However, for the few literate ones, the questionnaire was self-administered and they were requested to use four days to complete the items. The response rate for the self-administered questionnaire was 100%. The data collected by the questionnaire were recorded in tables expressed as frequencies and percentages.

### 3.6 Data / Analysis

After the data for the study had been checked for accuracy and completeness, they were then kept safely in a large brown envelope for analysis. Data were entered into a computer and analyzed with the Statistical Package for the Social Sciences (SPSS) and Microsoft Excel 2013. The relevant information was retrieved in a standard form using tables, figures, frequencies and percentages for analysis and interpretation of the information.

### 3.7 Ethical Consideration

The nature, purpose and procedure of the study were explained to each participant and they were made aware that they were free to refuse to answer any questions or drop out of the

study at any time. Consent was then obtained from each participant in the study where participants either appended their signatures or thumbprints. Participants were assured of the confidentiality of personal information and written materials. There are no known risks to who take part in this study. Participants will rather benefit from the study since they have an opportunity to express their views and experiences with regards to solid domestic waste management.

### 3.8 Assumptions

All responses and information provided by the respondents were assumed to be accurate and a true representation of the study area.

# CHAPTER FOUR

# RESULTS AND DISCUSSION

## 4.0 Introduction

The main purpose of this study is to look at the effect of indiscriminate disposal of waste in Amamoma community in the Central Region. This chapter deals with the presentation and analysis of the data collected from the respondents of the study.

## 4.1 Social characteristics of respondents

The result shows that majority 35 (36.46%) of the respondents in the study area were males and 61 representing 63.54% of the total respondents were females. It is very evident that females more than males in the study area were represented.

It is evident from the table that majority 41(42.71%) of the respondents were between the ages of 26-35years. Again, 23 (23.96%) out of the total respondents were above 46years and also 22 (22.92%) were between 36-45. Notwithstanding, 10 (10.42%) of the respondent were between the age of 18-25years.

With regards to occupation, the result shows that majority 38 (39.58%) of the respondents in the study area were students, 32 representing 33.33% indicated that they were public service workers. 15(15.63%) had private employment. The least, 11 respondents representing 11.46 % were unemployed.

It is indicated that majority 40(41.67%) has attained tertiary education. While 36(37.50%) had senior high school education, 20 (20.83%) indicated they had Junior high school education.

The income level of the respondents indicated that 40 (41.67%) were average income earners, that is they earn between GHC500-1000 per month, whilst high income earners in

the study area earned GHC 1000 and above they were 30 (31.25%) respondents. Low income earners as indicated were 15 (15.63%) earning between 200-500 Ghana Cedis per month. 11 (11.46%) had no income.

The religious background of respondents indicated that majority of 62 respondents, representing 64.58% were Christians whilst 34 representing 35.42% were Muslims

**Table 4.1: Socio demographic data of respondents**

| Variables | Frequency N = 96 | Percentages (%) |
|---|---|---|
| **Sex** Male | 35 | 36.46% |
| Female | 61 | 63.54% |
| **Age Distribution** | | |
| 18-25 | 10 | 10.42% |
| 26-35 | 41 | 42.71% |
| 36-45 | 22 | 22.92% |
| 46 and above | 23 | 23.96% |
| **Type of Occupation** | | |
| Public Service | 32 | 33.33% |
| Private | 15 | 15.63% |
| Unemployed | 11 | 11.46% |
| student | 38 | 39.58% |
| **Educational Level** | | |
| No schooling | 0 | 0.00% |
| Primary | 0 | 0.00% |
| J.H.S | 20 | 20.83% |
| S.H.S | 36 | 37.50% |
| Tertiary | 40 | 41.67% |
| **Income Level** | | |
| High (GH 1000 and above) | 30 | 31.25% |

Table 4.1 cont'd

| | | |
|---|---|---|
| Average(GH 500-1000) | 40 | 41.67% |
| Low(below GH200-500) | 15 | 15.63% |
| No Income | 11 | 11.46% |
| **Religious affiliation** | | |
| Christian | 62 | 64.58% |
| Muslim | 34 | 35.42% |
| Others | - | - |

*Source: field survey (2019)*

### 4.2 Waste Management

From the table 2, all the respondents indicated that they generate waste product.

In Africa thousands of tons of solid waste are generated daily and most of it ends up in open dumps and wetlands, contaminating surface and ground water and posing major health hazards. Generation rates, available only for selected cities and regions, are approximately 0.5 kilograms per person per day in some cases reaching as high as 0.8 kilograms per person per day (Akafia, 2014).

On a daily basis, each household generates garbage or waste items that are no longer needed or which are not being used fall in the category of waste and we tend to throw them away (Danso, 2011). Danso (2011) also indicated that, in the 2000 Population and Housing Census, Ghana's population was18.9 million. With an average daily waste generation per capita of 0.45 kg, Ghana generates annually about 3.0 million tons of solid waste. Accra, the capital, and Kumasi, the second largest city, with a combined population of about 4 million and a floating population of about 2.5 million generate over 3,000 tons of solid waste daily. According to Oteng-Ababio, 2010;Houber, 2010), the domestic waste generation in Accra rate was approximately between 2500-3000 metric tonnes a day.

It is established that population growth greatly contributes to an increase in waste production, it has also been empirically established that waste generation has increased rapidly over the years (Martin, 2011)

Municipal or household wastes are often generated from several sources where variable human activities are encountered. Several studies indicate that much of the municipal solid waste from developing countries are generated from households (55–80%), followed by commercial or market areas (10–30%) with varying quantities from streets, industries, institutions among others (Nabegu, 2010, Nagabooshnam, 2011, Okot-Okumu, 2012).

### 4.3 Waste Generation:

As indicated in the table below, all 96 respondents in the study area admitted that they generate solid waste in their houses.

**Table 2: Generation of Solid waste**

| Statements | Yes | % | No | % |
|---|---|---|---|---|
| Do you generate solid waste in your household? | 96 | 100 | 0 | 0 |
| Total | 96 | 100 | | |

*Source: field survey (2019)*

### 4.4 Types of waste Product generated

Knowledge on types and the components of solid waste generated will inform the use of appropriate methods to effectively deal with the various components in solid waste. Methods such as source separation, recycling and composting can be used depending on the component of waste in the waste stream.

The figure indicates that 58% of the respondents produce plastic waste in Amamoma community and 4% of the respondents generate wood and glass waste, whilst 15% generates paper waste. This implies that lots of polythene were used for packaging and buying items. This further explains why polythene bag are littered around the study area and in the drains.

Municipal solid waste contains waste products from all aspects of human activity and as such is an extremely complex and heterogeneous material. Increasingly, it has been shown that a few chemical compounds within municipal solid waste contribute significantly to environmental and health impacts (Oyegunle, 2016).

The characteristics of solid waste vary from place to place. Factors that influence the composition are the average income level, the sources, the population, social behavior, climate, industrial production and the market for waste materials ( Akafia, 2014).

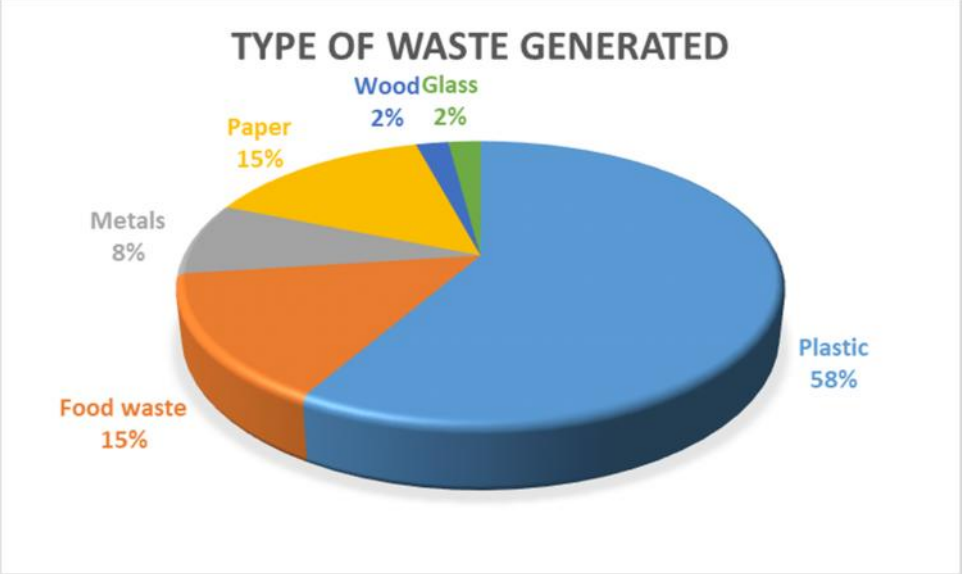



**Figure 1: types of waste generated**

*Source: field survey (2019)*

### 4.5 Waste Disposal Method

As highlighted in figure 2 above, 30 respondents representing 35.29% indicated that they dump refuse at the dump site, whilst 25 (29.41%) dump their waste in a skip container. 20 (23.53%) dump their waste in open spaces and 10 (11.76%) dump theirs in bins. This reveals why there are refuse heaps all over the study area. This can go a long way to block drains and pollute water bodies which could lead to the outbreak of cholera as some of the polythene bags are wrapped with human excrement.

This method of waste disposal according to Mantell, 1972 and Masak, 2012 causes environmental problems. They can destroy an area's appearance and provide a home for animals and insects that spread diseases. (Komakech, 2014) strongly disagrees with this method of disposal practiced by the people by pointing out that when wastes (agricultural wastes) are drawn into streams by run-off water, eutrophication, resulting in 'biological oxygen demand' (BOD) kills the aquatic fauna. The respondents adopted this practice of waste disposal probably due to lack of knowledge on how to manage solid domestic waste. Reports by the World Encyclopaedia (2015) indicated that recycling is the best method of wastes disposal because it helps to manage wastes, re-use and lessen environmental hazards as compared to other methods. People should be encouraged to put their waste into useful agricultural inputs such as compost.

The figure 2 below presents diagrammatically the methods of waste disposal in the study area

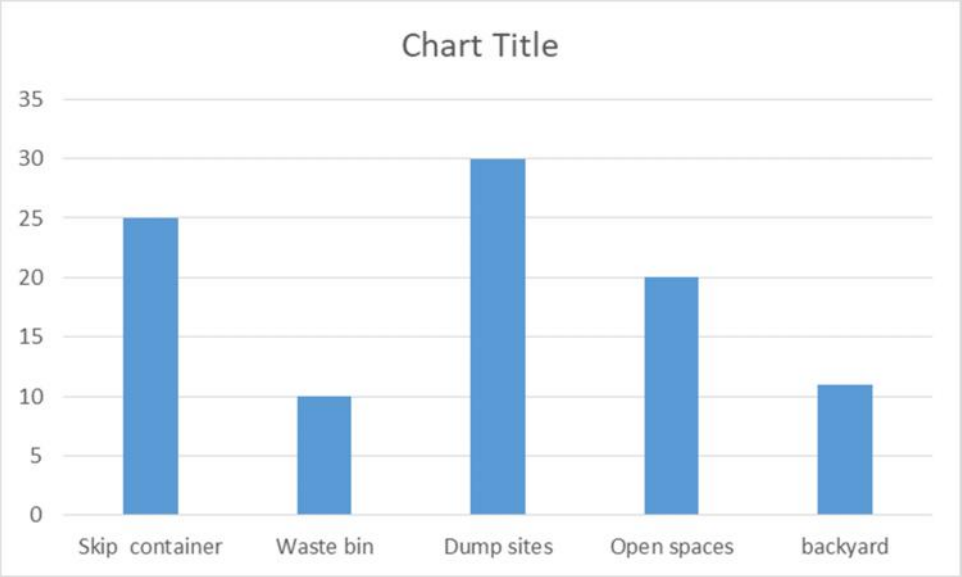



**Figure 2: place of waste disposal**

*Source: field survey (2019)*

As shown in the table 3 below. 35 respondents, representing 36.46% indicates that it is the duty of Zoomlion to clean the environment and it is the reason why they throw waste indiscriminately. 10 respondents (10.42%) indicates that they throw waste at a place that is convenient for them whilst 15 respondents (15.63%) said their choice of waste disposal is to keep the environment clean.

Generally, it implies that majority 79.19 % of the total respondents in the study area chose to practice unhygienic and environmentally unfriendly waste disposal method because it is convenient, and it is the responsibility of zoomlion to clean the place. Only 20 respondents representing 20.84% take their waste to the right places. They say they do this to keep their immediate surroundings clean and that it was safe too.

**Table 4.3: reasons for using the various waste disposal methods**

| Reasons | Frequency | Percent |
|---|---|---|
| It is the duty of zoomlion to clean it | 35 | 36.46% |
| Because it is convenient | 10 | 10.42% |
| Because, the dump sites is closer to my house | 10 | 10.42% |
| It is safe to dump it there | 5 | 5.21% |
| It is the most convenient place | 2 | 2.08% |
| That is the only place to throw it | 14 | 14.58% |
| To keep my immediate surrounding clean | 15 | 15.63% |
| Very convenient | 5 | 5.21% |
| Total | 96 | 100.0 |

*Source: field survey (2019)*

The Figure 3 below shows that 35(38%) of the respondents pay for dumping waste whiles 56(62%) do not pay.


**Figure 3: Do you pay for dumping waste?**

Source: field survey (2019)

### 4.7 Willingness to pay for refuse Management

***Reasons for refusal to pay for waste disposal services***

Reasons why the respondents in the study area would not pay for disposing waste in places of preference as indicated in figure 2 shows that majority, 50 (52.08%) claims it is the duty of zoomlion to collect waste and hence there is no reason for them to pay for the disposal of the waste they generate. Twenty-four (24) respondents representing 25 % indicated that they have no money to pay for dumping their waste whilst 12 (12.50%) indicated that the amount charged was too high.

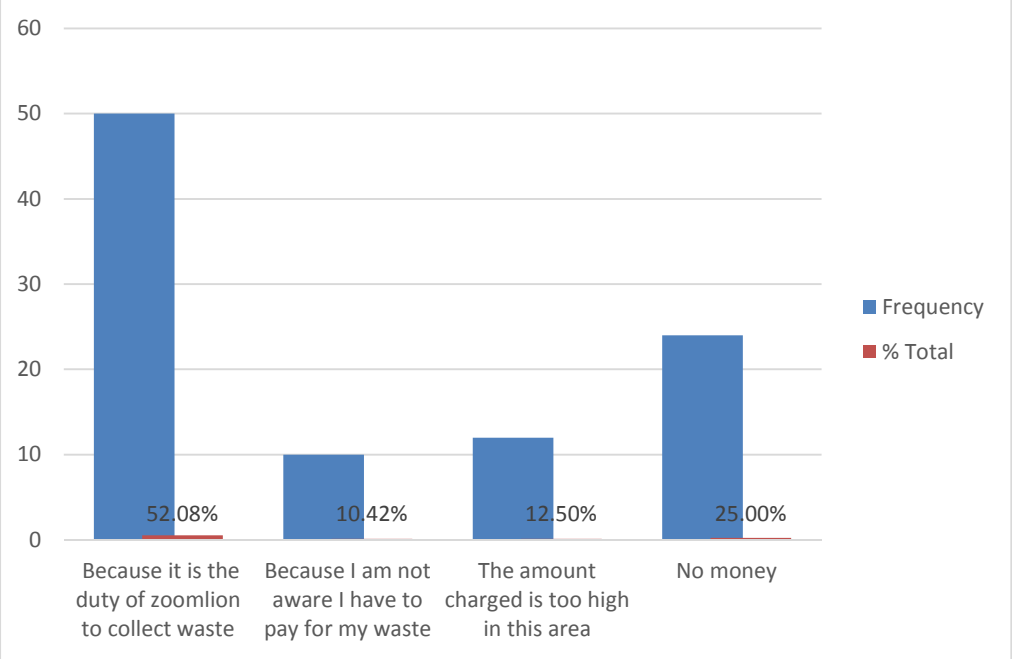



**Figure 4: Reasons for refusal to pay for waste services**

*Source: field survey (2019)*

Table 4 below indicates that majority, 60 (62.50%) of the respondents were willing to pay GHc 10 only for the collection and disposal of their waste. This is evident in the unsightly

nature of waste in the study area. Tsiboe et al (2004) and Kingombe (2014) stated in their studies that a combination of poverty, population pressure, and economic hardships is placing a considerable strain on household environments in Accra. Majority of the people in Ghana live below the internationally recognized poverty line of one dollar a day. Satterthwaite (1998) and Dongballe (2016) virtually agree in principle that the waste problem emanates from poverty and lack of funding as a result of low level of economic growth. Financial constraints undoubtedly are a factor that contributes to improper solid domestic waste management.

**Table 4.4: Average charges for waste disposal**

| Amount | Frequency | Percent |
|---|---|---|
| 35Cedis | 14 | 14.58% |
| 15 Cedis | 15 | 15.63% |
| 10 Cedis | 60 | 62.50% |
| 1 Cedis | 7 | 7.29% |
| Total | 96 | 100.00 |

*Source: field survey (2019)*

### 4.8 Distance to dump site

The table clearly shows that majority 36(37.50%) of the respondents indicated that it takes more than 25minutes to get to the skip/bin and this may encourage indiscriminate dumping of waste. Whiles 28(29.17%) indicated it takes them 21-25mins to get to the skip/bin, 22(22.92%) stated that it takes them between 11-15mins to get to the skip/bin. And 10(10.42%) stated that it takes between 2-10mins to get to the skip/bin.

**Table 4.5: time spent to get to skip/ Bin**

| Time | Frequency | Percent |
|---|---|---|
| 2-10mins | 10 | 10.42% |
| 11-15mins | 22 | 22.92% |
| 21-25mins | 28 | 29.17% |
| More than 25mins | 36 | 37.50% |
| Total | 96 | 100 |

*Source: field survey (2019)*

The figure 5 below shows that 56 (62%) of the respondents indicated that it is not convenient for them to walk more than 10mins to dump rubbish. However, 35(38%) of the respondents stated that they are comfortable walking up to 10mins to dump waste.

According to Ampofo (2015), environmentalists should not only join scientists and other responsible sectors of industry and agriculture to find better ways for disposing of wastes, but to locate convenient places for their disposal.

Location of the dumping sites too can be discouraging, considering the fact that children who are assigned to carry wastes to the dumps may find it inconvenient to walk long distances and out of frustration may dump them anywhere (Yakubu, 2017).

Fasida (1996) also stressed that the paramount consideration in the management decisions involving waste disposal is site location. To eliminate the problem involved in indiscriminate disposal of waste, sites located for waste disposal be “paramount” as quoted by Fasida. The results therefore suggest that the community has not taken the pains to identify suitable sites to enable them manage wastes well.

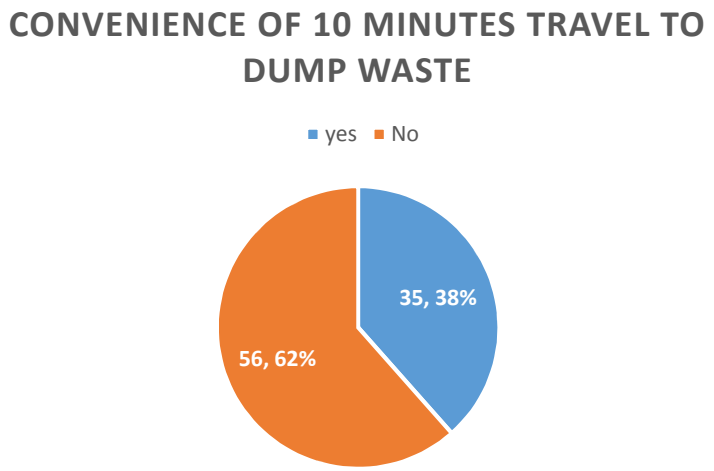



**Figure 5: convenient time to dump waste**

*Source: field survey (2019)*

### 4.9 Management of waste

The Table 6 below shows that majority 93(96.88%) of the respondents employ the services of Zoomlion Ghana Limited to dispose the waste generated. However, 3(3.13%) also employ the services of Motor tricycle operators (Aboboya) in disposing the generated waste.

**Table 6: Waste management Company responsible for collecting waste for disposal**

| waste management institution | Frequency | Percent |
|---|---|---|
| Motor tricycle operators | 3 | 3.13% |
| Zoomlion | 93 | 96.88% |
| None | | 0 |
| Total | 96 | 100.0 |

*Source: field survey (2019)*

It is evident from the figure 5 below that majority 80(88%) of the respondents indicated that the waste management services collect their waste once a week. Again, 11(12%) indicated that they collect the waste twice a week.

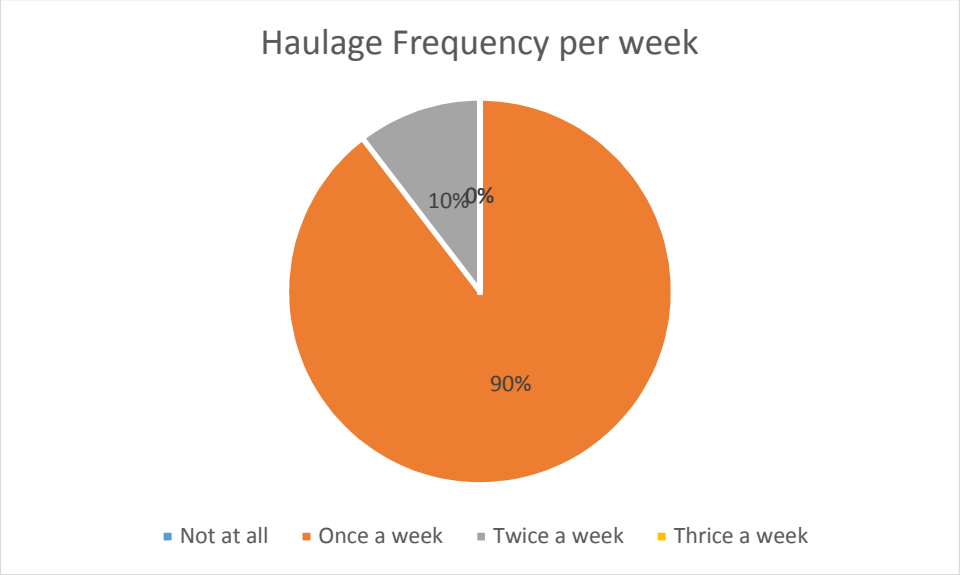



**Figure 5: waste collection frequency**

*Source: field survey (2019)*

The study revealed that 20 (20.83%) of respondents wants to pay for disposal and collection of waste, whilst 40 (41.67%) are of the view that every household should get a bin for the storage of waste. Twenty-five (25) (26.04%) of the respondents are supporting the strict enforcement of the bye laws. and also, 7 (7.29%) want more public education carried out to discourage people from disposing of waste indiscriminately. Four (4) (4.17%) respondents want an approved dumpsite located close to households.

**Table 6: Management of solid waste**

| Response | Frequency | Percent |
|---|---|---|
| Every household should get a bin for storage of waste | 40 | 41.67% |
| Paying for the disposal and collection of waste | 20 | 20.83% |
| More education on the effects of indiscriminate refuse disposal | 7 | 7.29% |
| Strict enforcement of existing sanitary laws | 25 | 26.04% |
| Provision of approved dumping sites close to households | 96 | 4.17% |
| Total | | 100.0 |

*Source: field survey (2019)*

### 5. Environmental implications of indiscriminate dumping of waste in the area

The figure 6 below gives clear evidence that majority, 88(92%) of the respondents are aware that there is a relation between poor waste disposal and health. However, 8 (8%) indicated that they are ignorant of the fact that poor waste disposal has a link with health.

The main environmental effects of refuse dumping in Amamoma was the stench as well as outbreak of diseases such as malaria, cholera, diarrhoea and typhoid, due to attraction of flies and mosquitoes from the polluted areas and hence, air and water pollution to that effect. The respondents stated that the main effect of refuse dump is the attraction of flies and mosquitoes that leads to outbreak of cholera, malaria and typhoid. Other effects mentioned include surface water contamination and soil contamination; where hazardous

chemicals from the refuse leach into the soils and affect plant and animals that come in contact with such polluted soils, thus, land or soil pollution in the said area.

Improper solid waste management activities can bring about the following:

a) Increase disease transmission or otherwise threaten public health. Rotten organic materials pose great public health risks, including, as mentioned above, serving as breeding grounds for disease vectors. Waste handlers and waste pickers are especially vulnerable and may also become vectors, contracting and transmitting diseases when human or animal excreta or medical wastes are in the waste stream (Marianna et al, 2014).

b) Create greenhouse gas emissions and other air pollutants. When organic wastes are disposed of in deep dumps or landfills, they undergo anaerobic degradation and become significant sources of methane, a gas with 21 times the effect of carbon dioxide in trapping heat in the atmosphere. Garbage is often burned in residential areas and in landfills to reduce volume and uncover metals. Burning creates thick smoke that contains carbon monoxide, soot and nitrogen oxides, all of which are hazardous to human health and degrade urban air quality. Combustion of polyvinyl chlorides (PVCs) generates highly carcinogenic dioxins (Marianna et al, 2014).

c) Damage ecosystems. When solid waste is dumped into rivers or streams it can alter aquatic habitats and harm native flora and fauna. The high nutrient content in organic wastes can deplete dissolved oxygen in water bodies, denying oxygen to fish and other aquatic life form. Solids can cause sedimentation and change stream flow and bottom habitat. Siting dumps or landfills in sensitive ecosystems may

destroy or significantly damage these valuable natural resources and the services they provide (Marianna et al, 2014).

d) Injure people and property. In locations where shantytowns or slums exist near open dumps or near badly designed or operated landfills, landslides or fires can destroy homes and injure or kill residents. The accumulation of waste along streets may present physical hazards, clog drains and cause localized flooding (Chinasho,2015)

e) Discourage tourism and other business; the unpleasant odour and unattractive appearance of piles of uncollected solid waste along streets and in fields, forests and other natural areas, can discourage tourism and the establishment and/or maintenance of businesses (Orock ,2017).

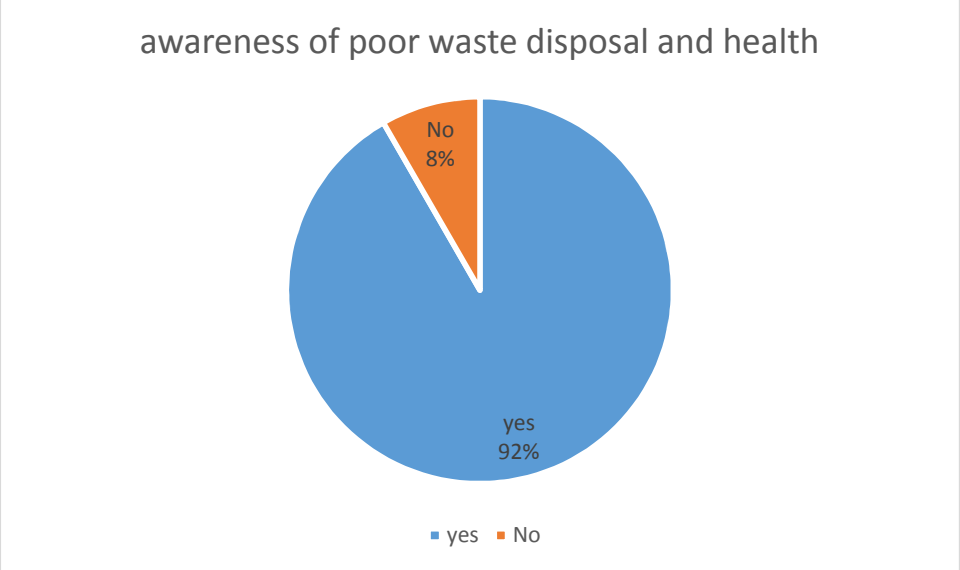



**Figure 6: linkages between indiscriminate waste disposal and health**

*Source: field survey 2019*

It is revealed from table 7 that majority of the respondents (57.29%) allude to the fact that there are no strict laws governing environmental sanitation. This they said encourages people within the study area to dispose of refuse indiscriminately. Twelve (12.50%) respondents indicate that they do not have bins to store waste, whilst 13 (13.54%) indicated that the skip container allocated to the area by zoomlion was inadequate to cater for the volume of waste generated in the study area. Eight (8.33%) respondents admit that public education was inadequate to enhance behavioural change of the people within the study area to stop indiscriminate disposal of waste. Notwithstanding, 8 (8.33%) admit that the communal containers are located far away from their dwellings.

**Table 7: Reasons for Indiscriminate Waste Disposal**

| Reason | Frequency | Percent |
|---|---|---|
| Because there are no strict laws governing sanitation | 55 | 57.29% |
| I don't have a waste bin | 12 | 12.50% |
| Inadequate skip container | 13 | 13.54% |
| inadequate public education | 8 | 8.33% |
| the container is far | 8 | 8.33% |
| Total | 96 | 100.0 |

*Source: field survey ( 2019)*

All 96 respondents admitted that poor waste disposal promotes the spread of diseases. The indiscriminate disposal of waste can attract vermin which can serve as a vehicle to contaminate food sources and spread diseases. Receptacles at the dump sites can collect water to aid the breeding of mosquito larvae which will mature into adult mosquitoes to bite and cause malaria.

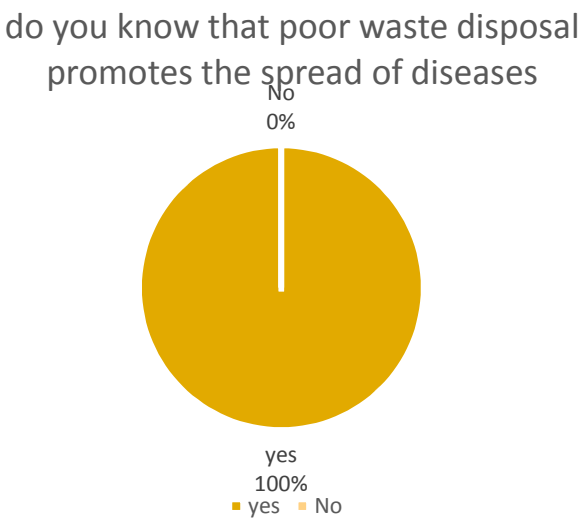



**Figure 7: Poor Waste Disposal and Diseases**

***Source: field survey, 2019***

It is indicated in figure 8 that majority, 65(68%) of respondents in the study area fall sick most often whilst 31 (32%) indicated that they don't fall sick most often.

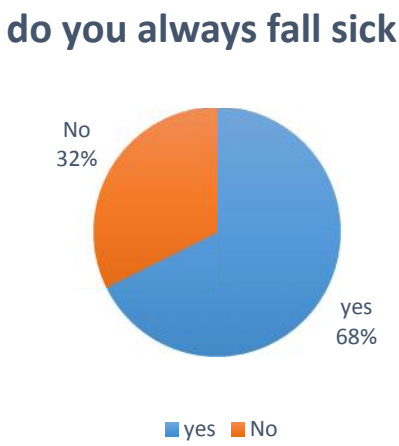



**Figure 8: Health Status of Respondents**

*Source, field survey (2019)*

Table 8 below clearly shows that majority 45(46.88%) of the respondents normally suffer from Malaria because of poor waste disposal. Also, 29 (30.21%) indicated that they normally suffer from cholera. 22 (22.92%) suffer from Typhoid fever.

**Table 8: Types of sickness residents normally suffered from.**

| Response | Frequency | Percent |
|---|---|---|
| Malaria | 45 | 46.88% |
| Cholera | 29 | 30.21% |
| Typhoid | 22 | 22.92% |
| Total | 96 | 100.0 |

*Source: field survey (2019)*

From the Table 9 below, it shows that most (97.92%) respondents are of the view that improper waste disposal affect the environment.

**Table 9: Effects of improper waste disposal on the environment**

| Response | Frequency | Percent |
|---|---|---|
| Yes | 94 | 97.92% |
| No | 2 | 2.08% |
| Total | 91 | 100.0 |

*Source: field survey (2019)*

# CHAPTER FIVE

# SUMMARY, CONCLUSION AND RECOMMENDATION

## 5.1 Introduction

The chapter looks at the overview of the study, conclusions and recommendations based on findings as presented in the previous chapter.

## 5.2 Overview of the Study

This study sought to investigate the effect of indiscriminate solid waste disposal and environmental issues associated with the management of solid waste in Amamoma; a community in the Cape Coast Metropolitan Assembly area. The objectives of the study was to assess the types and composition of solid waste generated in Amamoma community, to identify the method of waste disposal within Amamoma, to analyse the mode and frequency of solid waste collection, to analyse how the waste collected is finally disposed of, to assess the capacity of the waste management institutions in managing solid waste in the area, to make recommendations for effective management of solid waste in Amamoma.

Primary and Secondary data were used for the study. Primary data were acquired through semi-structured questionnaires administered to a sample of 96 respondents which was randomly selected from the study area. Data were entered into a computer and analyzed with Statistical Package for the Social Sciences (SPSS) and Microsoft Excel 2013. The relevant information was retrieved in a standard form using tables, figures, frequencies and percentages for analysis and interpretation of the information.

Information on environmental issues emanating from poor management of indiscriminate solid waste was obtained from literatures that are relevant to the study. The results of the

findings obviously show that major streets, open spaces, and even water ways are being used as refuse dump sites within the study area. The major environmental issues resulting from improper disposal and poor management of solid waste in Amamoma are physical nuisance of the waste to the environment.

Therefore, this paper recommends that a strong legislation with severe penalty be put place and there should be a continuous public enlightenment/education on the danger of indiscriminate waste to the general public.

### 5.3 Summary of findings

Through the analyses, the following are the key findings of the study.

#### 5.3.1 Composition of Waste

The Study revealed that plastic waste was amongst the highest recorded types of waste generated in Amamoma community. Respondents generate plastic waste.

The considerable proportion of plastics in the waste stream could be explained by the increasing use of plastic products in packaging and by the fact that plastics are also being used in Ghana as stretched high density polyethylene (HDPE) in sachet water packaging, polyethylene terephthalate (PET) bottles for bottling drinks and water, low density polyethylene (LDPE) and polystyrene (PS) as bags From the data it appears that the sizable fraction of plastic waste is an indication of the fact that with the setting up of many plastic industries in Ghana, the generation of plastic waste is likely to increase over time thereby rendering the current challenges regarding plastic waste management in the country very severe.

### 5.3.2 Waste Disposal and attitudes of respondents towards waste management

The data revealed that majority of the respondents dump their waste at unauthorized places because of convenience and the assertion that cleaning and management of waste was the preserve of Zoomlion. With regards to willingness to pay for refuse management, majority indicated that they would not pay because the Government has contracted Zoomlion to manage waste. Other challenges were the inadequate communal refuse receptacles. Only three skip has been allocated to community and the haulage frequency of once per week is not ideal as indicated in figure 5, the long distance between the nearest skip and people's houses, and the dissociation of an important segment of the sample of respondents (34%) from the two methods of waste collection in the municipality as they had their own way of dealing with the waste generated in their houses. Again, the respondent suggest that households be given litter bins for the storage of waste to minimize the chance of dumping at unauthorized places. Generally, attitudinal issues accounted for the indiscriminate disposal of refuse in the study area.

### 5.3.3 Health Hazards and impact of poor waste management.

Majority of respondents are aware of the implications of poor waste management on their health as indicated, cholera and typhoid fever are the most common illnesses they suffer from. A visit to the dump sites, one saw pigs, chickens, and other domestic animals feeding on disposed items and flies could be seen perching on items believed to be human excreta tied up in a polythene bags.

Proper methods of waste disposal have to be undertaken to ensure that it does not affect the environment around the area or cause health hazards to the people living around.

## 5.4 Conclusion

The results of this study indicate that the indiscriminate disposal of waste in Amamoma is associated with many challenges which need to be addressed holistically so as to achieve the core objectives of waste management i.e. the protection of public health and the quality of the environment. The key findings regarding these challenges are as follows:

Indiscriminate solid waste generation, disposal and management in Amamoma is a serious issue because of the environmental issues this waste bring. From the findings of this study, it was revealed that indiscriminate disposal of solid waste in the study area has several effects on individuals as well as the society at large.

These effects range from its negative impact on environment, health, and also peoples' attitude which will have multiplier effects on the present and future inhabitants of the area.

Indiscriminate disposal of solid waste causes infectious disease among people, contamination of food and water, air pollution.

It also serves as breeding sights for disease vectors. Indiscriminate disposal of refuse causes environmental degradation, soil pollution, creates harmful soil that is bad for crops production, environmental mess and poor environmental hygiene.

People's attitude such as refusal to pay waste management bills, laziness, violation of bye laws on refuse disposal and also some people may not be able to pay for waste management bills. All these could be described as the reasons of indiscriminate disposal of waste in Amamoma.

## 5.5 Recommendation

Based on the findings of the study, the following measures are recommended to mitigate the effect of indiscriminate disposal of waste in Amamoma. These are discussed below:

### 5.5.1 Enforcement of Regulations on Waste Disposal

The study has proved that the residents have negative attitude toward waste disposal. To curtail this negative public attitude to waste disposal, the Metropolitan Assembly must strictly enforce existing by-laws on waste disposal. Penalties for waste disposal offences should include court fines, signing of bond of good behaviour, orders and even imprisonment depending on the gravity of the offence committed. Such enforcement measures could change the rather poor waste disposal culture among the residents.

To facilitate the enforcement of by-laws on waste disposal, the existing environmental sanitation guards need to be well equipped for the task. They also need the support of the law- enforcing agencies such as the police and the courts to help bring offenders to order. These measures will go a long way to improve the waste disposal situation in the area and also make the work of the service provider easy.

### 5.5.2 Public Health Education

There should be public enlightenment on the dangers of indiscriminate disposal of solid waste.

### 5.5.3 Payment for Waste Management

Households within Amamoma should be encouraged to pay realistic fees for waste services to discontinue the practice of disposing waste indiscriminately.

### 5.5.4 Provision of adequate skip containers and domestic bins

Adequate skips and dustbins should be provided by Zoomlion in collaboration with the Metropolitan Assembly for residents in the study area to store waste. This will discourage people from dumping waste indiscriminately.

### 5.5.5 Communal Labour.

Residents of Amamoma should embark on monthly cleanup exercise to rid the community of accumulated waste

### 5.5.6 Waste Segregation and Composting

At the household-level proper segregation of waste has to be done and it should be ensured that all organic matter is kept aside for composting, which is undoubtedly the best method for the correct disposal of this segment of the waste. In fact, the organic part of the waste that is generated decomposes more easily, attracts insects and causes disease. Organic waste can be composted and then used as a fertilizer.

## REFERENCES

Adongo, R., Kuuder, C., Amoako, E., Asare, W., Duwiejuah A., Arthur, V. (2015). Stakeholder Views on Waste and Its Management in Tamale Metropolis, Ghana. *Journal of Scientific Research & Reports 6(5), 340-349*

Alam, P. and Ahmade, K. (2013). Impact of Solid Waste on Health and the Environment, International Journal of Sustainable Development and Green Economics, 2(I-1, 2), 165-168 World bank report on urban waste problem, 2012 https://cleanleap.com/urban-waste-problem-and-tech-solutions Environmental Sanitation Policy. Ghana (2010). Pg 7-12

Aljaradin (2012 Status of Solid Waste Management in India, Implementation Status of Municipal Solid Wastes, Management and Handling Rules 2000, Central Pollution Control Board, New Delhi.

Banda, L. (2011). *Challenges of Waste Management.* Sunday Times of Zambia. Retrieved on 26 June, 2019 from www.times.co.zm

Briney, A. (2013) *An Overview of Municipal Waste and Landfills: How Cities Deal With Garbage, Recycling, Landfills, and Dumps. Free Geography Newsletter (free downloads).* Retrieved on 26 June, 2019. Available at http://www.geography.about.com/od/globalproblemsandissues/a/municipalwastelandfills

Dr. R.K. Khitoliya (2014) Environmental Pollution, (Revised Edition). Pg 25-28 Elizabeth Lachner – 2015, Bioengineering. Pg 155 https://books.google.com.gh/books

Environmental Protection Agency, (2009). Municpal Solid Waste Generation in the United States: Facts and Figures for 2009.

Environmental Protection Agency, (2011). Waste. Retrieved from www.epd.gov.hk/e/pd/english/environmentinhk/waste_maincontent.html. Retrieved on 26 June, 2019.

EPA, MES, MLGRD, Ghana Landfill Guidelines. Best Practice Environmental Guidelines. Accra: Ghana: EPA, MES, MLGRD, Ghana Landfill Guidelines; 2002. [Google Scholar]

EPA. Manual for the preparation of District Waste Management Plans. Accra: Ghana: EPA; 2002. [Google Scholar]

FEPA (1992) Federal Environmental Protection Agency Act, 1992. FME (2005).

FME (2005). Federal Ministry of Environment, Abuja. *National Environmental Sanitation Policy and Guidelines*. January 2005.

Jurgita.Malinauskaite (2017) solid waste management and waste-to-energy in the context of a circular economy and energy recycling in Europe, vol 140 Ghana, Cholera kills 25 in Ghana. Africa News Website. Accra: Ghana; 2010. http://www.afriquejet.com/news/africa-news/ghana:-cholera-kills-25-in-ghana-2009020521233.html

Khatib (2011) Urban Solid Waste Series, Vol., 3. Amsterdam and Gouda: Tool, Transfer of Technology for Development and WASTE Consultants

Mbina, A. and Edem, E. (2015). Challenges of Urban Waste Management in Uyo Metropolis, *Nigeria.Civil and Environmental Journal,* 7(4), 196-205

Morrison, M. (2011). *SWOT analysis in Nursing and Healthcare*. Accessed online at https://rapidbi.com/swot-analysis-in-nursing-health-care/. Retrieved on 29th June, 2019

Ogawa, H. (2005). Sustainable Solid Waste Management in Developing Countries. (www.gdrc.org) (Accesses on 1st June, 2019)

Pervez Alam1 & Kafeel Ahmade2 (2013) impact of solid waste on health and the environment.

Puopiel, F. (2010). 'Solid Waste Management in Ghana, the case of Tamale Metropolitan Area', MSc Thesis, Kwame Nkrumah University Science and Technology, Kumasi- Ghana.

Santra, S. C.(2013). *Environmental Science*. (3rd Edn). Kolkata: New Central Book Agency (P) Ltd India.

Tchobanoglous, G., Theisen, H. and Vigil, S. (1993). Integrated Solid Waste: Engineering principles and management issues. McGraw-Hill Publishing company, USA. USEPA,2017 https://www.epa.gov/recycle/recycling-basics

Tobore, E. (2012). Solid Waste Management in Nigeria. Retrieved from: www.dwaste.com/new.../item/.../13_2eb98714b1d4af8a8c8c0d5e0ba7b5ed.html . On July 8, 2019

Tsiboe IA, Marbell E.(2004) A look at urban waste disposal problems in Accra, Ghana. Masters thesis. Roskilde University 2004. p1-90

U.S. Environment Protection Agency (2010). Proposed Revision to Definition of solid waste- frequent Questions. http://www.epa.gov/osw/nonhaz/municipal/index.ht

**APPENDIX**

# PRESBYTERIAN UNIVERSITY COLLEGE, GHANA
# FACULTY OF DEVELOPMENT STUDIES
# DEPARTMENT OF ENVIRONMENTAL AND NATURAL RESOURCES MANAGEMENT
# MASTER OF SCIENCE IN ENVIRONMENTAL HEALTH AND SANITATION
# QUESTIONNAIRE

Dear respondent,

The researcher is a Master of Science in Environmental Health and Sanitation student. This research seeks to collect data on the topic: **Indiscriminate disposal of waste in Amamoma.** Your candid opinion on the subject matter will be most welcome. Be assured of the confidentiality and anonymity for all the responses you will provide.

I count on your usual cooperation and professionalism.

Thank you.

**Please tick (*) the appropriate box provided.**

**SECTION A: Socio-demographic data of respondents.**

1. What is your gender? Male [ ] Female [ ]
2. What is your age in years?
   a) 18 – 25 [ ]
   b) 26 – 35 [ ]
   c) 36 – 45 [ ]
   d) 46 and above [ ]
3. What is your occupation?
   a) Public service [ ]
   b) Private [ ]
   c) Unemployed [ ]
   d) Student [ ]
4. What is your level of education?
   a) Not schooling [ ]
   b) Primary [ ]
   c) JHS [ ]
   d) SHS [ ]
   e) Tertiary [ ]
   f) Others [ ]
5. What is your monthly income level?

a) High-GH1000 and above [ ]
b) Average-GH 500-1000 [ ]
c) Low- below GH200-500 [ ]
d) No income [ ]

6. What is your religious affiliation?
a) Christian [ ]
b) Muslim [ ]
c) Others [ ]

**SECTION B: Waste Management**

7. Do you generate solid waste in your household?
……..

8. Which of the following types of waste do you generate in your home?
a) Food waste [ ]
b) Plastic waste [ ]
c) Paper waste [ ]
d) Metal waste [ ]
e) Wood [ ]
f) Glass [ ]

9. Where do you dump your waste?
a) Skip container [ ]
b) Waste bin [ ]
c) Dump sites [ ]
d) Open spaces [ ]
e) Back yard [ ]

10. Why do you dump it in the said place in question 9?
a) It is the duty of Zoomlion to clean it [ ]
b) Because it is convenient [ ]
c) Because the dump site is closer to my house [ ]
d) Because it is safe to dump it there [ ]
e) Because it is the most convenient place [ ]
f) That is the only place to throw it [ ]
g) To keep my immediate surrounding clean [ ]
h) Because it is very convenient [ ]

11. Do you pay for dumping waste in skips?
……..

12. If no, why?
a) Because it is the duty of Zoomlion to collect waste [ ]
b) Because I am not aware I have to pay for my waste [ ]
c) The amount charged is too high in my area [ ]
d) No money [ ]
e) Others……..

13. If yes, how much are you charged averagely?
a) GHC 35 [ ]
b) GHC 15 [ ]
c) GHC 10 [ ]
d) GHC 1 [ ]

14. How long do you travel to dump waste?
    a) 2-10 minutes [ ]
    b) 11-15 minutes [ ]
    c) 12-25 minutes [ ]
    d) More than 25 minutes [ ]
15. Is it convenient to travel 10 minutes to dump waste?
    a) Yes [ ]
    b) No [ ]
16. Which Institution/ Waste Management Company is responsible for collecting and safely disposing your waste?
    a) Motor tricycle operators (aboboya) [ ]
    b) Zoomlion Ghana Limited [ ]
    c) Cape Coast Metropolitan Assembly [ ]
    d) None [ ]
17. How many times is the waste collected in a week?
    a) Once a week [ ]
    b) Twice a week [ ]
    c) Three time a week [ ]
    d) Not at all [ ]
18. How do you think disposal of solid waste should be managed?
    a) Every household should get a bin for the storage of waste [ ]
    b) Paying for the collection and disposal of waste [ ]
    c) More public education of the effects of indiscriminate disposal of waste [ ]
    d) Strict enforcement of existing sanitary laws [ ]
    e) Provision of approved dump sites close to households [ ]

**SECTION C: Effect of Waste Management**

19. Are you aware there is a link between poor waste disposal and health?
……..
20. If yes, why do you indiscriminately dispose of waste?
    a) Because there are no strict sanitary laws [ ]
    b) I do not have a waste bin [ ]
    c) Inadequate skip containers in the area [ ]
    d) The container is far [ ]
    e) Inadequate public education [ ]
21. Do you know poor waste disposal promotes the spread of diseases?
…….

22. Do you always fall sick?
……
23. What kind of sickness do you normally suffer from?
    a) Malaria [ ]
    b) Cholera [ ]
    c) Typhoid [ ]
    d) Others [ ]
24. Does improper disposal of waste affect the environment?
…….