

UNIVERSITY FOR DEVELOPMENT STUDIES

TAMALE



HEALTH EFFECTS OF THE GBALAHU LANDFILL SITE ON THE RESIDENTS

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THE REQUIREMENT FOR THE MASTER OF PUBLIC HEALTH DEGREE (MPH)**

BY

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DECLARATION

Students declaration

I hereby declare that this submission is my work towards the degree of Master in Public Health (MPH) is my work and to the best of knowledge it contains neither materials previously published by another person nor materials which have been accepted for the award of any other degree in the University except where due acknowledgement has been given in the text.

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Supervisors declaration

Hereby declare that the preparation and presentation of this thesis was supervised in accordance with the guidelines of supervision laid down by the University for Development Studies.

NAME: DR SHAMSU-DEEN ZIBLIM (Supervisor)

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Date:



DEDICATION

I dedicate this work to my lovely husband, Dr Egho-Promise E. Iyobor and my wonderful princess, Favour and Faith for their understanding and support all through the programme.



ACKNOWLEDGEMENT

I owe all thanks and gratitude to the Almighty God for His divine grace, love and for showers of His munificent mercies on me by granting me the wisdom, knowledge, understanding, health and strength to complete this academic exercise successfully.

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ABSTRACT

Urbanization and exponential population growth have led to a large quantum of waste generation which is sent to the landfill site where they are inappropriately managed as a result of inadequate funding, old and frequently broken-down equipment and workers with poor technical skill resulting in aesthetic environmental conditions in the landfill site at Gbalahi. The population living close to the landfill site is exposed to various forms of diseases which adversely affect their health. This study therefore aimed at investigating the health effects of the landfill site on the people of Gbalahi.

The study design adopted for this study was a cross sectional and mix method approach was employed in conducting this study. Survey questionnaire was the sole quantitative tool for data collection while key informant interview guide, focus group discussion guide as well as observation checklist were the tools used for the qualitative data collection. 150 participants took part in the study.

The study revealed that those living very close to the landfill site suffered from all kind of morbidities. It also revealed that water bodies in the area are constantly contaminated leading to outbreak of diseases in the area. The most common diseases reported were malaria, cholera,

diarrhea, respiratory infections and typhoid. The study concluded that the people in the area are suffering and their health situation is deteriorating daily. It therefore recommended that the

Tamale metropolitan Assembly should come to their aid by providing them with quality drinking water, the Ghana Health Service should also help in conducting periodic health screening for the people and also for long term development plan, the Tamale metropolis should try to relocate the people or relocate the landfill site so that people will be far from its effects.



LIST OF ABBREVIATIONS AND ACRONYMS

AMA	Accra Metropolitan Assembly
EDR	Environmental Dioxin Risk index
EPA	Environmental Protection Agency
FCUBE	Free Compulsory Universal Basic Education
GSA	Ghana Standard Authority
GSS	Ghana Statistical Service
IARC	International Agency for Research on cancer
JHS	Junior High School
KMA	Kumasi Metropolitan Assembly
MMDA	Metropolitan, Municipal and District Assembly
MMDAS	Metropolitan, Municipal and District Assemblies
MSWM	Metropolitan Solid Waste Management
NEMA	National Environment Management Authority
NHIS	National Health Insurance Scheme
NIMBY	Not in My Backyard
SPSS	Statistical Package for Social Sciences
STMA	Sekondi Takoradi Metropolitan Assembly
SWM	Solid Waste Management
SSA	Sub-Saharan African
TaMa	Tamale Metropolis Assembly
WHO	World Health Organisation
UN HABITAT	United Nation Habitat



VOCs Volatile Organic Compounds (etc)

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CHAPTER ONE

1.1 Study Background:

In the world currently, Solid Waste Management (SWM) of municipal and metropolitan is one of the most sensitive development issues hounding developing countries. Categorically, it can be stressed that increase in the solid-waste generation rate is a function of both population and prosperity (Mane and Hingane, 2012). Most developing countries including Ghana are facing exponential growth in population, coupled with other issues associated with urbanization. Urbanization been associated with growing economies has posed a significant stress on the environment. Furthermore, Achankeng (2003), admitted that the existing unprecedented urban growth in Africa can also be attributed to globalization as a factor. It was postulated by Hardoy, Mitlin and Satterthwaite (2001), that the rapid rate of urbanization accounts for the large number of people, trade and manufacturing in most African countries hence results in the quantum of municipal solid waste. It was noticed that in the urban sub-Sahara Africa, the growth rate of the population is four to seven per annual. Globally with high rate of industrialization, people are introducing new and complex chemicals into the environment without any rigorous bio-assessment of their toxicity (Mane, et al., 2012).



Solid waste comprises of waste from household, solid waste from industries and commercial organizations that are harmless (like hospitals), shop waste, grass waste and waste from road cleaning which suggests a change in lifestyle and increase production skill in the world. (Schubeler, Wehler and Christen,1996). Though, inappropriate solid waste management (assembly, transference, handling, reprocessing, resource retrieval and dumping of solid waste) is related to an extensive variety of dangers plus the sluggishness of fiscal growth, spread of disease, ecological squalor, weather alteration and adverse effect on livings. In the urban

settlements large amount of waste is produced within a negligible zone which makes the threat more conspicuous. Certainly, poor Solid Waste Management in metropolises and big towns has harmful effects on the atmosphere, quality of the people's life as well as the health of the public (NEMA, 2014).

World Health Organization (WHO) has reported solid waste as the next utmost significant ecological fitness apprehension other than water superiority (Zerbock, 2003; Monney, Tiimub, and Bagah, 2013). In urban Africa, mainly in sub-Saharan Africa (SSA), problems instigated by solid waste is mainly as a result of volatile development that finally transforms to the production of large quantity of solid waste (UN-HABITAT, 2010; Taiwo, 2011). One of the greatest vital challenges confronting establishments in rapidly developing metropolis in the emerging nations is solid waste management. (Monney, et al., 2013).

Generally, the waste management approach implemented by the decision makers locally, provincially and countrywide determines the public health effects and impact on health which could directly lead to possible adverse health effect like risk of cancer and reduced quality of life. The health challenges confronting the resident close to the waste site is common and essentially identical to the challenges confronting the resident far from the waste site. Impacts of

health are not exact; the response that is seen is dependent on the susceptibility of the individuals as well as the level of exposure to contaminant as people have different ways of responding to internal and external assaults. Some household close to the waste site may be affected as those far from the waste site as well as some individuals in these houses while others are not affected, this is due to differences in individuals' level of sensitivity and confrontation to a variety of biochemical and bodily abuse. In cases where the rising occurrence of a hostile health



consequence cannot be established to nearness of the hazard, it will be difficult to state categorically that the cases are directly linked to the hazard under consideration.

Extensive variety of damaging contaminants are emitted from the landfill site which includes leachate, gases and particulate substance which can pollute the air, soil, water bodies and cause illness to human. (Koshy, Paris, Ling, and Jones, 2007). Within the past few periods, solid waste disposal especially in some main Nigeria cities, have brought about major environmental and public health challenges in most of the open dumpsites that were cited in the outskirts and are now are within the city due to development and relocation/immigration.

According to Ghana Statistical Services, 2013, Population and Housing result from 2010 statistics show that from 1960, a little above half of the population in Ghana reside in cities for the very first time. The city population rose from 23.1 in 1960 to 50.9 in 2010. Greater Accra region for instance, the number of the city population has risen from 72.6% in 1960 to an incredible 90.5% in 2010 (Ghana Statistical Service, 2013). The resultant effect of this increase has led to the scramble for land for residential building and also for waste disposal.

The real problem of this technical process is to link the threat to the health effect. It is well proven that dangerous mixes are emitted from the landfill which causes health challenges to the

populace residing or working close by. One important question must be asked if there is an uptake by the populace or they exposed to these hazards? if yes, to what extent. If the exposure rate is insignificant or no exposure at all then it will be very difficult to establish that there is a direct association amid the landfill site and the health effects. People can get in contact with contaminant from the landfill site in different ways such as by taking in contaminated food or water, inhalation, physical interaction with the skin and fire. (USA, National Research Council, 1991)




1.2 PROBLEM STATEMENT

Though, there is evidence of many residential facilities around the landfill sites. The rapid population growth, urbanization and its associated real estate growth has led to a competition of the land around the landfills, located within a peri-urban area. According to Ghana statistical service (web) the 2010 National Population and housing census states that the metropolis population was 233,252, which comprises 111,109 males (49.8%) and female 112,143 (50.2%). With a population density is 318.6 persons per square kilometer which is about 12 times higher than the regional average density is 25.9 persons per square kilometer (Puopiel, 2010).

Waste management problem has been on from the era when human had to change from hunting, assembly societies to established communities. Generally proper waste management practice has been known to offer a better living condition as well as decreases the threat of health hazards which leads to good and increase output and wellbeing of the population.

In Ghana, urbanization has picked up a significant momentum over the last two decades. Hasty urbanization in the previous eras has led to a high populace attentiveness in main cities of Ghana, including Tamale, thus leading to huge pressure on land, city substructure and facilities (Owusu-



Sekyere, Osumanu, and Yaro,2013b). In Accra for example, waste generation is noticed to have tripled in the past two eras, due to the rapid rate of urbanization (Water Aid and European Union, 2008) which is putting terrific pressure on existing solid waste disposal facilities. Unfortunately, urban establishments do not have the requisite monetary and mechanical capitals to be able to manage the problems related with the large quantum of solid waste generated. (Ogwueleka, 2009). Inappropriate management of the landfill site has brought about severe ecological effect, if not put under control will result in catastrophic effects. Lack of protective clothing/materials

against the landfill hazard as well as frequently broken-down old equipment make the work at the site difficult. Unfortunately, Lack of pile resources at the site to shield the waste dumped so as to diminish the odour and fly irritations resulting from the waste accumulated. This buttresses the fact that there is still a huge challenge with the management assembly of solid waste despite the numerous private waste collection firms that has been employed to supplement the effort of government in the area of waste collection and management. As far as the rate of urbanization continues to rise and strategies to remedy the challenges do not keep pace with the rise, the problem of indiscriminate waste disposal will continue to be a topical issue. (Owusu-Sekyere, et al., 2013).

According to Pacione, (2005), with respect to waste management in terms of collection, he stated that about one-third and one –half of the entire waste produced within metropolises are not collected hence is the major glitches confronting the unindustrialized country. In the two-principal metropolis in Ghana Accra and Kumasi, Studies have shown that more than 3,000 tons of solid waste are produced daily and only 70% is collected (Anomanyo, 2004; Ketibuah, Asase, Yusif, Mensah, and Fischer, (2004). The 2009, statistics presented by The Accra Metropolitan Assembly stated that in Accra only about 2,000 metric tonnes of waste was produced daily, out of which only 1,200-1,300 tonnes were appropriately collected (AMA, 2009). For instance, in Tamale, Puopiel (2010) stated that about 27% of 810 tons were collected in the daily waste produced. (Puopiel, 2010). In Ghana, (Monney et al., 2013) noticed that a proportion of solid waste generated that is not collected usually gets into our drains and open spaces which is a threat to the environment and the life of the human beings. The consequences include flooding, water contamination, and the proliferation of diseases and unpleasant sights of foul-smelling and pest-infested heaps of urban solid waste (Boadi and Kuitunen, 2004; Puopiel, 2010). Solid waste



disposal has the greatest historical significance among the environmental challenges. (Gilbertson, 1969).

Researches done with the use of physical or three-dimensional methods have proven that there is a relationship between residing close to the landfill site and health effects (Pukkala and Pönkä, 2001; Gouveia and do Prado, 2010). Goldberg, Siemiatyck, DeWar, Désy, and Riberdy 1999; Pukkala et al., 2001 and Gouveia et al., 2010 acknowledged that among people residing close to the landfill site there is an increased risk of liver, stomach, lung, prostate, kidney and pancreatic cancer and of non-Hodgkin lymphoma. Similar studies also established that it has an adverse pregnancy outcome such as congenital abnormalities, low birth weight, abortion and neonatal death (Elliott, Briggs, Morris, de Hoogh, Hurt, Jensen, Maitland, Richardson, Wakefield and Jarup 2001; Elliot, Richardson, Abellan, Thomsom, Hoogh, Jarup and Briggs, 2009 and Palmer, Dunstan, Fielder, Fone, Higgs, and Senior, 2005). Notwithstanding the health aspects, other studies have also detected the effects of landfill sites on the landed properties close to it. The findings of the studies showed that environmental nuisances or irritants such as noise, smoke, fire, odor from landfill sites reduced the economic value of housing properties (Nelson, Genereux, and Genereux 1992; Lim and Missios 2007), especially in areas such as Ghana, where landfills are poorly managed (Boadi et al., 2004; Puopiel, 2010; Owusu, Nketiah-Amponsah, Codjoe, and Afutu-Kotey 2014). Empirical study conducted in Ghana has shown that landfills do depress the value of nearby residential properties (Owusu, et al., 2014). Regrettably, a lot of birds, insects, reptiles, rodents even flies are attracted to the landfill sites because of the waste they feed on and carry vector borne disease. The presence of the landfill site close to residential houses predisposes the populace to diseases or infectious such as malaria, typhoid, tetanus,



cholera, eczema, dysentery and dengue fever, because the landfill site is a breeding site for disease vectors like rats and mosquitoes that transmits serious disease (Oduro 2004; Coffie 2010).

After the recognition and consideration of the hazard involved in living close to landfill site, the Ghana government passed the National Sanitation Policy to help manage waste disposal in the country. Under the Government's Sanitation Policy (2002) in the area of waste removal/land filling, there has been establishments responsible for 'acquiring adequate land, protect designation with imbursement of owed recompense for the land for instant and imminent use also to shield such achievement by appropriate separation and fencing. The reason for this policy is to purchase adequate land for waste disposal that should not have health impact, bring bad scent to the residence in the nearby communities.

Gbalahi landfill site in the Tamale metropolis has become an eyesore and a major hazard to the health of the people in the area. Other than the artistic problems produced by the indecorous dumping approaches, the health and ecological insinuations cannot be overlooked. During raining season, the rain water carries part of the wastes from the landfill into the Gbalahi dam which is the only drinking water source for the people. A lot of studies (Goldberg, et al., 1999; Elliott, et al., 2001; Pukkala, et al., 2001; Palmer, et al., 2005; Elliott, et al., 2009; Gouveia, et

al., 2010) have been done in this area trying to examine the health effect of the landfill site on residents who live close by in developed Country. According to Boadi et al., 2004; Puopiel, 2010; Owusu, et al., 2014, in the developed countries few studies have been carried out which uncovered some effect of the landfill site on nearby residents, but findings are still inconclusive.

It is against this background that this study is conducted to actually ascertain the health effects of landfill on the population living close to it and also to come out with measures that when



implemented will help reduce the health risks of the people staying close to landfill in Gbalahi in the Tamale metropolis and beyond.

In addressing this issue, the following questions are posed:

1.3 RESEARCH QUESTIONS

The main research question of this study is, what is the health effect of the Gbalahi landfill site on the residents?

1. What are the types of wastes deposited at the Gbalahi landfill?
2. What is the perception of the people living closed to the Gbalahi landfill on the health implication of the hazards they are exposed to?
3. What is the effect of the Gbalahi landfill site on water and food pollution?
4. What are the common diseases the people are exposed to as a result of their proximity to the Gbalahi landfill?
5. What are the measures put in place by the Tamale Metropolitan and the Sagnarigu Municipal assemblies to reduce or mitigate the hazards the residents of Gbalahi are exposed to?

1.4 STUDY OBJECTIVES



The main objective of this study is to examine and analyze the health effects of the Gbalahi landfill site on the residents.

1.4.1 SPECIFIC OBJECTIVES

The study addressed the following specific objectives:

1. To investigate and examine the type of waste deposited at the Gbalahi landfill site.

2. To ascertain the perception of the people living closed to the Gbalahi landfill on the health implication of the hazards they are exposed to.
3. To assess the effects of the Gbalahi landfill site on water and food pollution.
4. To investigate the common diseases the people are exposed to as a result of their proximity to the Gbalahi landfill.
5. To examine the measures put in place by the Assembly to mitigate the health challenges which residents near the dumpsite are facing

1.5 Significance of the Study

The research efforts examined the effects of Gbalahi landfill site on the health of the residents in the Tamale Metropolis in the northern region of Ghana. The finding of this study will serve as a stock of knowledge in environmental management and it will thus help policy makers to design the most effective and efficient ways of landfill site management so that the health of the population will not be compromised.

This study is also meant to create awareness among residents of Gbalahi beyond living around landfill sites and the need to adhere to personal hygiene practice and also to assist them to understand the health risks they are exposed to.

The study will as well assist the residents living around the landfill area on measures, they will adopt in protecting themselves against infections and other environmental related morbidity.

It is expected that this study will add to the answer in the search for solution to the appropriate process and organization of the landfill in the Tamale metropolis and Ghana at large which will be of great interest to the relevant stakeholders, legislators, researchers, administrators and the overall population.



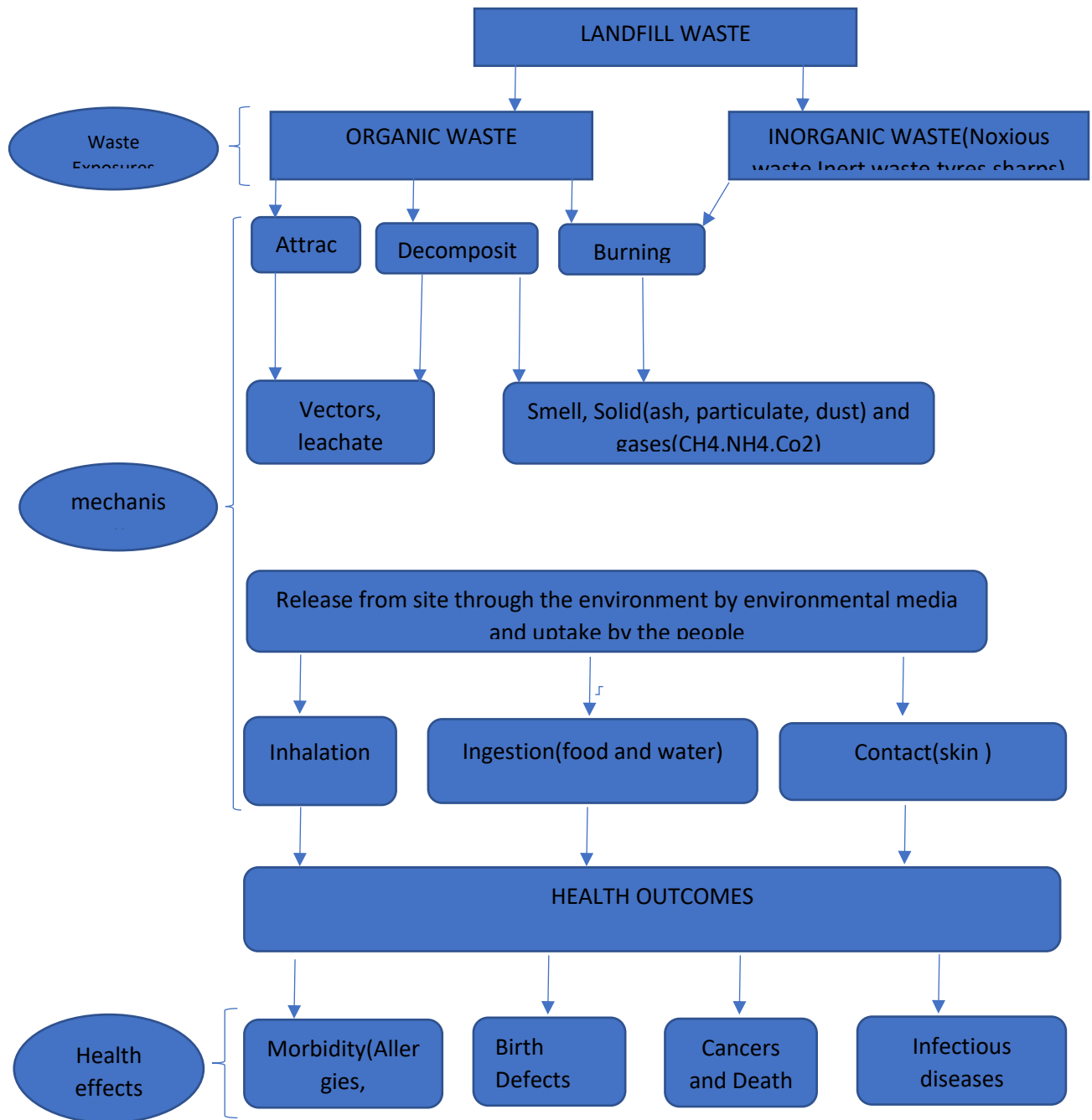
1.6 LIMITATION OF THIS STUDY

Due to the diverse languages spoken by the people in the area, as a non-native who is not from the country and does not understand the local language. Most of the respondent could not speak English which made answering the questionnaire difficult; the service of a linguist was employed to assist in carrying out the study. Some household that were chosen in the study had no occupant. Finance was also a challenge. Time was also a constraint, as students are expected to put in so much efforts to complete the thesis work within the time frame scheduled. Academic researches for the award of any degree are carried out within a stipulated period of Time.



FIGURE 1.1 CONCEPTUAL FRAME WORK

Source: Author's own construct, 2018



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The conceptual frame work reveals the waste from the landfill site which could be organic or inorganic. If organic, it attracts vectors, after decomposing it release leachates, offensive odors and gases and both organic and inorganic if burnt it release gas, dust, ash and particulate. These

are released into the environmental and through the environmental media, get in contact with human through various means like inhalation, ingestion and physical contacts subsequently leads to different health problems and outcomes.

1.7 Organization of the Dissertation

The dissertation has six chapters. Chapter one deals with the study background, problem statement, main and specific objectives of the study, research questions, conceptual framework that guided the study and significance of the study. Chapter two deals with the review of literature related to the topic under investigation. The review was done in relation to the study objectives; it also reviewed literature on health implications and nuisances associated with landfill site. Chapter three which is the methodology discusses the method used to collect data, sample size and method used in selecting the sample from the population. Chapter four focuses on analysis of data collected and the presentation of result while chapter five deals with discussion of the result and chapter six which is the final chapter, gives a summary of the major findings and ends with policy recommendations.



CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

The chapter focuses on the review of related literature on the study and also to guide the study on the gap of knowledge that this study needs to address. The chapter will concentrate mainly on the environmental and health effects of landfill on the population staying close to the site. The review was conducted in such a way that it does not go out of the objectives of the study.

2.2 Evolution of Land filling Practice

Some hundreds of centuries ago, majority of resident who reside in urban and rural areas dispose their waste outside their residences. Ultimately, due to the glitches of odor, rodents, litters, etc., associated with the waste in the area, it is then towed for disposal at an open dump typically situated in close, low-value land, which comprised burning of the waste. For instance, in California, food wastes that are dumped in landfill also serve as food for pigs. As a result of spread of trichinosis, an intestinal nematode causes disease (*Trichinella spiralis*), pigs eating or having solid waste as food was finally brought to a halt. According to Benenson (1985) due to

the infestation of the pigs with trichina cysts in the uncooked waste; a lot of the populace was infested by eating inadequately boiled pork. Improperly cooked pork meat has live trichina in them, when consumed they are release of the animal's cysts into the gastrointestinal track of humans or other faunae; which in turn gets into the plasma brook ultimately encyst in the muscle. Normally, trichinosis is not devastating if the trichina encysts in big, non-sensitive muscles. Nevertheless, when trichinosis gets into vital organs of the body it can lead to severe weakness and possibly death. In the earlier part of the 20th century, the percentage of the



population of the US that was infested with trichinosis after consuming improperly boiled pork was about 16% (Tchobanoglous, Theisen and Eliassen 1977). In a certain period, an attempt to decrease the challenges associated with the spread of trichinosis by pigs feeding on waste, effort was put in place to boil the waste before disposal. It was not a better solution; hence it was abandoned in favor of stopping animal from feeding on waste. A current study conducted in the city of Philadelphia to distinct pick-up of waste food that is to be used to feed pigs in New Jersey (Michaels, 1994). The waste food was boiled in order to diminish the possibility of the transmission of trichinosis. In an attempt to gain more knowledge on the operation, the pig farmer in new jersey who were involved were not ready to volunteer information on the extent to which the waste is boiled. This led to the inability of the author to tell if the waste was adequately boiled to kill the trichina cyst in the raw pork leftovers that are thrown away in Philadelphia.

Until 1950, in California open method of refuse dumping was the major method of waste disposal which had numerous challenges ranging from contained smells, pests like rodents, and seagulls, likely illness vectors like hovers and rodents; which was also a sources of underground water contamination in the neighborhood of the dump. From 1950's The US Public Health Service and some states comprising California started civic solid waste management (which frequently included manufacturing waste, both now called "hazardous" and "non-hazardous" waste) which is now known as "sanitary landfills."



Universally, the landfill sites are constructed safely to minimize all forms of negative externality such as ground water pollution through leachates to the surroundings. Environmental Research Foundation (2011); acknowledged that "A secure landfill is a carefully engineered depression in the ground (or built on top of the ground, resembling a football stadium) into which wastes are

put. The intention is to evade any hydraulic (water-related) linkage between the wastes and the surrounding environment, particularly groundwater. Basically, a landfill is a bathtub in the ground; a double-lined landfill is one bathtub inside another.” Normally, there are three kinds of landfill for solid waste disposal which includes: sanitary or secured landfills, controlled landfills and open dumps. According to the above definition, sanitary or secured landfills are extremely coated at the base to avert permeation by infiltrating fluids, controlled landfills is a type of landfill where waste are dumped and barely covered with soil while in the open dumps there is no typical practice for waste disposal (Gouveia, et al., 2010). Majority of developing countries dumps huge volume of their solid waste produced in either the controlled landfills or the open dumps which constitutes a health threat to the residents around the landfill site. However financial constraint is the main reason so many waste management authorities are unable to practice a sanitary landfill method of waste disposal. A study carried out by Gouveia & Prado on the health hazard of city solid waste landfill sites in Sao Paulo, Brazil, revealed that 47% of the entire waste put together were disposed of in sanitary landfills, 23% were dumped in the controlled landfills and 30% were disposed in the open dumps. Abul, Salam (2010) did a study in Manzini city, Swaziland, and acknowledged that the number of open dump site outweighs the secured landfill for waste disposal there by constituting great health risk to the residents. The



open dumps are breeding site for disease carrying vectors in the community they are cited; hence they are located in the outskirts. Due to the cost involved and the challenges associated with the practice this has prompted the municipal government authorities of few unindustrialized countries to implement cost-reduction programme and conservation tenets of "reduce, reuse, and recycle" to minimize the quantum of waste generated and recycle others (bio-degradable or non-biodegradable items). The above ideal is accomplished by violent community education of

consumers and producers on methods of waste reduction, “while institutions and businesses that could buy up discarded materials are facilitated to enhance recycling and reuse”. The above measure and actions will have optimistic environmental impact on the communities as well as significant financial dimension (Goldman and Ogishi, 2001).

Naturally, hygienic landfills are situated in low-value land, typically swamplands, which essentially is an open dump where everyday waste was concealed with a few creeps of soil. However, the soil was used to cover the waste to minimize entry of pests, hovers, and other irritation organisms from accessing the waste as well as to diminish the degree of emission of gases and smells from the landfill. In addition, the use of soil to cover the waste daily was to reduce gusting documents then additional wreckage related to the landfill. The initial and recent practice of sanitary land filling did not include any important requirements to avert either air contamination from vaporous releases or groundwater contamination from fluid discharges.

In modern centuries, the hygienic land filling method and related guidelines have been altered to frequently comprise “coating” underneath the landfill and other planned topographies in an effort to enclose the waste to solve the glitches of landfill releases. As will be said later, nonetheless, the “current” “dry tomb” landfill has been established today at best, is lone to adjourn difficulties

associated with such emissions and do not solve other several worries around the hostile impacts the landfill has on nearby property, proprietors and operators.

In developing countries, the presence of numerous open landfill site, has prompted the necessity to study the health insinuations of landfill on the residents. A cross-sectional epidemiological study was carried out in Cameroun by Yongsi, Hermann, Ntetu, Sietchiping and Bryant (2008) to study the health dangers of various waste disposal system and the finding revealed a “14% prevalence of diarrhea amid the respondents and a strong statistical association was found



between household refuse management methods and incidence of diarrhea among the respondents”. In Swaziland, Abul, Salam (2010) conducted a study around the Mangweneni Dumpsite, to examine the health implications of solid waste management among the residents. A unique study indeed as the “respondents were stratified by the distance of their homes to the dumpsite”. In this study the sample size was divided into two, as the first group resided within 200 metres radius, while the second group resides 200 meters away from Swaziland Manzini Dumpsite.

Both Lee and Jones-Lee (1993a) deliberated on the possible hostile impacts of public solid waste (MSW) landfills and waste managing amenities on the owner and use of nearby properties. As deliberated on by Lee and Jones-Lee, the momentous indigenous disagreement of the landfill citing is as a result of the MSW landfill emissions, lorry traffic, and challenges related with the usual land filling method and those who resist the citing of such a facility are frequently damagingly tagged and branded as "NIMBY's" ("not in my backyard"), meanwhile their worries are defensible. However possible adverse effect of the MSW landfill on the patronizes and property owners can be alleviated by appropriate positioning, landfill procedure, relocation of the landfill when it is full and management of the waste as far as it is a threat, passable measures are seldomly adopted by the developer of the landfill. The numerous challenges confronting the land fill of public solid wastes are straight consequence of vaporous and fluid (leachate) released from the landfill which spread to other neighboring possessions there by averting the patronage/usage of these assets and water resources. However, the users of the landfill site do not pay fees commensurate to the waste been dumped, in order for the fee to be used to care and manage the landfill site to prevent spread of disease, hostile effects on nearby property owners.



Joint challenges associated with the positioning of landfills was deliberated by Lee, Jones-Lee, and Martin (1994), while Lee, et al., (1993a, 1994a) debated on the methods to employ in tackling the possible opposing impacts of the landfill to consistently mitigate the defensible worries communicated by the owner or properties users close to the landfill, when it was found out that a government organization has nominated their locality for the citing of a new landfill or for continuous functioning arranged for closure. According to Lee, et al., (1993a, 1994a) the main concern with the placement of the landfill that is developed nowadays is to pay attention and tackling the possible harmful effects, which include the provision of a sufficient land bumper near the landfill. In the past and even now, the land filling practice do not consider the procurement of adequate lands around the landfill to minimize the harmful impacts of vaporous releases as well as those related to the landfill operations to be included as part of the budget of land filling of public solid waste.

According to Lee, et al., (1993a,1994a), acknowledged the scope of the effect of the numerous municipal solid waste landfills is due to range of issues like the degree of groundwater contamination, smells, and refuse truck movement that has effects on usual traffic stream etc.

Hirshfeld, Vesilind and Pas (1992) stated that the value of property close to the MSW landfills is unfavorably wedged by the landfill for a distance of a mile or two from the part where waste disposal ensues. It is definitely rational to imagine that a landfill that is located less than one mile and rather two miles to the landfill-owned buffer land among the farthest part where waste disposal ensues and neighboring possessions land owners will be averse to the property owners or users.



Globally, obtainable research on the operation and management of landfill sites appears to be directed by the same ideologies. For centuries now, numerous vocabularies and descriptions have been used for the word “solid waste” as well as used interchangeably with simple waste, refuse or garbage. According to Gilbertson 1969, he reiterated that the word “solid wastes” remained been used lately to distinguish amid the modern extensive notion connecting the management of waste and the earlier importance of refuse as well as other domestic wastes. Additionally, today, it indicates that solid waste comprises of non-gaseous, non-liquid waste produced from vast array of public, manufacturing, marketable, infirmity and agronomic events. Likewise, refuse can be defined as household, city and manufacturing solid waste, whose disposal means is not by water as the transport medium hence distinguishes it from liquid waste. Refuse is comprised of household trash and additional undesirable things waste cleaned from the roads and undesirable substances and constituents of numerous categories from marketable and manufacturing initiatives. (United Nation Centre for Human Settlement-Habitat,1994).

A rise in solid waste generation and their improper management is a leading difficulty of indigenous organization like Municipal Corporation. Urbanization as well as increase in population is one of the elements responsible for an upsurge in the quantity of waste generated.

According to finding from study done by Alam and Ahmade (2013) stated that liquid, excreta and solid waste from household and the municipal have severe health threat and is accountable for blowout of communicable diseases and environmental contamination. Solid waste disposal causes air, soil and water contamination which offers a conducive environment for organic vectors like insect pest, hovers and rodents. According to pradyumna (2013), a wide range of diseases such as dysentery, cholera, bacterial infection, food poisoning, worm infestation, dengue fever, leptospirosis and diarrhea, are instigated by these biological vectors.



In 1982, Clark, Meyer, Balistreri, Gartside, Elia, Majeti and Specker stated that based on the information given by the parents the occurrence of countless health difficulties such as abdominal pain, seizures, eye irritation, hypersensitivity, skin rashes, learning problems and incontinence are seen in children that reside near the landfill site is likened to control. Health reviews examined numerous health problems that were self-reported. It was noticed that numerous problems are linked to health as a result of the odor produced from landfill sites. One of the numerous challenges associated with the landfill site is the odor emanating from leachate, landfill gases, and deposited material. Numerous health glitches such as headache, allergies nose and eye, irritation of skin, fatigue, psychological disorders, nausea and gastrointestinal problems is developed as a result of inhalation of or exposure to this offensive odor.

Logue and Fox 1986, worked on the housing health of families residing close to the Drake Chemical Superfund site in Lock Haven, Pennsylvania. According to Ozonoff, Colten, Cupples, Heeren, Schatzkin, Mangione, Dresner and Colton 1987 discovered that there were challenges on the health of the residential which was as a result of the landfill sites. There are immediate and lasting effects of health due to Environmental pollution from waste dumping (Porta, Milani, Lazzarino, Perucci and Forastiere (2009) and Mattiello, Chiodini, Bianco, Forgione, Flammia, Gallo, Pizzuti and Panico (2013). Some Immediate health impacts include asthma, congenital abnormalities and respiratory infection. (Elliott et al., 2001; Ashworth, Elliott and Toledano 2014; Kah, Levy and Brown (2012) acknowledged additional symptoms such as nausea, headache, dizziness eye and respiratory irritation, stress and anxiety while the Lasting effect to waste exposure may be cancer chronic respiratory, brain, cardiovascular, liver and nerves disorder. (Minichilli, Bartolacci, Buiatti, Pallante, Scala and Bianchi (2005); Vrijheid 2000 and Carpenter, Ma and Lessner (2008). Zmirou, Deloraine, Saviuc, Tillier, Boucharlat and Maury (1994) and



Deloraine, Zmirou, Tillier, Boucharlat and Bouti (1995) stated similar immediate health effect resulting from industrial lethal waste landfill. Investigations conducted using human being discovered an association amid waste-related contamination and biomarkers valuation. Additional work by Rivezzi, Piscitelli, Scortichini, Giovannini, Diletti, Migliorati, Ceci, Rivezzi, Cirasino and Carideo (2013) and Giovannini, Rivezzi, Carideo, Ceci, Diletti, Lppoliti, Migliorati, Piscitelli, Ripani and Salini (2014) revealed the presence of a large dioxin concentration in breast milk of the resident of Naples and Caserta countryside, optimistic association with environmental dioxin risk index (EDR) age of the women who were tested and unlawful waste fires that represents an index based on dioxins level in buffalo milk sample. “The term dioxins refer to a group of environmentally persistent chemical compounds with similar chemical and biological characteristics that are released into the air during the combustion process (USEPA 2000)” “These toxins bio magnify, which means that as dioxins move up the food chain, their concentrations are repeatedly multiplied. Exposure to high levels of dioxins has been linked to cancer, liver damage, skin rashes, and reproductive and developmental disorders” (USEPA 2000). Chlorine-containing substances and landfill fire in the landfill can cause Dioxin formation which is harmful to human health (Liphoto, 2001; Kampa and Castanas 2008; Durmusoglu, Taspinar and Karademir 2010 and Root, Henkelmann, Schramm, 2004).



Furthermore, when Dioxin is ingested, it is linked to a rise in mortality due to ischemic heart disease (Martin and Griswold 2009). There is no safe level of exposure to dioxin according to the draft review of dioxin reassessment by the United State Environmental Protection Agency, EPA’s 2004; even with the lowest level of exposure there are serious health impacts such as “reproductive impairment, developmental injuries, and increased risk of diabetes” (USEPA 2014). Burning tyres emits styrene and butadiene (benzene derivatives) which could be

carcinogenic to humans and butadiene are linked with leukemia in humans” (Health impacts of burning tyres in cement kilns homepage on nontoxic burning (2006). Majority of the poisonous gasses emitted can cause genetic mutation which leads to the development of cancer later in life. In addition, uncontrolled tyre burning has the propensity of about 8 times higher than plastic burning to cause genetic mutation Eireann (2005). Those who are of greatest risk are the children due to their small body size, “they inhale more air per pound of body mass than do adults, and can absorb a proportionately larger dose of toxins”. “Also, children’s bodies are more susceptible to damage from the lead, cadmium and other heavy metals found in tyre smoke because their nervous systems are not fully developed” (Health effects of burning trash homepage on Zender group (2005)). The environment was not spared of the harmful effect of leachate contaminant like drinking water ladened with pesticides waste as acknowledged by Clark et al 1982; Gartside, Elia, Majeti and Specker (1982). According to Sullivan, (1993) admitted the impact of environmental pollution on reproduction from conception to parturition. Dunne, Burnett, Lawton and Raphael 1990, stated the existences of deleterious effect of chemical waste on urban populace. After dumping of solid waste at the landfill site, a lot of biochemical and physical reaction takes place, such as gas production and leachate contaminating surface and ground water sources (Abbas, Jingsong, Ping ,Ya and Al-Rekabi 2009; Kangsepp and Mathiasson, 2009; Lou, Chai, Niu, Ou and Zhao 2009 and Olsson, Gustafsson, Berggren, Bendz and Persson 2009).

The study done on cytogenetic observation on community populace exposed to little level of ecological impurities according to Lakhanisky, Bazzoni, Jadot, Joris, Laurent, Ottogali, Pays, Planard, Ros and Vleminckx 1993 and Sorsa, Wilbourn and Vainio 1992. “Cytogenetic bio-monitoring of a population of children allegedly exposed to environmental pollutants. Phase 2: Results of a three-year longitudinal study” as stated by Klemans, Vleminckx, Schriewer, Joris,



Lijssen, Maes, Ottogali, Pays, Planard and Rigaux 1995. Smaller telomere dimension and lesser telomerase enzyme activity were seen in peripheral blood mononuclear cells of healthy pregnant women who reside in north-east Naples area. (Felice de, Nappi, Zizolfi, Guida, di Spiezio Sardo, Bifulco and Guida 2012).

2.3 Citing of Open Landfill Sites

Ordinarily, an extensive evaluation process is needed before the citing of a sanitary landfill in order to recognize the best obtainable disposal location. The location has to meet up and comply with the required standard in line with government regulations, also to reduce economic, environment, health and social costs (Siddiqui, Everett and Viewx (1996). However, numerous requirement and factors have to be considered when choosing a site or location for waste landfill, which are classified into “topography, and geology, socio-economic effects, economy and safety, and natural resources” (Savage, Diaz and Golueke (1998). In Africa, majority of the open dumpsites were located arbitrarily. No or in some cases, very little consideration is made regarding the environmental impacts in selecting the dumpsites under standard conditions, an environmental influence assessment is a requirement when siting a dumpsite. Nevertheless, in majority of the cases, the priority is the convenience of the site. Again, there has been a

propensity by some local authorities to locate landfill sites close to the collection areas. The landfill site must not be located too far from residential areas as this will deter people from carrying wastes to these sites. It appeared that borrow pits and quarries are often selected as a reclamation strategy. It has been asserted by Zerbock, (2003) in Harare, Zimbabwe, the golden quarry landfill site is an abandoned gold mine which commenced operation as a landfill in 1985 to recover the land by filling the shafts and pits. It was also contended by Rotich, Zhao and Dong (2006) that, in Eldoret, Kenya, an abandoned sand quarry at Mwendeni was a disposal of



municipal solid waste, yet it was clear if the site was a water catchment area for small rivers that drain into the Sosiani River. Again, the Dandora municipal dumping site in Nairobi, Kenya, is an old quarry which had to be restocked using garbage. It is becoming a health hazard to the people residing close to the landfill site (Environmental News Service, 2007). The Nairobi River for instance, passes through the Dandora Municipal dumpsite and few of the waste from the site gets into the river (Environmental News Service, 2007). This obviously is a health risk to the communities far and near who depends on the river for water for domestic and various purposes. In Thohoyandou, South Africa, was attributed to the seepage from a nearby sewage treatment plant and a waste site, which leachate had polluted with lead flowing into the rivers.

Hasty urbanization is responsible for the landfill site that were formerly located in the outskirts and at a safe distance from the municipal boundaries which are now found close to or even with human settlements and housing estates (Schertenleib and Meyer 1992). This is why most residents resist the citing of the landfill close to their residence as they cause dust, and other nuisances. Residents residing close to landfill sites are at risk of contracting diseases associated with waste. According to Oyaró (2003) he stated that, an investigation carried out on 328 children who reside close to the Dandora landfill site, it was noticed that more than half of the children had high concentration of lead in their blood stream. It was also noticed that the children were disproportionately affected by respiratory diseases, asthma, anemia and skin infection, which is associated with high toxins from landfill site that receives metals, woods, plastics, chemicals and hospital waste (Environmental News Services, 2007; Oyaró, 2003).

The poverty-stricken nature in Africans, has lead thousands of African stranded who tries to make a living by salvaging recoverable materials from landfill sites. Every day, a lot of children, women, and even the elderly are found at the landfill site, almost the whole day sifting through

the rubbish for valuable items. These people use their bare hand without protective gear when sifting through the waste at the landfill site according to Wilson, Velis, and Cheeseman (2005). Oyaro 2003, stated that the lack of protective gear and equipment expose them to direct contact with hazardous waste like “broken glass, human and animal faecal matter, paper that may have become saturated with toxic materials, as well as containers with residues of chemical, pesticides, and solvents”. Furthermore, these people are at risk to contracting HIV and AIDS even hepatitis when they get needle pricks, exposed to bandages stained with blood and other disposable materials from hospitals. This state of affairs was observed at the Dandora landfill site in Nairobi, Kenya. Basic principles of occupational health and safety are ignored by the informal waste pickers, who are at risk, hence scavenging landfill site is known as one of the most detrimental activities to health. Those people who look for food at the landfill site are not spared of inhaling the bio-aerosols fumes and smokes produced by the burning activities that takes place at the landfill site which can cause health challenges like eye infection, Respiratory and dermatological problems, even low life expectancy among these people.

2.4 Waste and Landfill Site Location

Waste or garbage is defined as useless, superfluous, valueless or unwanted things produced when human is carrying out activities and are to be disposed of the environment. The waste is collected, sent to the landfill site or intended for composting, burning or reprocessing. After dumping, the solid waste may be a mixture of soil, water or air quality due to its explosive carbon-based complexes, insecticides, thinners and heavy metals, e t c (Gouveia, et al., 2010). Landfill is mostly the final disposal site of municipal solid wastes in the cities. Usually, the landfill site is located in the suburbs of the urban and rural areas, which may be responsible for contamination as a result of the development and multiplication of flies, mosquitoes, and rodents



(Mustafa, 1993). Usual occurrences at landfill sites, is the putrefaction of organic materials by micro-organisms, which may include food, timber goods, or other plants ruminant, decay, that reappear in the atmosphere in the form of a simple compounds, like carbon dioxide, water, or ammonia (Mustafa, 1993). Unfortunately, most synthetic organic polymers, like plastics, were noticed to be resilient to biological breakdown. This began to create momentous financial and ecological complications when landfills sites are in excess of plastics. As a result of the above challenges, (Marc, 2006) suggested that the location of the landfill sites ought to be appropriately cited and managed to evade threat to the health of human and the atmosphere. Remedial and controlling measures tends to be luxurious, multifaceted, and pose adverse pressures on the environment and its habitants

According to (Ellis, 1969) he accepted the facts that there is an increase; surely there will be a noticeable upsurge in mass and capacity of refuse generated in developed and developing countries not merely by household consumer, including trade and industry. Furthermore, He stated that increase wealth and a change of lifestyle are responsible for the feasting on a variety of consumer goods. The proportion rise in the capacity and mass of solid waste that is observed can be related to the varying nature of refuse, which is due to series of factors such as an increase request for user goods and the all-pervading advertisement and marketing both in the paper and automated media given to numerous goods leading to a huge quantity of packaging material been waste. The difficulty encountered in waste management is as a result of the increase use of plastic packages by industry which has made an unlimited impact. Currently, in our society a huge quantity of waste is been generated and accrued with minor fraction adequately disposed of sanitarily. This lifestyle is a threat to our living and health setting and the earlier we change the better for us and posterity.



2.5 Composition, Classification Quantity and Sources of Waste

Solid waste is classified according to two schools of thought. Firstly, is according to the exact substance or source of the waste and the secondly, is described according to treatment discernibility and it is classified into 4 groups namely: (1) Waste to be burnt or composted. Examples are biological kitchen waste, offal wastes (bones), vegetables, etc. (2) Waste matter that can be burnt only such as timber, skin, neoprene, plastics, insubstantial, etc. (3) Waste matter that can be neither burnt nor composted (blocks, gravels, crystal, ceramic, earthenware, iron and other metals) and (4) Waste with fine gritty material (saw sand, rice leftover, etc.).

According to Hoornweg and Thomas (1999), they stated that an increase in solid waste capacity in most cities is as a result of an increase in population size. In developing countries, most of the cities are faced with great challenges where about 0.76 million tons or approximately 2.7 million cubic meters of metropolitan solid waste is generated per day. In addition, upsurge in solid waste production and a change in the nature of waste generated is due to higher living standard. The existence of degradable biological complexes, damp contents, element size and structure, compactness and compressibility and some of the solid waste composition is responsible for the degradation rate in dumpsites.



Globally, a rise in the quantity of waste generated can be assigned to numerous factors, such as a change in the values and ways of living, extent of development, climatic issues and growth rate of the population. Due to the above there is the tendency to discard usable and recyclable materials as a result of change of taste to acquire new thing to fit current status leading to increasing the quantity of waste generated. The extra packaging of goods to make it attractive to consumer's ends up adding to the quantum of waste produced. For instance, In Sekondi-Takoradi area of Ghana, when an item is bought, they are all packaged separately in a polythene bag and

eventually parceled into another bigger bag. For example, “fufu and soup, rice and stew, cooking oil, water” etc. are all packed in plastics, which litters our environment, finally end up at the landfill site. Plastics has a great effect on the soil fertility level because of its non-degradable nature, hence retain its original nature for several years. In most developed countries, solid waste policies are tailored to reduce waste quantum which is different in major developing countries such as Ghana.

Waste disposal method or way of treating waste depends on the nature, constituent or composition of the waste. There are numerous sources of waste generation, just to mention but a few, household, skill, manufacturing, organization and specialized. Domestic wastes are household waste, comprises primarily tubers and other putricibles matter, newspaper, metals, fabrics, plastics, crystal, etc. while skill waste are produced from selling, marketable, and commercial outlets like marketplaces, which may consist of newspaper, packing cases, tubers and putricibles, plastics, crystal, scuffle iron, etc. Manufacturing wastes are generated from industrial procedures which contain rejected fabric, fish and canning waste and waste from destruction and building events, as well as agronomic farm waste. Specialized wastes are waste produced from radioactive waste, infirmity and pharmacological waste, condemned food, abandoned automobiles and vegetations and equipment. Organizational waste is waste generated in institutions such as schools, administrative offices, army bases, religious houses, whose constituents are comparable to domestic and commercial waste but contain more paper than food waste. (Ghana Sanitary Landfill Guidelines, 2002).



In developing countries, like Ghana there is lack of pertinent data on waste produced. The policy on Waste management is formulated on the base of assumptions and not on firm experiential data. For example, city’s daily output of solid waste was estimated by the waste management

department of Sekondi-Takoradi Metropolitan Assembly (STMA) to be about 285 metric tonnes on the bases of per capita waste production specified by the Ghana Statistical Service in the year 2000. Though, it is quite complex to determine the correctness/precision of the per capita daily waste output calculated by the Ghana Statistical Service, following waste production approximation given by the city authorities. Lifestyle vicissitudes and ingesting patterns amid the populace could be responsible for a variation in the quantum of waste produced. It has been established that city populaces produce more waste than those in rural area as a result of a high rate of product consumption. (Onibokun and Kumuyi,1999).

In 1969, Gilbertson opinion with respect to solid wastes was that the quantity of waste generated per person each day and everywhere is on the rise, which is due to social, economic and technological changes. Gilbertson further admitted that is a momentous and alarming variation in the features and structure of wastes. There is a huge increase in the amount used for waste collection, treatment and disposal yearly and it takes a chunk of municipal budget. The rate of waste turn-over and the nature of waste are significant factors that must be put into consideration in the design of an effective management of solid waste program. The rate of waste generation may differ due to several factors like the state of the Country's economy, lifestyle of the people, the demographic profile of the populace and seasonal differences. Typically, the developed countries generate more waste per capita (0.7 – 1.8 kg/d) as compared to middle income (0.5 – 0.9 kg/d) and low-income countries (0.3 – 0.6 kg/d) (The United Nations Centre for Human Settlements,1994). Small quantity of waste is generated in the rural area which poses little problems as compared to urban area where large quantity of waste is produced as well as the challenges associated with it. With an increase in population growth, the challenges associated with solid waste become massive in Ghana, even Tamale Metropolis, which is a growing city is



not excluded. Therefore, it will be crucial to carry out a survey to obtain the exact capacity and structure of solid waste that need to be managed. In 1969 Gilbertson stated that there are numerous techniques to approximate the capacity of waste generated in certain vicinity, which includes precise weight method, exact waste capacity and bulk density. Among this three, the precise weight method gives more accurate data on the volumes of waste generated. This is done by weighing the collection truck from a particular area based on the populace; the exact mass of the waste acquired declaring the weight per capita per unit time.

According to (Ellis, 1969) he acknowledged that the extra mass and the capacity of solid waste, has brought about and will continue to produce various complications. In most countries, industry and house are built on a vast array of land available because of the rapid rate of urbanization and large quantity of waste is produced by these developments thus leading to scarcity of land for waste disposal. Rush brook and Pugh,1999, in the entirety communities, domestic waste is generated, development and manufacturing growth has swiftly amplified the variety and multiplicity as well as the capacity of waste that needs to be collected and disposed. Therefore, there is the need to plan for the development of a waste management facility. There is need to know the magnitudes and sorts of waste that are produced inside and everywhere in the municipality by the waste managers which may be part of the waste management proposal, also predictable upsurges in capacities of waste produced should be foreseen so that plan can be put in place for future provision of facilities. With regard to this, it is imperative to make an analysis of the distance that refuse can economically be transported through before it gets to the final disposal site, consideration the cost of compacting waste materials. Hence the need for the final waste disposal site in terms of the type of waste, volume generated should be considered when



choosing a landfill site and determining of the lifespan of the land fill (Ghana Sanitary Landfill Guidelines, 2002).

2.6 Landfill Site and Associated Risks

Despite, the” huge socio-economic promises” landfills give to the communities as well as the nation, they are frequently labeled as a “curse” in the communities they are situated, as a result of boundless effect they have on the health and the environment (Owusu-Sekyere et al., 2013a). Household and industries get rid of unwanted materials or waste that make the environment unfit for human to inhabit or constitute nuisance to the environment. Numerous complications are associated with landfill site processes which may include deadly calamities (e.g., been trapped within the waste piles), substructure damage (e.g., destruction of road by heavy vehicles), contamination of the indigenous surroundings like groundwater pollution and adulteration of residual soil after closure. Other pollutants related to the deposition of waste on the landfills includes but not limited to litter, dust, excess rodents, unexpected landfill fires (Njoku, Odiyo, Durowoju and Edokpayi, 2018). Other challenges may include odour, pests, or noise pollution.

Majority of developing countries like Ghana, open gutters are choked with garbage, posing serious problem as well as providing breeding ground for various insects, pest that has the ability to cause diseases. Increase in health education and awareness on the danger of improper waste disposal or environmental issues has led to zero tolerance to wrong waste disposal methods used in the past. Environmental protection and management are the responsibility of the District Assemblies which includes avoids dangers to human health, preserve natural resources and uphold pleasurable environs. Therefore, to safeguarding the environment and natural resources appropriate collection, handling and dumping of solid waste must be taken into consideration.



According to Oduro (2004) In Ghana, the citizen has been plagued with a lot of health challenges as a result of the waste management practice employed. Uncontrolled to semi-controlled open dumping has been the waste management practice. Due to the huge level of nuisance and environment challenges created by this waste and it will continue to create, it also serves as a point of contamination of underground water used by the citizen, leading to several diseases like Malaria, diarrhea, intestinal worms and upper respiratory tract infections which are the topmost diseases reported in our health facilities and periodic widespread epidemics of cholera. Diarrhea, dysentery, intestinal parasites (worms), typhoid and cholera due to poor waste disposal.

Nogarh (2007), acknowledged that the awful and poor waste collection method of waste managers was responsible for the incidence of numerous communicable diseases in the communities in our country and the accumulation of waste in our urban cities leading to an increase in cases of preventable diseases. This report has essentially been the situation due to poor upkeep of the site by the specialists in charge. The health and environmental effects of the landfill site on the residents will be considered.

Earlier research revealed that people who reside close to the landfill site are prone to a lot of medical challenges like asthma, cuts, diarrhea, stomach pain, reoccurring flu, cholera, malaria, cough, skin irritation, cholera, diarrhea and tuberculosis as compared to people who reside far from the landfill sites (Thada, 2012 & Adeola, 2000). Brender, Maantay and Chakraborty 2011

Stated that the proximity does not equate to the exposure level of the individual. The reason for the health challenges is due to chronic exposure to chemical, inhalation of toxic fumes and dust from the landfill sites. The concentration of exposure and the level of exposure of the pollutant to the residents is proportional to the health hazard, that is the lesser the concentration and level the less illness the residence will suffer from and vice versa. Furthermore, there was a “significant



correlation between residential proximity to environmental hazards and adverse health outcomes especially risks for central nervous system defects, congenital heart defects, oral defects, low birth weight, cancer, leukemia, asthma, chronic respiratory symptoms, etc.”. Landfill proximity to residents will also have significant effects on property value in the area (Reichert, Small, and Mohanty, 1992; Bouvier, Halstead, Conway, Manalo, 2000; Mmom and Mbee, 2013 and Akinjare, Oluwatobi and Iroham, 2011).

The uncontrolled manner in which solid waste are disposed of in majority of the open landfill site creates detrimental health challenges to human health, animals and degradation of the environment in several ways and forms. This improper waste disposal leads to welfare and economic losses (Zurbrugg, 2002). The soil is not left out as it is polluted by been in contact with solid waste and leachate. In a study conducted at a dump site in Kariba in Zimbabwe, trace metal was noticed in soils samples taken from the area during 1996 and 1997. Some elements were noticed at the disposal site such as copper (Cu), lead (Pb), iron (Fe), and zinc (Zn) (Chifamba, 2007).

2.7 Effects of Landfill on the Health of the Population Close to the Site

Landfills are a major contributor to the world’s anthropogenic greenhouse gas emission because an enormous amount of carbon-monoxide is generated from the degradation process of deposited waste in landfills (Kumar, Gaikwad, Shekdar, Kshirsagar and Singh 2004). Generally, landfills operation is usually connected with contamination of surface and ground water by leachate from landfill bulldozers, volatile organic compound (environment victoria, 2013). Exposure to contaminants and emissions can be through different means and modes, which includes direct contact, inhalation or ingestion of contaminated food and water. In several studies the consumption of contaminated drinking water has been acknowledged as the route of introduction



to injurious substances (Griffith, Duncan, Riggan and Pellom 1989; Berry and Bove, (1997) and Adami, G., et al (2001). In advanced countries like Great Britain, previous studies carried out raised worries about likely additional brain, risk of bladder and hepatobiliary cancer and leukemias amid populace who reside close to the landfill sites. The hazardous constituents of landfill waste are further expected to cause cancers in bladder, stomach, large intestine and rectum according to Griffith, et al., (1989). Likely bladder cancer was noticed by Mallin (1990); Goldberg, al-Homsi, Goulet and Riberdy, 1995; Goldberg et al., 1999) observed probable cancers in the stomach, hepatobiliary, lung and cervix cancers; Williams and Jalaludin (1998) saw likely cancers in the brains; and Lewis-Michl, Kallenbach, Geary and Melius, (1998) also established further danger of cancer of the bladder and leukemia particularly amid women residing close to the landfill sites. Environmental toxicants originating from landfill sites might accrue in the liver and biliary tract predisposing residents to risk of liver cancer as shown by laboratory experiments (Elliott et al, 1996, 2000; Vrijheid, 2000).

Zmirou, et al, 1994; Hamar, McGeehin, Phifer and Ashley 1996; Ward, Williams and Hills, 1996; Jarup, Briggs, de Hoogh, Morris, Hurt, Lewin, Maitland, Richardson, Wakefield, and Elliott, 2002 stated that extensive variety of gaseous product are emitted into the atmosphere from the landfill site due to degradation of waste, some of which are, primarily methane and carbon dioxide likewise minor amounts of hydrogen sulphide, VOCs (volatile organic compounds) and metal vapours. Different kinds of trace elements are emitted from the landfill site which includes hydrogen sulphide, dioxin, carbon monoxide, xylene, etc. other micro toxins that are toxic like polychlorinated dibenzofurans and polychlorinated dibenzo-para-dioxins (PCDFs and PCDDs) known as polycyclic aromatic hydrocarbons (PAHs) and dioxins. Chronic high-level exposure to hydrogen sulphide can cause respiratory paralysis and central nervous system malfunctioning



(Li, and Moore, 2008) inhalation and ingestion of heavy metals will cause asthma, vomiting, lungs cancer, risk of reduced lung function and emphysema. Heavy metals pollution has been implicated in anemia and high blood pressure (Duruibe, Ogwuegbu and Ekwurugwu, 2007 and Jarup, 2003). PAHs have a carcinogenic property which can cause cancers when humans come in contact with them such as skin cancer, other body part deficiency, tumour of the lungs, skin cancer (Sakawi, Sharifah, Jaafar and Mahmud 2011). Furthermore, studies revealed that the inhalation of the particulate matter by humans causes lining inflammation, systemic inflammatory changes and blood coagulation that is responsible for angina, obstruction of blood vessel and myocardial infarction (Kampa and Castanas 2008).

In the agricultural system, the challenges associated with the contamination heavy metal is of great concern, as high level in the human system above the extremely low body requirement poses significant risk to human health. (Gupta and Gupta, 1988). “Heavy metals, in general are not biodegradable, have long biological half-lives and have the potential for accumulation in the different body organs leading to unwanted side effects (Jarup, 2003, and Sathawara, Parikh and Garwal, 2004.)”. Copper (Cu) is one of the heavy metals but it is an essential element, but prolong exposure can lead to methemoglobinemia, hemolytic anemia hepatic and kidney damage. Cancer, incurable vomiting, tubular growth, diarrhea and kidney damage can be caused by high level of cadmium in the human body (Abbas, Parveen, Iqbal, Riazuddin, Iqbal, Ahmed and Bhutto, 2010). High levels of lead in the human body when greater than the maximum permissible limit can cause diseases of the teeth, bone, liver, gum, nervous system, pancreases, and blood diseases (Abbas, et al., 2010). Chromium VI is implicated in diseases such as liver damage, lung cancer respiratory problems, skin rashes, stomach upset and ulcers, weakened



immune systems, kidney and genetic material mutation (Avena,1979).

According to Jarup, et al,2002, the international Agency for Research on cancer (IARC) acknowledged that numerous compounds like benzene and cadmium are among compound that are capable of causing cancer in human. The possible route of exposure of human to these compounds is through ingestion of contaminated water and food, skin contact with contaminated water and soil and inhalation of polluted air. World Health Organization (WHO 2000), current statement recommended that any possible contact is probable to be restricted to 1 km from the landfill sites by the air pathway and 2 km by the water pathway.

A study was conducted by coffie (2010) In Ghana, on the effect of the Oblogo waste landfill site on the populace residing in the communities, there was a great incidence of infectious and communicable diseases such as malaria, cholera, diarrhea, typhoid fever etc., which was as a result of the position of the landfill sites and the way it is managed in the communities. There was a steadily report from the Dompase landfill site area of the Kumasi metropolitan area (KMA) of Ghana, of a high frequency of self-reported health symptoms like fatigue, sleepiness and headaches amid populaces near the landfill site. (Owusu-Sekyere et al., 2013a).



2.7.1 Landfill Site and Air Pollution

Fumes (gases) emitted from landfill sites are responsible for environment pollution and dangerous effects on health such as VOCs, (Volatile Organic Compounds) leading to vapour types of cancer and birth problems etc. The category of waste and stage of squalor of the waste is responsible for the composition of gas been emitted. Usually, the gases produced from the landfill waste are mainly methane, carbon dioxide, nitrogen dioxide etc. Residents are exposed to these gases by inhalation of air born emission or dust. Nitrogen oxide and Sulphur dioxide causes

irritation, been in contact with these gases can cause swelling, bronco-constriction and affect the immune cell. Both hydrogen chloride and hydrogen fluoride irritate the mucosa membrane and when inhaled, the particles are deposited in the nose and upper respiratory tract leading to cough, chest tightness and breathlessness, (EPA QS,2009).

International Agency for Research on cancer (IARC) acknowledged that an extensive variety of waste squalor products are freed from the landfill sites into the environment in the form of gases such as methane, carbon dioxide, hydrogen sulphide, VOCs and metal vapours (Zmirou et al.,1994; Hamer, et al., 1996; Ward, et al., 1996). Cadmium (IARC, 1993 & 1994) has the tendency of causing cancer in humans and classified under Group 1 whereas formaldehyde (IARC,1995), styrene and lead (IARC,1987a) can also cause cancer in human, but that it is under Group 2A and Group 2B respectively. Although, (Hamer et al,1996). Stated that it is very problematic to exactly measure individual contact to environmental contaminants, he further worked on Volatile organic compound (VOC) in blood of populaces who reside close to harmful waste site and established an uncommon type of sickness which is believed to be as a result of VOC exposure. Numerous studies have shown that pesticides generally used on landfill site has a relationship with brain cancer (Bohnen and Kurland,1995). Exposure to VOCs (volatile organic compounds) like benzene that are emitted from landfill sites has been associated with the development of leukemia, (IARC, 1987b).The reasons that influence the by-product or emissions from landfills include the quantity and type of waste deposited, how old the landfill is, and the “climatic conditions of the landfill sites. Chemical and microbiological reactions within the landfill site is often leads to the formation of numerous gaseous pollutants, persistent organic pollutants such as dioxins, polycyclic aromatic hydrocarbons, heavy metals and particulate matter” (Liphoto, 2011). The continuous inhalation of carbon-monoxide by humans living



around landfill sites can cause loss of coordination, nausea, vomiting, and high concentration can lead to death (Health protection agency, 2011). Gases that are acidic like nitrogen dioxide, Sulphur dioxide have harmful effects on the health of humans and the environment as well (Boningari and Smirniotis 2016). Research has shown that, the inhalation or ingestion of nitrogen dioxide and Sulphur dioxide by humans can lead to symptoms such as nose and throat irritation, bronchoconstriction, dyspnea and respiratory infections, especially in asthmatic patients. These effects therefore, can trigger asthma attacks in asthmatic patients (Kampa, et al, 2008). Again, high contact of nitrogen dioxide by humans rises the susceptibility to respiratory infections (Kampa, et al.,2008). In addition, “when these acidic gases reach the atmosphere, they tend to acidify the moisture in the atmosphere and fall down as acid rain”. Phadi, Dash and Swain, 2013, identified sulphur dioxide to have harmful effects on plant growth and productivity. However, humans are at risk of reduced lung function, asthma, ataxia, paralysis, vomiting emphysema and lung cancer when heavy metals are inhaled or ingested. Conditions such as high blood pressure and anemia have been shown to be caused by heavy metal pollution (Kampa, et al, 2008). “More so, when in contact in high proportions, heavy metals affect the nervous system which causes neurotoxicity leading to neuropathies with symptoms like memory disturbances, sleep disorders, anger, tubular dysfunction, risk of stone development or nephrocalcinosis, and renal cancer”. It is established that, high level of lead exposure by human system causes “injury to the dopamine system, glutamate system and N-methyl-D-Aspartate” (Kampa, et al, 2008).



According to Benedetti, Fazzo, Buzzoni, Comba, Magnani and Fusco (2015) recognized the incidence of soft tissue sarcomas in an Italian area was due to unlawful waste disposal sites. Arsine and stibnite (Volatile organic compound) produced by holo-genetic or perfumed hydrocarbons are intensely poisonous. WHO 2000, In the human body, Arsine is converted into

arsenic. Hazardous gases freed from landfill such as Hydrogen sulphide and other gases which humans are exposed to by inhaling polluted air and use of contaminated water. “WHO report suggested that any potential exposure is likely to be limited to 1 km from landfill sites by the air pathway, and 2 km by the water pathway “(Paigen, Goldman, Magmant, Highland and Steegman 1987).

2.7.2 Landfill Site and Effect on Water and Maternal and Child Health

According to Rushbrook and Pugh (1999), all landfill ha the tendency to produce leachate especially in wet condition or during rainfall; hence it is mandatory to build a leachate management system to prevent the impact on the health of the populace and the environment. In the landfill site, the “Quantity of free liquid not absorbed into the waste, Concentration of pollutants in the leachate, Rate at which leachate can leave the site ,Proximity of leachate beneath the site coming into contact with drinking water supplies , Ability of environmental, physical, chemical and biological processes to reduce the concentrations of pollutants before they come into contact with water supplies” . Leachates generated from the landfill site percolates into the soil and water, which has a high concentration of sodium, potassium, organic carbon, chloride, ammonium hydrogen carbonate. Once the elements are released into the soil, some modulation or modification occur by advection, retardation (sorption), dispersion and degradation of contaminant. These contaminants percolate into groundwater and /or surface and affect the health of human and the ecosystem. (COWI, 2000). Biodegradable waste is converted to water, carbon dioxide and methane in the presence of abundant oxygen.

Pacey, (1999) stated that leachate is a major water pollutant in an area where a landfill is located and if not controlled pollutes ground and surface water. Furthermore, the leachates quality is



complex and contains a lot of soluble organic, inorganic and bacteriological constituents as well as suspended solids which could be carcinogenic in nature.

According to cutler, Parker, Rosen, Prenney, Healey and Caldwell (1986) a study carried out in Woburn, Massachusetts, revealed the presence of toxic chemicals (industrial solvents, mainly trichloroethylene) in municipal drinking water wells from a landfill site. It was reported among Woburn Residents a cluster of leukemia cases in 12 children, which an initial study revealed that the number was meaningfully higher than expected based on national rates. Contaminated municipal drinking water source as a result of waste disposal site has serious consequence such as birth defects, spontaneous abortion and children health like leukemia (Wrensch, Swan, Lipscomb, Epstein, Fenster, Claxton, Murphy, Shusterman and Neutra, 1990; Wrensch, Parker, Rosen, Prenney, Healey and Caldwell, 1992). According to Jarup et al., 2002 study on the danger of Cancer in the residents living 2km from the landfill sites in Great Britain, findings established leukemia in children and adult. Although, it has been established that there is Brain, Bladder and hepatobiliary cancer in people. The presence of a landfill site in a residential area have serious health implication triggering diverse forms of cancer, birth problems as acknowledged in a study carried out by Vrijheid, 2000, Goldberg et al., 1995.



A study conducted by Goldman et al., (1985) on low birth weight, prematurity and birth defects in children living near dangerous waste sites. Comparable findings were obtained as stated by Vianna and Polan (1984). Berry, et al., (1997) printed that there is an association between low birth weight and residing close to the landfill due to harmful waste. “Low birth weight and preterm births among infants born to women living near a municipal solid waste landfill site” was stated (Goldberg et al., 1995). There is evidence of poor development among Children who resided close to hazardous waste site as recommended by Kramer, 1987 and Paigen et al., 1987).

Elliott et al., 2001 printed a paper on “Risk of adverse birth outcomes in populations living near landfill sites” and acknowledged the facts that there are small additional risks of congenital abnormalities among exposed populaces. According to Kharrazi, Von Behren, Smith, Lomas, Armstrong, Broadwin, Blake, McLaughlin, Worstell and Goldman 1997, stated that in California the inhabitants who reside by huge injurious waste landfill displays severe effect on pregnancy outcome. According to the UK study done by Elliot et, al., 2001, it was found “significantly elevated risks for several defects, including neural tube defects, hypospadias and epispadias, abdominal wall defects and surgical correction of gastroschisis and exomphalos”.

According to Creon et al., study, identified three specific types of birth defects (neural tube defects [NTDs], heart defects, and oral clefts) were considered on the basis of exposure measurement (on both residence in a census tract containing a waste site and distance of residence from a site). Neural tube risk was (2-fold increase) and heart defects risk was (4fold increase) in mothers whose residence were within 1/4 mile of a site.

Several studies have reveals that the landfill site emission is implicated in congenital malformations, birth weight, prematurity and child growth and cancers. In New York State, a multi- site study of residents revealed that about 12% risk of congenital malformations in

children whose parents reside within one mile of hazardous landfill site (Geschwind, Stolwijk, and Bracken (1992). A study conducted by Fielder, Poon-King, palmar and coleman (2000);

Vrijheid, Dolk, Armstrong, Abramsky, Bianchi and Fazarinc (2002), and Dolk, Vrijheid, Armstrong, Abramsky, Bianchi and Garne 1998). The findings support the above findings of high risk of congenital malformations among populace who reside close to the landfill site.

EUROHAZCON, a multi-site European study discovered among resident living within 3km from 21 landfill site studied that there was a 33% increase in non- chromosomal birth defects Dolk et



al (1998). Heavy metals are implicated in a lot of health challenges such as miscarriage mutation or cancers. (Weigert, 1991).

2.7.3 Landfill Site and Cancer

Many environmental contrast studies have examined cancer mortality and occurrence around the landfill sites. Two studies done in the US revealed an increase frequency of cancer around hazardous landfill sites (Najem, Louria, Lavenhar and Feuerman,1983; Griffith, et al.,1989) especially that of the gastrointestinal tract, esophageal, stomach, colon and rectal cancer. A report from two studies carried out (Goldberg MS et, al., 1995& 1999) amid the incidence of cancer in residence close to the “Miron Quarry site, the third largest in North America found increased incidence of cancers of the liver, kidney, pancreas and non-Hodgkin’s lymphomas”.

2.7.4 Effect of Landfill Site on the Physical Environment

Several studies have reported that, landfill site has numerous environmental nuisances and developing countries has a huge composition of waste generated as paper, plastic, with poor litter regulator which are unpleasant to neighbors. In developing countries where most of that are produced have a high composition of papers and plastics, inappropriate litter control is principally annoying to neighbor (Rushbrook, et al., 1999). Developing countries like Ghana for instance has a huge quantity of plastic bags and paper in the landfill site blown out by wind. Around the Oblogo landfill site, the environment is untidy, unhygienic, unkept making it unattractive due to windblown mess (litters and plastic bags) making the municipality unsafe and unhealthy. (Coffie, 2010).



Secondly, odor emanating from the landfill site which is from numerous sources and such as gases, fresh garbage, stinking substances, agrarian and sewage mud (Adu-Boahen, 2012). ill health from communities is as a result of malodorous emissions from the land fill site. Some symptoms such as nausea, headaches, drowsiness, fatigue and respiratory problems affecting populace who reside near the Dompase landfill are ascribed to odors emanating from the site (Owusu-Sekyere et al., 2013a). In 2010, Coffie acknowledged that unwholesome stench originates from the Oblogo landfill sites, the leachate from the waste; all extends into the houses of the resident in the town around Weija, a number of intellectuals accept that individual reactions to stench are extremely different and could be subject to numerous factors like sensitivity, age and previous contact to the odour.

The fact that there is no cover for food waste, Odors cannot be eradicated in an exposed landfill particularly where there are no selected areas for dumping of such waste. It is particularly at night that this stench travels a lot of miles from the landfill site. In most developing countries there is a significant rise in the complain of odour emanating from the landfill site among road users, land user as well as resident who live close to the landfill site. Lack of segregation and a huge amount of organic waste is responsible for the odour emanating from the waste, which is the major complain of the populace who reside close to the landfill site at Kojokrom. (Adu-Boahen, 2012). The open storage of leachate in landfill can influence the levels of odour experienced in a landfill include litter, close to landfills sites have shown concern due to several hazardous pollutants coming from landfill operations (Palmiotto, Fattore, Paiano, Celeste, Colombo and Davoli, 2014).

Thirdly, flies, pest and vermin are found in the landfill site, making the environment unhealthy, which should not be allowed because of their huge public health hazard (Adu-Boahen, 2012).



Rushbrook et al., 1999, stated that improper management of waste is responsible for abundance of birds, vermin, rodent, pests and flies in the landfill sites. In Ghana, mosquitoes and flies can be seen in landfill sites which can cause numerous diseases (Adu-Boahen, 2012). Flies carry bacteria on their wings and legs from waste and perch on food leading to food borne diseases while mosquitoes breed on stagnant, uncovered water and uncovered wastes like piles of tires etc. Encephalitis, dengue fever and malaria are caused by mosquito. Disease like Rabies, rat-bite fever, leptospirosis, typhus and bubonic plague are caused by rats and other rodents (Adu-Boahen, 2012). On observations large number of flies were noticed in the kitchen and toilet of resident living in Dompase area exposing residents to high level of food and water contamination. These insects were alleged to be responsible for the disease; hence their presence was a source of concern (Owusu-Sekyere et al., 2013a).

Fourthly, poisonous gases, fire, dust, smoke leachate and noise are not left out as a source of environmental nuisance. It has been documented that with a high level of dust in the atmosphere, individuals with previous respiratory conditions such as asthma, bronchitis, chronic obstructive pulmonary disease (COPD), etc. could suffer adverse reaction (US Department of Health and Human Service,2003). Gases emanating from waste and leachate add to long-term effects by polluting the air, water and land. Fire at landfill site may result from self-gas ignition at the landfill site or be ignited by fire in the waste transported from the points of collection in town as a result of hot ash put in central public basins. Resident around the landfill site usually have challenge with the smoke, ash and particles from the landfill sites during burning of the refuse (Adu-Boahen, 2012). According to Coffie (2010) noticed that smoke from the Oblogo landfill site spread to the residence as well as noise from vehicles bringing waste to the landfill sites for disposal was very high and intolerable for residents.



2.8 Approaches to the Study of the effects of the landfill on the health of the population

2.8.1 The Biomedical Approach

In conducting this study, two theories or approaches are employed in guiding the focus of the study. These theories are essential because they have a link with the environment where the landfill is cited and the exposure to the risks factors that are associated with the citing of the landfill to the population in the geographical area where the landfill is cited.

The biomedical and the ecological model or perspectives were therefore adopted to guide the study.

The biomedical approach emphasizes on health as the non-appearance of infection or illness (Ivanitz, 2000; Morgan, Calnan, & Manning, 1993; Tetrick, 2002). It offers a scientific clarification of health and takes into explanation the bodily presentation of illness (Ahmed, Kolker, & Coelho, 1979; Engel, 1977; Ivanitz, 2000). Based on the Cartesian contrast amid mind and body (Lock & Scheper-Hughes, 1996), the body is alleged as part of a usual world, and diseases are presented completely as physical entities happening in exact places of the body (Balog, 2005; Ivanitz, 2000). This model's primary stress is about the physiological disease process and the curative aspect of diseases through scientific management of symptoms (B. O. Abiodun, 2005; Bardin, 2002; L. Bennett & Duke, 1995; Han & Ballis, 2007; Kheong, 2003).

Thus, biomedical ideas of health distillate on disease and illness rather than health (Abiodun, 2005; Bardin, 2002; Bell, 2000; Hummelvoll & da Silva, 1994), with the emphasis being on the level of exposure to germs and circumstances that expose people to infection (Cockerham, 1978; Marks & Worboys, 1997).



Kermode (2004) noticed that in the biomedical model, health consequences are measured by default - by apparent decreases in disease and illness. Through its scientific method, it has been contention since the 1960s and 1970s that treatments are commenced for the unhealthy patients with an attention on disease and system pathology (Abiodun, 2005; Bardin, 2002; Bell, 2000; Hummelvoll & da Silva, 1994). This is a very narrow approach to health and prevents a broader and deeper understanding of health. Despite that, the biomedical approach constitutes the dominant model guiding exposure of people. “The substantial decline in the death rate, which coincided with the spread of this approach in 19th century Europe and the specific etiology theory of disease, added credibility to the effectiveness of this model” (Ahmed et al., 1979; Engel, 1977; Morgan et al., 1993). “It was particularly recognised and distinguished from previous approaches in terms of its effectiveness in controlling disease and improving the health of people. It was documented that between 1851 and 1971 the crude death rate (CDR) in England and Wales declined from 22.7 per 1000 people to 12.5 per 1,000 people” (McKeown, 1979). This decline of Seventy-six percent was due to a decrease in mortality from communicable diseases (Ahmed et al., 1979; Engel, 1977; Morgan et al., 1993).

The biomedical model did not only become popular in the clinical knowledge of disease, but also its leading role in the academic study of disease was renowned in the literature (Ahmed, Kolker & Coelho, 1979; Tetrick, 2002). The positive formation of the fundamental link amid germs and disease was considered the most important particular break-through in the history of medicine (Ahmed et al., 1979; Tetrick, 2002). Twaddle and Hessler (1977) is considered as the greatest weapon achieved in the combat against disease. The stress on immunisation and treatment was generally celebrated as the launch of an era of optimism in which it seemed conceivable to



eliminate all illness of mankind (Ahmed et al., 1979; Engel, 1977; Morgan et al., 1993; Twaddle & Hessler, 1977).

Despite the achievement recorded and dominance of the biomedical model of health, its assumptions have been critiqued for a lot of reasons (Ember & Ember, 1985; Engel, 1977; Helman, 2000; Levin & Browner, 2005). First, this model has been progressively criticised for not giving passable deliberation to socio-psychological scopes of health and illness (Bardin, 2002; Bell, 2000; Helman, 2000; Kheong, 2003; Milford, Kleve, Lea, & Greenwood, 2006). Second, it is also criticised for its rapid dose method to treatment (Ahmed et al., 1979; Helman, 2000; Morgan et al., 1993). Been free of sickness does not mean health (Perry & Woods, 1995). Third, it is criticised for being gender prejudiced (Rogers, 2004). Additional all-inclusive studies have exposed that influences such as behaviours, socio-cultural background, gender, and life experiences underlie the meaning of health.

2.8.2 The Socio-Ecological Approach

The socio-ecological approach appeared as a consequence of the acknowledgement that health is a product of cultural and social conditions. Advocates of this perspective alleged health as a social construction or disability, whereby ill health is believed to be a result of poor social conditions (Marshall & Altpeter, 2005; McCarthy et al., 2004; Swanson & Wonjar, 2004). This social ecological model supported active social and political intervention, instead of dealing with illness after its occurrence (Marshall & Altpeter, 2005; McCarthy et al., 2004; Swanson & Wonjar, 2004). Sociologists, who were the major supporters of this viewpoint, were particularly concerned in discovering how dissimilar societal groups define health and illness and wanted to



comprehend how social forces moulded variances in people’s health. “Even though the socio-ecological approach contributes to the understanding of health, it does not take into account congenital medical conditions and other factors unrelated to social condition that may have a marvellous influence on health. This gives weight to the argument that a multifocal view of health may provide a deeper understanding of the concept” (Bardin, 2002; Bell, 2000; Daly, 1995; Swanson & Wonjar, 2004).



CHAPTER THREE

STUDY SETTINGS AND RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter is devoted to the study setting and research methodology employed in conducting the study. It tries to give an overview of the study area that will enable the readers to understand the kind of waste generated and its related health effect on the population especially that the landfill under investigation is the only landfill or waste dumping site for both the Tamale metropolis and the Sagnarigu municipality in the northern region of Ghana. The second part of the chapter deals with the research methodology adopted in carrying out the study such as the study design, sources of data, tools for data collection, study population, sampling procedure, techniques of data analysis, the positionality of the researcher and finally the limitation of the study.

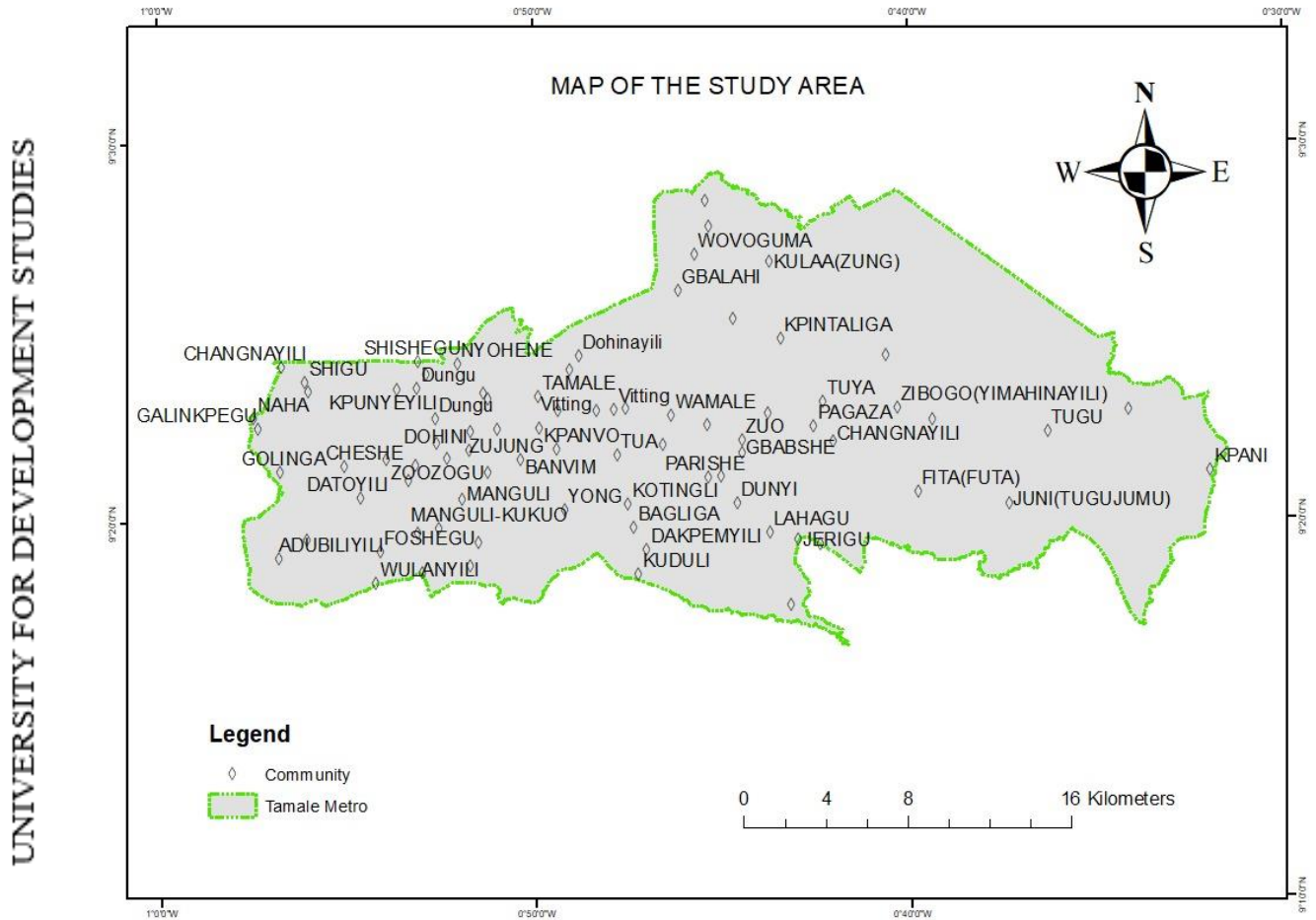
3.2 THE STUDY AREA

The Tamale metropolis (TaMA) was established under the Legislative instrument (L I) 1801 of 2004. Tamale metropolis is one of the six metropolitan Assemblies in the Ghana, but the only metropolis in the Northern part/region of the country Ghana. It has three (3) sub-metros which include Tamale central, Tamale North and Tamale South. Tamale metropolis is one of the 26 districts located in the center of the Northern Region. Its boundaries with six other districts namely, Savelugu-Nanton to the north, Yendi municipal Assembly to the east, Tolon-Kumbungu to the west, Central Gonja to the south-west and East Gonja to the south. The metropolis has an estimated total land size of 646,90180sqkm. (GSS) which make about 13% of the entire Northern



Region land area. Geographically, the metropolis lies between latitude 9°16'1 and 9° 34'1 North and longitude 0° 36'1 and 0° 57'1 west.

Figure 3.1 Below shows a sketch map of Tamale Metropolis



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Source: FIELD WORK, 2018.

3.2.1 RELIEF AND CLIMATE

Largely, the Tamale metropolis is located about 180 meters above the sea level with few isolated hills. The geographical land scape is ideal for road construction, residential and industrial building, and expansion of electricity. The rainfall pattern is a single rainfall which implies that it is once in a year. This translates to the fact that for agricultural production to be effective, irrigation farming is one option that must be considered to assist in agriculture all year round. Daily temperature in the region varies from season to season. There is high humidity in the raining season, slight sunshine accompanied with heavy thunder storms while the dry season is characterized by dry Harmattan winds from November -February and high sunshine from March-May.

The weather pattern is a possible resource for the preservation industry that might use the sunlight as a natural preservative. Another probable area that is left unexploited is the artificial parks and gardens that the hospitality industry could take advantage of looking at the high sun rays to build swimming pools, relaxation parks for both children and adults during the excessive sunshine period. With this initiative, most people will be able to have a nice family reunion time during the weekends and holiday periods and this will be an avenue for the Assembly to make some revenue for the development of the area.



3.2.2 SOIL AND VEGETATION

The Metropolis lies inside the Grassland Forest Region in the country where the trees are stunted and scattered in nature. Dawadawa, Nim, Acacia, Mahogany, Baobab among others are the majority of trees found there. The local Zanamat made by most farmers in the metropolis during the dry season, which the raw material is from the tall grasses seen in the raining season reduces the rural relocation of the youth from the rural areas to city centers. Also, the region has an

international recognition because of its economic Shea tree which is used for a lot of things. Thousands of households in the sheanut area have been engaged with the picking, processing and marketing of the Shea nuts. This has led to the employment of the youth in the area as well as a source of income for the women minimizing the level of poverty in the metropolis. Cashew is another international recognized crop which is grown in the metropolis for peanut production.

In the Metropolis there is shale, mudstone, gravel and sandstone that have worn into different soil grades. Due to cyclical erosion, soil types originating from this phenomenon are sand, clay and laterite ochrosols. The accessibility of this type of soil has contributed to the rapid real estate development in the metropolis where estate developers have resorted to the use of local building materials such as sea sand, gravel and clay.

The metropolis has various small to medium scale enterprises that has employed most of the youth there by has reduced the unemployment rate. Almost half (42%) of the employed class are involved in agriculture and related activities. Majority of the workforce (58%) in the metropolises are engaged in Transport, sales and services and Production due to a rise in Banking, marketing and Non-Governmental activities.

The roads network in the Metropolis are fairly good especially those that link the Metropolis to other district capitals which make comminuting from one place to another very easy. Most of the farming and the Peri-urban communities are linked to the marketing centers by feeder roads.

The Metropolis has a Teaching Hospital and two other Hospitals, as well as some private hospitals that provide health care services to the populace (Metropolitan Health Directorate, 2014).



3.2.3 POPULATION SIZE DISTRIBUTION AND GROWTH

Generally, the Tamale Metropolis is assumed to have a population range of between 350,000 to 450,000 people, however, according to Ghana statistical service (web) the 2010 National Population and housing census states that the metropolis population was 233,252, representing 9.4% of the region's population, which comprises 111,109 males (49.8%) and female 112,143 (50.2%). The population density is 318.6 persons per square kilometer for the Metropolis while the regional average density is 25.9 persons per square kilometer (Puopiel, 2010).

In the Tamale metropolis, there is diversity of ethnic groups of which about 80% of the total populations are Dagombas. Before the dawn of the Western and Eastern Religions, the Dagombas were mainly traditionalist with their culture deep rooted in their customs and beliefs. This still reflected in the many traditional festivals celebrated today in the area. However, this culture is not so pronounced due to the ethnic diversity in the metropolis and the influence of the Islamic religion.

The urban population is (80.8%) with few of the people in rural (19.1%) in the metropolis. There is massive variance between the densities of the city and rural areas. This reflex that there is movement of people to the Tamale metropolis and gives credence to the assertion that facilities and opportunities for modern employment are concentrated in few central places in the area especially the Central Business District. The metropolis is dominated by the youth (15-64 years is about 131,826) representing 59.0% of total population. The youthfulness of the population implies that it has the most important human resource potential for development.



3.2.4 WATER AND SANITATION

In the metropolis about 81.2% of the household has access to pipe borne water and about 18.8% still use unsafe drinking water source, this reflect the work that still needs to be done. Over 45,000 household in the metropolis, (26.1%) do not have toilet facilities in their houses, while about (56.2%) uses public toilet facilities hence urgent solution is needed because of the serious health implication. About 70.9% rural and 29.1% urban household do not have a proper place for waste disposal and waste in dumped indiscriminately in the area. The Metropolis has good electricity supply as about 70% of the communities are connected to the National Grid. (GSS 2010 Population and Housing Census).

3.3 STUDY DESIGN

To achieve the objectives set for this study, a wide variety of method was employed in the data collection and analysis. As Bryman (2008) advises a combination of methods to enable triangulation that capture different dimensions, the choice of different methods provides synergy in data capturing. The research therefore employed the mixed method (both qualitative and quantitative) approach to ascertain different views and experiences of the effects of citing of the landfill in Gbalahi in the Tamale metropolis with multiple households and respondents.

Wisdom and Creswell (2013), referred to “mixed method “as an emergent methodology of research that advances the systematic integration, or “mixing,” of quantitative and qualitative data within a single investigation or sustained program of inquiry”. A combination of different data collection techniques was used which complemented one another and was competently used to ensure high/good data quality and diminish the odds of bias. In social science research, this is deemed necessary due to the increasing recognition that research concerns in the discipline straddle the dualistic modes of analysis across environment, economic, cultural and physical



concerns (Demerrit, 2009). The mix method was employed because of the sensitive nature of the topic under investigation. The qualitative method was used to cross check the findings from the quantitative.

For the quantitative method, the survey method was employed to collect data from selected household in Gbalahi community. The instrument used was a questionnaire designed by the researcher. A questionnaire was preferred for the reason that it allowed anonymity and results in a more truthful response. The structured questionnaires were administered to the household (men, women, and children >18 years) living close to the Gbalahi landfill site. The format of the questionnaire was in two parts. The first part was made up of the socio-demographic data of participants. The second part was made up of questions to solicit information based on the objectives of the study consisting of open and close ended questions and Likert type scale with options namely: YES, not sure (NS), and NO. The questionnaire was given to respondents to fill with the assist of a trained research assistants. The standard procedures were adopted in the study to ensure validity and the quality of measurement procedures which provide repeatability and accuracy were considered and this guaranteed reliability, credibility and trustworthiness of the research work.

The qualitative method is a non-descriptive statistics. It employed focus group discussion, personal observation and key informant interview using focus group discussion guide, Observation checklist and Key informant interview guide respectively. The guide was made up of questions to solicit information based on the objectives of the study, on initial discussion on the citing of the site and works, how waste is accepted and deposited, knowledge of health problems and measures put in place by the assembly to surmount such hazards, infection control and knowledge and practice of personal hygiene. Social researchers argue that a hybrid research



approach (is a combination of qualitative and quantitative approach, where qualitative approach is utilized to uncover the meaning and attitude behind quantitative data) in which a variety of perspectives play a function in dealing with the problem under investigation which is most appropriate for research bordering on social issues (Batterbury, 2008; Simon, 2004). The inclusion criteria was respondent above 18 years and had lived in the community for more than 10 years while the exclusion criteria was respondent below 18 years, on-permanent resident and has not live in the community for 10 years and more.

3.3.1 THE SURVEY

The survey method was deemed relevant for this study because it was the most appropriate and effective way of reaching the target population in selected households in the study community considering the topic under investigation. The survey involved administering a questionnaire with a set of question and standard response (appendix A). In conducting the survey, one hundred and fifty (150) questionnaires were administered to one hundred and fifty (150) respondents in the study community using a simple random sampling method and in households where there was more than two occupants, this allowed every household member to have equal chances of being a respondent in the study. Special attention was given to households who were very close to the landfill site to ascertain their levels of exposure as well as the risks associated with the landfill and also how it affects their health and that of their household members. The themes covered by the questionnaire reflected the objectives of the study. The survey instrument contained questions that focused on the following thematic areas of the study: the socio-demographic characteristics of respondents, the landfill and pollution related effects of the



landfill site and measures put by the authorities to remedy the effects of the location of the landfill to the people in the study community.

Sampling is very vital in research. It is used when it is not possible to include the entire population in the community in a research projects (Williamson, 2002). A simple random sampling technique was employed to select respondents for the survey in the study community.

With the help of the leadership of the Gbalahi community, we zone the community into two zones A and B. Zone A was where the focus was because houses within the zone were closer to the landfill site. Zone B houses were about 200 to 300 metres away from the landfill. 100 households were selected from zone A and 50 household from zone B. In each of the zone every second house from the direction of the landfill site were selected. A Sample size of 150 was obtained from a population size of 240 using the YEMANE formula (1967) for acquiring sample size.

$$n = \frac{N}{1 + N(e)^2}$$

n= sample size, N= Total population and e= error of margin (0.05)²

3.3.2 FOCUS GROUP DISCUSSIONS (FGD)

Focus group discussion was employed to capture the wide range of experiences of the respondents which are useful in complementing the data collected through the survey and the key

informant interviews (Johnson and Onwuegbuzie, 2004). Focus group discussions allow the individuals in a group context to express their personal views, knowledge and experiences in an

informal way. In this study two focus group discussions were conducted five (5) participants in each group. The participants were drawn from the households especially those that were closer to the landfill. The first group was made up of women and the second group constituted men.



3.3.3 OBSERVATION

Personal observation was employed to provide perspectives on issues normally not discussed in interviews because they are taken for granted. Observation was used in this study to capture speculations, perceptions, feelings, ideas, problems, and prejudices as well as the closeness of the houses to the landfill. Observation is very essential in research as it aid the researcher to take note of the body language of the interviewee in order to have a true picture of the situation, especially in studies that are mainly on physical structures like the landfill where the research can see and feel what the respondents will be feeling. The observation conducted during the fieldwork was on the activities of the landfill side, the researcher also observed the distance of the houses and the landfill. Observation was also employed to ascertain the activities of livestock on the landfill.

3.3.4 KEY INFORMAT INTERVIEW

A key informant interview is a standard anthropological method that is extensively used in health-linked research and social development enquires. It is a method used for rapid assessment for gathering information from the affected people or community. (O’Leary, 2008). The word key informant refers to a person who has adequate knowledge on a particular issue or subject matter and can provide such detailed information and opinion on the subject of investigation. A key informant interview seeks to have qualitative information that can be narrated and cross-examined with quantitative data.

The interviewer remains neutral and must refrain from asking biased or leading question during the interview. (Kearn, 2000). Four key informants were selected to share their opinions about the health effect of the landfill on the people. The key informants selected were the Assembly man



of Gbalahi community, the sanitation officer of Gbalahi community, director of waste, Tamale Metropolitan Assembly, the chairman of the health committee in the community.

3.4 METHODS OF DATA ANALYSIS

The analysis began with the organisation of data from the audio-recorded interview, fieldwork notebook from observation, interviews, focus group discussion and document from the selected respondents and participants. Two analytical procedures were used since a mixed-method approach has been employed. The quantitative data analysis followed the conventional variable identification, entry and manipulation using the SPSS software, while the qualitative data analysis used manual coding procedures. First, the qualitative data were analysed using thematic and content analysis approaches. Second, the survey data were analysed using the SPSS version 20.

As recommended by Bryman (2008), procedures for qualitative data analysis should ensure data coding. Data coding involves a methodical examination of the text in order to recognise certain ideas, phrases, sentences and quotations that represent certain phenomena and show what the data represents (Kitchen and Tate, 2002). The quotations and sentences identified were highlighted and a descriptive label was assigned for each phenomenon expressed. The interpretation of the result was done by relating these categories to research question and theoretical ideas behind the research.

The quantitative data analysis involved the use of descriptive tables to show patterns, while cross-tabulations enabled relations between various variables. Various theoretical propositions were subjected to test by assessing the socio-demographic background of the respondents in relation to the main variables that measure migration dynamics, health, livelihoods and



outcomes. Both individual and community-wide variables were used to assess the influence on patterns and relationships.

3.5 THE POSITIONALITY OF THE RESEARCHER

According to Teye (2012), the concept of positionality is based on the assumption that the researcher's characteristics in relation to the research participants can impact the results that are produced. Researchers are part of the world they investigate, and as such bring their personal biases into the analysis and findings. This has been the major criticism of postmodernists against positivist science which argues for objectivity. In conducting this research, the challenges of the sense of attachment to the respondents through ethnicity and background heavily on even the identification of the research problem. This introduces the second dimension of the relationship between the researcher and the research.

The objects of study in the social sciences cannot be compared to the rocks studied by geologists, hence the relationship between the two needs a careful understanding. Since the study community members were facing multiple social, economic and health problems which is a question of social justice, the tendency to be sympathetic is very high and can constitute a hurdle to the objectivity demanded by positivist science. Also, as an academic of middleclass status interacting with people with little educational status, there are bound to be power dynamics at play that may influence responses. In dealing with these issues, an important aspect of the solution is to identify all these positionality dimensions and acknowledge how they can influence the research. Considerable care was taken in defining the researcher's status and role, and how this affect both the collection of data and analysis and conclusions of the study. Objectivity is not the objective, but conscious efforts to reduce personal distortions in the space of the respondents and influence responses and outcomes of the research.



Most important are strategies designed to minimise the power imbalance between the researcher and the respondents by coming down to their level through conversations, sharing sitting and eating spaces, and winning their confidence through telling stories of the researcher's background as a struggling young woman. The fact that the researcher chose to study the community helped to bridge the gap between the researcher and the respondents. The community members really appreciated the fact that someone cared about them and wanted to listen to their stories. The research team's relationship with them helped to eliminate any power relationships that existed and created an atmosphere of trust and openness between the two parties.

Sharing personal experiences in a research process is a researcher's way of doing research and Oakley (1981), for instance, states that such sharing is an effective way to overcome hierarchical relations. In this research, the relationship with the respondents through ethnicity did not influence how the former saw the social problem. The study was driven by the researcher's conviction that the community member's situation should be improved and that science should lead to the emancipation of mankind by rendering useful information and analysis of the human condition to which policies can apply corrective measures. The researcher built a good working relationship and won the trust of the respondents in the selected households for the study. Certainly, this procedure was also important in understanding the social-cultural issue and issues



that could raise ethical challenges in the research, like the possible questions to ask, and as a non-native female researcher, how to relate to a group of predominantly male research participants, in view of the cultural norms and values of northern Ghana.

By using mixed methods, the research minimises the effects of poor and distorted responses which mar data quality and analysis. Where particular issues were not well dealt with using a particular method, the use of triangulation resolved the issues. Complementation and

corroboration of findings with multiple methods increases the credibility of the findings in the context of problems with positionality.

3.6 ETHICAL CONSIDERATIONS

In this study it was necessary to collect a lot of information of a highly personal nature. For this reason, anonymity was of vital importance to protect the personal identity of the individual respondents. Necessary precautionary measures were taken to protect the confidentiality of the respondents. Participants were duly informed about the purpose of the study. They were also educated on the main components of the research design. Respondents were assured of confidentiality, though they were told, for instance, in the case of the life history interviews, that their voices would be recorded. No participant was coerced by any means to take part. They willingly accepted to actively participate in the study. Pseudonyms were used in the study report to conceal the identity of all the respondents.

Another area of interest was the relationship between the researcher and the subjects of the research. It has been argued by feminist researchers that conducting research on women's issues, especially their reproductive health and general health issues can pose special ethical problems for those who are part of the feminist tradition (Wolf, 1996). At times both the researcher and the

respondents were conscious of the social distance that affected effective communication and rapport. The solution adopted by the researcher to address this challenge was to play down or suppress matters concerning his social position and background. By doing this the researcher started helping the study community members, sharing drinks with them and also visiting and attending social activities with them on week end drew the researcher closer to the people. Finally, I was accepted and became part of the Gbalahi community.



CHAPTER FOUR

4.0 RESULTS

This chapter presents results and analysis of data collected from the field survey. The results obtained from the field have been appropriately categorized under key issues for consideration in this survey in order to make relevant analysis for research findings to be arrived thereof. Charts, and tables were used to present the data accordingly.

4.1 SOCIO-DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

One hundred and fifty respondents participated in this study. The mean age was 38.0 (± 15.95), majority of the respondents were within the age group of 21 to 40 years. On Gender, 62.0% (n=93) were female and 38.0% (n=57) were males. About 74.7% were employed, 20.0% unemployed whiles 4.7% were students and 0.7% retired. Most (96.0%) were Dagombas with the remaining 4.0% Fulani's, all respondents were Muslims. (Table 4.1)



Table 4.1 Socio-Demographic Characteristics of Respondents

Factor		Frequency	Percent	
Sex	Female	93	62.0	
	Male	57	38.0	
	Total	150	100.0	
Age (Years)	18 to 20 years	13	8.7	
	21 to 40 years	83	55.3	
	41 to 60 years	33	22.0	
	61 years and above	21	14.0	
	Total	150	100.0	
Employment Status	Employed	112	74.6	
	Retired	1	0.7	
	Student	7	4.7	
	Unemployed	30	20.0	
	Total	150	100.0	
If Employed, what work?	Artisan	1	0.9	
	Driver	2	1.8	
	Farmer	79	70.5	
	Other	2	1.8	
	Salary Worker	1	0.9	
	Seamstress	5	4.5	
	Trader	22	19.6	
	Total	112	100.0	
	Ethnicity	Dagomba	144	96.0
		Fulani	6	4.0
Total		150	100.0	
Marital Status	Married	127	84.7	
	Never Married	20	13.3	
	Widow	3	2.0	
	Total	150	100.0	
	Level of Education	Junior High School	9	6.0
No Education		114	76.0	
Primary		22	14.6	
Senior High School		1	0.7	
Vocational School		4	2.7	
Total		150	100.0	
Religion		Muslim	150	100.0
	Total	150	100.0	

Source: field survey, 2018



4.2 LENGTH OF STAY AND DISTANCE FROM LANDFILL SITE

From Table 4.2 Below it was realized that 92.7% of respondents had lived in the Vicinity for Ten years or more. With regards to distance, almost half (49.3%) were 200 meters or further from the landfill site, 12.7% 100 to 149 meters, 6.0% less than 50 meters while 16.0% were 50 to 99 meters and 150 to 200 meters respectively.

Table 4.2 Length of Stay and distance from landfill site

Factor	Frequency	Percent
How long have you lived in this vicinity?	Less than 1 year	3 2.0
	1 – 5 years	5 3.3
	6 – 10 years	3 2.0
	Above 10 years	139 92.7
	Total	150 100.0
Distance from landfill site	Less than 50 meters	9 6.0
	50 – 99 meters	24 16.0
	100 – 149 meters	19 12.7
	150 – 200 meters	24 16.0
	Above 200 meters	74 49.3
	Total	150 100.0



Source: field survey,2018

4.3 HEALTH PROBLEMS POSED BY THE LANDFILL SITE

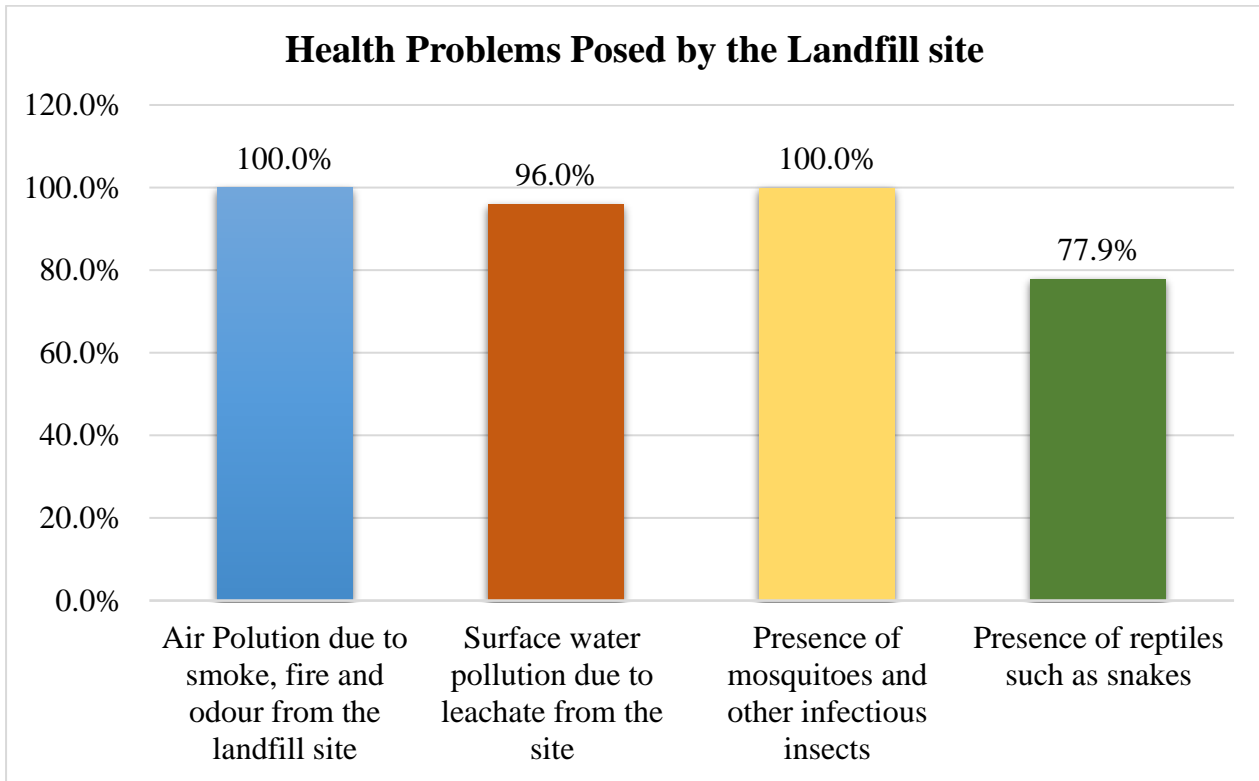


Figure 4.1 Health Problems Posed by the Landfill site

Source: field survey, 2018

On the issue of health problems posed by Landfill site, all respondents (100.0%) indicated that there was air pollution due to smoke, fire and odour from the landfill site including the presence of mosquitoes and other infectious insects. About 96.0% also said there was surface water pollution due to leachate from the site while 77.9% indicated there was the presence of reptiles such as snakes.

In an individual interview with one of the respondents, he reported as follow:

“If you are eating in this house and a truck or any other vehicle passes, it can blow so many infected materials into your food. As for this one, it has not yet even gotten to the landfill site but already given you your share of the infection. Also, as the vehicles passes, the dust is all around,



it will all settle after they stop passing and that is the time we will also go to sleep. When asked this question, this was the response”. Where do you think the dust is going to settle after the wind stops blowing? “Everything will settle on us and particularly on our food. Is it something that is good? Hmmm! We are just eating and drinking infected and contaminated food and water” (an opinion leader of Gbalahi)

Another respondent reported “here it is difficult to get water, I travelled to Kalphoni to get good drinking water but the moment it gets to this house it becomes contaminated because of the activities in the landfill. Hmm! This house is just by the road and the trucks that carry the rubbish sometime drops them in front of the house because they are over loaded”.

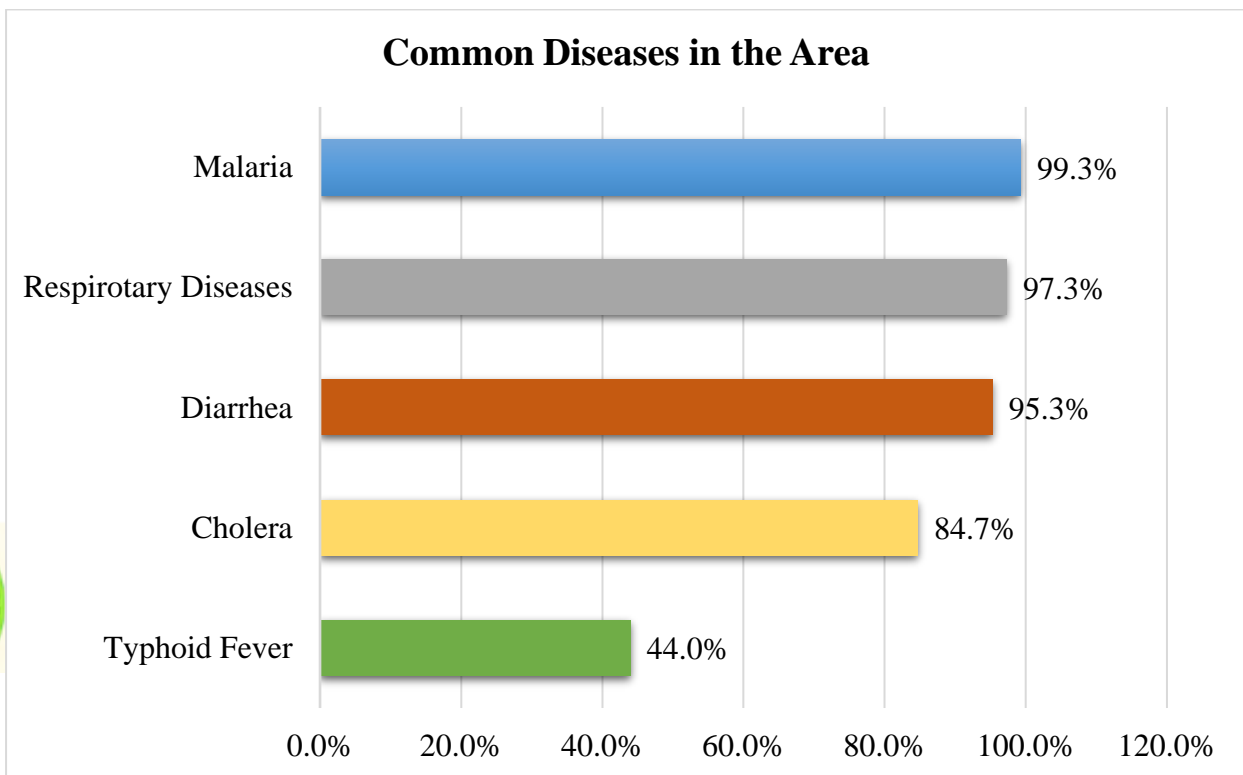


Figure 4.2 Common Sicknesses in the Area

Source: field work, 2018

4.4 COMMON SICKNESSES IN THE AREA


The most common sickness in the area was malaria (99.3%) followed by respiratory diseases (97.3%), diarrhea (95.0%), cholera (84.7%) and typhoid fever with 44.0% as illustrated in figure 4.2 above.

In an individual interview with the respondents some of them reported as follows:

“Do I even know the sickness my family and I are suffering from? Almost every day a member of this family is sick and at the hospital. We are even tired of visiting the hospital. Is it a crime to live in this area? I spent all my monies on health. Just look at this boy since last week he has been having a running stomach”. Source: A respondent in Gbalahi.

[...] “Well, if you ask me about the most prevalence diseases in this community for instance, my response will be malaria, because malaria is the most common diseases because that is what we suffer a lot in this household. But I cannot speak for other households. My response is just limited to my household”. (A resident from Gbalahi)

In an interview with the Assembly man of the area, he remarked as follows:

 *“The common illness in this community is malaria but the issue of typhoid in this community is alarming. Almost every household in this community has at least one person suffering from typhoid. The public health unit of the metropolis came here for some assessment and their finding revealed that the location of the landfill in this community exposes the people to all kinds of morbidities including the typhoid the people are always complaining of”*.

Source: Assembly man Gbalahi electoral area.

[...] “Malaria, typhoid, diarrhea, vomiting, cough (respiratory disease) and skin diseases are the diseases most people in this community are suffering from. The people here always complain about their ill health any time we meet them. We have reported to the metropolitan assembly for solution but to no avail.” (Waste management officer of the Tamale Metropolis)

4.5 THE HEALTH EFFECTS OF LANDFILL ON THE PEOPLE LIVING CLOSE TO THE SITE

One hundred and forty-nine respondents representing 99.3% said the location of the landfill site poses threat to the health of the people in the area. When quizzed further they (99.3%) indicated members of their household had suffered from sickness related to the landfill site. Some 45.3% indicated that members of their household report been sick as frequently as twice a month.

The data also revealed that 94.0% of respondents knew someone in the surrounding area who had suffered a health crisis due to the landfill. Overall 62.7% said their health status was “very deteriorated” compared to when the landfill was not there, 34.0% said there was no difference in their health status while 3.3% said they felt less healthy as shown in **Table 4.3**



Table 4.3 Health Effects of Landfill site on the People Living Close to the Site

Factor		Frequency	Percent
Does the location of the landfill site pose any threat or risk to you?	No	1	0.7
	Yes	149	99.3
	Total	150	100.0
Does the location of the landfill pose any health problem to you and your household?	No	1	0.7
	Yes	149	99.3
	Total	150	100.0
Have you or any member of your household ever suffered any sicknesses before?	No	1	0.7
	Yes	149	99.3
	Total	150	100.0
If yes, how frequent do you or household members fall sick?	Once every week	1	0.7
	Once in a month	50	33.3
	Twice in a month	68	45.3
	Once in three months	22	14.7
	Above 3 months	8	5.3
	N/A	1	0.7
Do you know of anyone in this surrounding or area who has also suffered a health crisis due to the landfill?	No	9	6.0
	Yes	141	94.0
	Total	150	100.0
How will you evaluate your health status now as compared to when the landfill was not here?	Less healthy	5	3.3
	Very deteriorated	94	62.7
	N/A	51	34.0
	Total	150	100.0

Source: field survey, 2018

- [...] *“It is not only this community; all the surrounding communities are also affected. In*

raining season, women used sanitary pads and other wastes that fall off the moving trucks are washed into our dam contaminating our only source of drinking water. Mosquitos, big black flies are seen too. You can even see the flies yourself, they feed on our food, and in the afternoon you cannot even sit outside. Even the liquid waste is washed into our dam. In the dry season, dust, smoke also affects us especially in the evening, when the smoke comes on, we breathe it in whether we like it or not, thereby making a lot of people have chest pain, breathing problem, Asthma”. (Assembly man of Gbalahi)



“My sister, everything here is contaminated, the water we drink, the food we eat, the air we breathe, and we are not safe in this community. Our community is the community that records the highest death rate in the metropolis. Look at our population and almost every month a member from this community will die. Why? It is so sad. Our youth have migrated to different town because of our situation”. (respondent in Gbalahi)

4.6 EXTENT OF EFFECT OF POLLUTION FROM LANDFILL ON RESIDENTS

The data also revealed some threats faced by residents near the landfill, it was realized that 100.0% said smell or odour from the site was more severe. 90.7% also indicated the presence of pest such as flies and vermin were also more severe. **Table 4.4**

- [...] *“You are very lucky today that the wind is not blowing, the smoke you would have seen will have prevented you from conducting this interview, or you conduct the interview and take your share which is a disease to wherever you came from. The smoke from the landfill site is not limited to only we those in this community but those in the nearby communities as well. Our neighbors in, Taha the next community also face similar challenges but ours is too much because*

we are very close to the landfill.” All of us here inhale the smoke and the polluted air. The community smells, you cannot sit in your room because of the smell. We breathe in illness and breathe out morbidity”. (Community Health Volunteer, Gbalahi)



Table 4.4 Extent of effect of pollution from landfill on Residents

Factor	More Severe	Severe (2)	Moderate (3)	Less	N/A
Smell or odour from landfill	150 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Pest such as flies, vermin	136 (90.7%)	9 (6.0%)	5 (3.3%)	0 (0.0%)	0 (0.0%)
Poisonous gases	63 (42.0%)	16 (10.7%)	17 (11.3%)	54 (36.0%)	0 (0.0%)
Noise from machine on site	24 (16.0%)	10 (6.7%)	14 (9.3%)	28 (18.7%)	74 (49.3%)
Litter from the refuse	108 (72.0%)	40 (26.7%)	2 (1.3%)	0 (0.0%)	0 (0.0%)
Surface water and household water contamination	143 (95.3%)	6 (4.0%)	1 (0.7%)	0 (0.0%)	0 (0.0%)
Dust	139 (92.7%)	7 (4.7%)	4 (2.7%)	0 (0.0%)	0 (0.0%)

Source: field survey, 2018

4.7 KNOWLEDGE OF WASTE DUMPED AT LANDFILL AND HOW IT IS TRANSPORTED

The analysis also showed that 148 respondents representing 98.7% of the sampled population said they knew what is dump at the landfill whiles all of them (100.0%, n=150) indicated that they have an idea about how the waste was transported to the landfill site. They were quick to

indicate that the mode of transporting the waste to the landfill site is not proper because of the poor state of the road. *“Most of the times you come out and see big drops of waste by your house and you have no option than to carry it to the landfill”*. (A man in Gbalahi)



Table 4.5 knowledge of waste dumped at landfill and how it is transported

Factor	Frequency	Percent
Do you know what they dump on the landfill?	No	2 1.3
	Yes	148 98.7
	Total	150 100.0
How are the waste transported?	Vehicles	150 100.0
	Total	150 100.0

Source: field work,2018

In an individual interview with the assembly member of the area he reported as follows:

- [...] *“most of the wastes are transported by the Zoom lion trucks and tricycles to the landfill. Some even use their tipper trucks to transport the waste. This landfill is the only one in both the Sagnarigu Municipality and the Tamale metropolis. You can imagine the population of the area and all the wastes both liquid and solid including health care waste are dump here”.*
(Assemblyman of Gbalahi)

In an interview with one of the residents in the area revealed the following:

“The road here is very poor, most of the times, the trucks that carries the waste to the landfill broke down on the way. The driver will just abandoned the vehicle and the waste. At time it takes them more than a week before they can come to off load the waste and work on the truck. This makes life uncomfortable to some of us especially we those standing by the road. There was a time we the community members mobilised ourselves and had to burn the waste in a truck because it was there for almost a month and no authority care about our plight. So sad my sister”.



4.8 TYPE OF WASTE DEPOSITED AT LANDFILL SITE

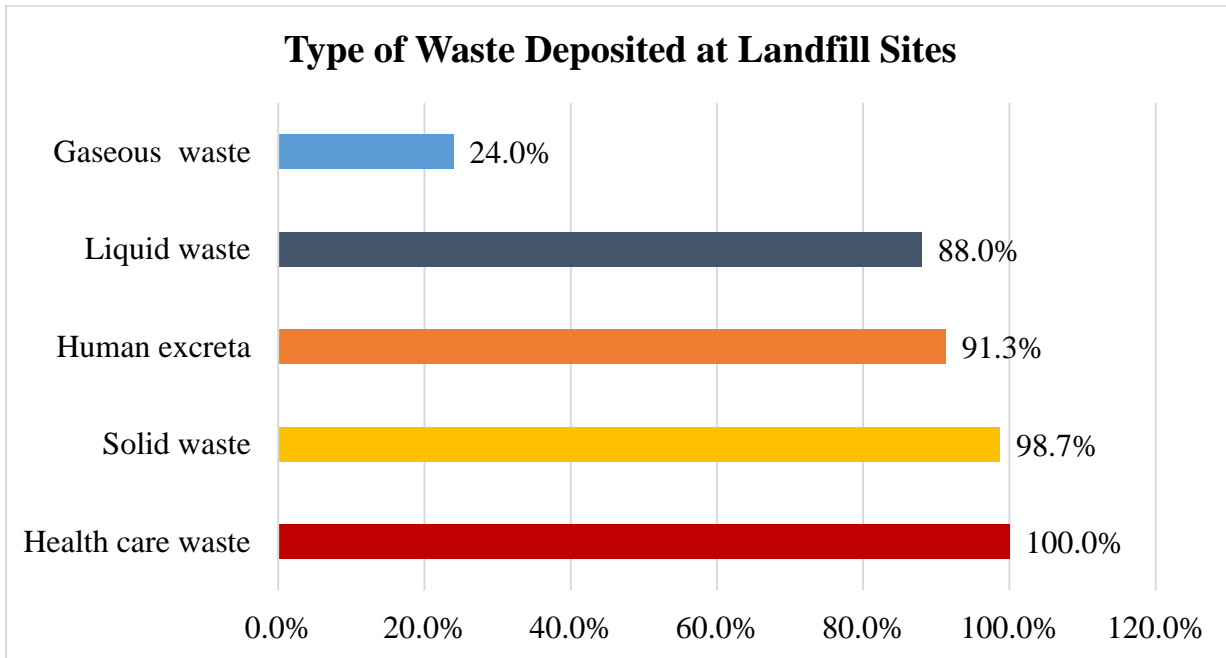


Figure 4.3 Type of Waste Deposited at Landfill Site

Source: field survey, 2018

The most common waste disposed at the landfill was Healthcare waste (100.0%, n=150), followed by solid waste (98.7%, n=148), then human excreta (91.3%, n=137) and liquid waste (88.0%, n=132). The least was gaseous waste (24.0%, n=36) as shown in figure 4.3



- [...] *“A lot of things that they bring here (are) especially rubber, almost all (kind of) waste things”.* (Community Health Volunteer, Gbalahi)

4.9 LANDFILL AND WATER AND FOOD POLLUTION

All respondents accessed water for domestic use from the dam (100.0%, n=150), 149 respondents representing 99.3% of the study population had their water source more than 200

meters from the landfill while one respondent (0.7%) was within 200 meters from the landfill. On the issue of water pollution, 96.7% (n=145) said they suffer water pollution due to the location of the landfill while 98.0% (n=147) indicated the location of the landfill affected or polluted their food (Table 4.6).

Table 4.6: Landfill and water and food pollution

Factor		Frequency	Percent
Where do you access your water for domestic use?	DAM	150	100.0
	Total	150	100.0
What is the distance from your water source to the landfill?	200 meters or less	1	0.7
	More than 200 Meters	149	99.3
	Total	150	100.0
Do you suffer water pollution due to the location of the landfill?	NO	5	3.3
	YES	145	96.7
	Total	150	100.0
Can you tell me if the landfill location affects or pollute your food?	NO	3	2.0
	YES	147	98.0
	Total	150	100.0

Source: field survey, 2018

- [...] *“Even in the rainy season, it is not only the running water that pollutes our river. Sometimes a truck will just be passing and part of the waste will drop on the road and finally find its way into our source of drinking water because the proximity of the water source to the road” (Man from Gbalahi)*

During a focus group discussion, a member lamented her frustration as stated below:

“Madam we the women here are the most vulnerable, because you spend hours in searching for water and it take just a second for the water to be polluted. Just look at my water containers, I have to cover them with these plastics and yet still they are polluted. It has posed serious



financial challenge to most of us because the little that we have we spend it on purifying our water and also buying rubbers to cover our domestic water”.

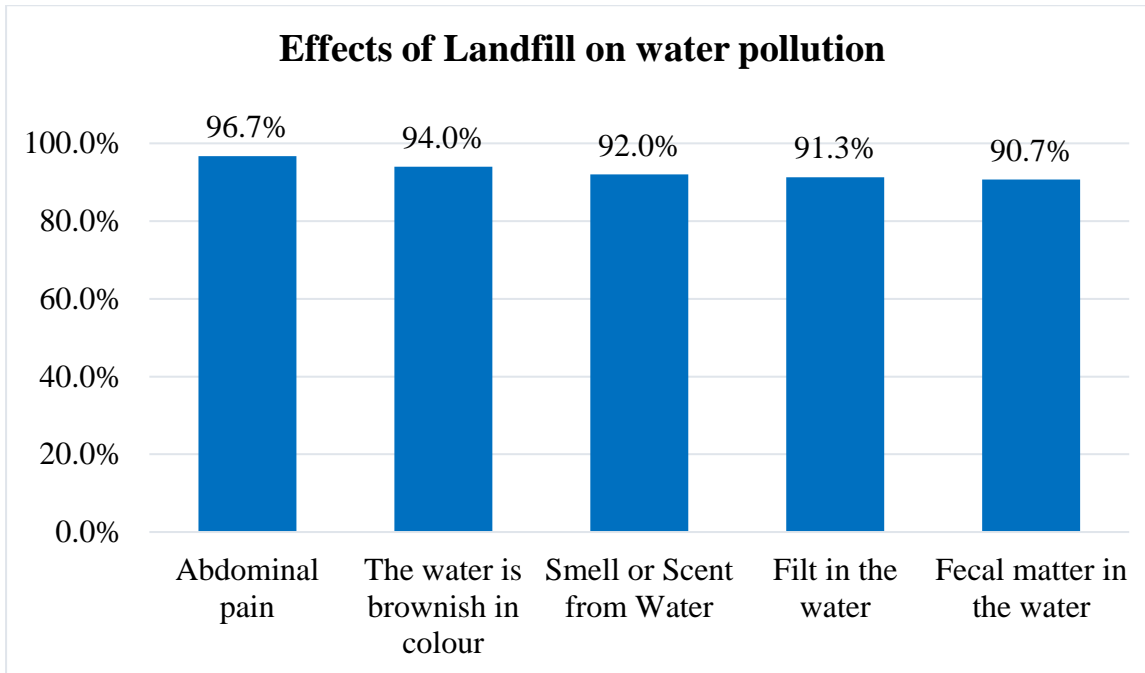


Figure 4.4. Effects of landfill on water pollution

4.10 EFFECTS OF LANDFILL ON WATER POLLUTION

From the illustration in figure 4.4, the worst effect of the landfill on water pollution was abdominal pain (96.7%, n=145), followed by brownish colour of water (94.0%, n=141) then smell or scent from water (92.0%, n=138). Filth in water and fecal matter in the matter were 91.3% (n=137) and 90.7% (n=136) respectively.



4.11 EFFECT OF LANDFILL ON FOOD POLLUTION

Of the 150 respondents, 93.3% (n=140) said wind blow filth and particles from the landfill into their food while 98.0% (n=147) said big black flies from the site perch on their food as show in Table 4.7

Table 4. 7 Effect of landfill on food pollution

Factor	Frequency	Percent
Wind blow filth and particles into our food	No	10 6.7
	Yes	140 93.3
	Total	150 100.0
Big black flies perch on our food	No	3 2.0
	Yes	147 98.0
	Total	150 100.0

Source: field survey, 2018

- [...] *“The moment they finish washing the pots and other cooking utensils after cooking, you will see those big black flies occupying the left-over water in the pots if not poured away immediately. And when they prepare food down for you, you won’t feel like eating it. And it is that filth over there, which is producing those flies.”* (Man, from Gbalahi)

A Chi-square Test for association was conducted between water pollution from landfill and the effects of landfill on water pollution. The results revealed that there was statistical significance between the variables with $p < 0.05$ (Table 4. 8).

The test was further conducted on food pollution from landfill and effects of landfill on food pollution. The result also showed there was statistical significance (Table 4.9).



Table 4.8 Water pollution from landfill and effects of pollution on water

Effect of landfill on water pollution	Water pollution from landfill								
	No		Yes		Total		X^2	p-value	
	N	%	N	%	N	%			
Abdominal pain	No	5	3.3	0	0.0	5	3.3	150.00	.00
	Yes	0	0.0	145	96.7	145	96.7		
	Total	5	3.3	145	96.7	150	100.0		
Smell or scent from water	No	5	3.3	7	4.7	12	8.0	59.48	.00
	Yes	0	0.0	138	92.0	138	92.0		
	Total	5	3.3	145	96.7	150	100.0		
The water is brown in color	No	5	3.3	4	2.7	9	6.0	81.03	.00
	Yes	0	0.0	141	94.0	141	94.0		
	Total	5	3.3	145	96.7	150	100.0		
Filth in the water	No	5	3.3	8	5.3	13	8.7	54.51	.00
	Yes	0	0.0	137	91.3	137	91.3		
	Total	5	3.3	145	96.7	150	100.0		
Fecal matter in the water	No	5	3.3	9	6.0	14	9.3	50.25	.00
	Yes	0	0.0	136	90.7	136	90.7		
	Total	5	3.3	145	96.7	150	100.0		

Source: field survey, 2018

Table 4.9; Food pollution from landfill and effects of landfill on food pollution

Effects of landfill on food pollution	Food pollution from Landfill								
	No		Yes		Total		X	p-value	
	N	%	N	%	N	%			
Wind blow filth and particle into our food	No	3	2.0	7	4.7	10	6.7	42,86	.00
	Yes	0	0.0	140	93.3	140	93.3		
	Total	3	2.0	147	98.0	150	100.0		
Big black flies perch on our food	No	3	2.0	0	0.0	3	2.0	150.00	.00
	Yes	0	0.0	147	98.0	147	98.0		
	Total	3	2.0	147	98.0	150	100.0		

Source: field survey, 2018



Table 4.10: Location of landfill and common Diseases in the area attributed to landfill site

Common diseases in the area attributed to landfill site		Does the Location of the landfill pose any health problem to you and your household				
		No		Yes		p-value
		N	%	n	%	
Cholera	No	0	0.0	23	100.0	.182
	Yes	1	0.8	126	99.2	
	Total	1	0.7	149	99.3	
Diarrhea	No	0	0.0	7	100.0	.049
	Yes	1	0.7	142	99.3	
	Total	1	0.7	149	99.3	
Malaria	No	0	0.0	1	100.0	.007
	Yes	1	0.7	148	99.3	
	Total	1	0.7	149	99.3	
Typhoid fever	No	1	1.2	83	98.8	.813
	Yes	0	0.0	66	100.0	
	Total	1	0.7	149	99.3	
Respiratory Diseases	No	0	0.0	4	100.0	.028
	Yes	1	0.7	145	99.3	
	Total	1	0.7	149	99.3	

4.12 MEASURES TO MITIGATE HAZARDS TO RESIDENTS

With regards to measures put in place to mitigate the hazards the resident of Gbalahi are exposed to, there was no clear measures or plan in place.



- [...] “So there is nothing going on in this community that is coming from the Metropolitan Assembly as a way of reducing the suffering that we go through here.” (Man, from Gbalahi)

- [...] “There is no compensation plan in place for the residence. For instances the children that consumed the expired product at the landfill site and they collapse, they are sent to the hospital by their parents who pay the medical bills with their money, if they do not have National Health

Insurance Scheme (NHIS) card. We were promised some amenities like electricity, portable drinking water, good, tared, motorable and accessible road and a health post. Only the electricity was brought to the community, the individuals then have to connect the light into their houses” (Assembly man of Gbalahi).

- [...] *“There is nothing like that” (Community Health Volunteer from Gbalahi)*

- [...] *“No compensation plan is in place” (Waste Manger of Tamale Metropolis)*

In an individual interview with a unit committee member in the Gbalahi electoral area, he revealed

“The metropolis has no plan of solving the problem. We met Metropolitan Chief Executive and put before him our challenges with regards to the landfill, he told us to relocate but where can we get money again to buy plots of land to build another house? Nobody cares about us, the earlier we find solution to our problem the better”. (Respondent from Gbalahi)

4.13 Health Problems Posed in ZONE A (200 metres) and ZONE B (>200 metres)



About half of the resident below 200 metres (ZONE A) from the land fill site was seen to suffer from air pollution (50.7% n=76), surface water pollution (52% n=78), presence of mosquito and infectious insect (50.7%, n=76). About 34% (n=51) respondents who reside above 200 meters (ZONE A) while 43.3% n=65 who resides less than 200 metres (ZONE B) said they do experience the presence of reptiles.

Table 4.11: Health Problems Posed in ZONE A (200 metres) and ZONE B (>200 metres)

		DLFS-12											
		<50M		50-99M		100-149M		150-200M		>200M		Total	
		f	%	f	%	f	%	f	%	f	%	f	%
Air pollution due to smoke, fire and odour from the landfill site	NO	0	0.0	1	0.7	0	0.0	0	0.0	0	0.0	1	0.7
	YES	9	6.0	23	15.3	19	12.7	24	16.0	74	49.3	149	99.3
	Total	9	6.0	24	16.0	19	12.7	24	16.0	74	49.3	150	100.0
Surface water pollution due to leachate from the site	NO	1	0.7	3	2.0	1	0.7	0	0.0	2	1.3	7	4.7
	YES	8	5.3	21	14.0	18	12.0	24	16.0	72	48.0	143	95.3
	Total	9	6.0	24	16.0	19	12.7	24	16.0	74	49.3	150	100.0
Presence of mosquitoes and other infectious insects	NO	0	0.0	1	0.7	0	0.0	0	0.0	0	0.0	1	0.7
	YES	9	6.0	23	15.3	19	12.7	24	16.0	74	49.3	149	99.3
	Total	9	6.0	24	16.0	19	12.7	24	16.0	74	49.3	150	100.0
Presence of reptiles such as snakes	NO	0	0.0	5	3.3	1	0.7	5	3.3	23	15.3	34	22.7
	YES	9	6.0	19	12.7	18	12.0	19	12.7	51	34.0	116	77.3
	Total	9	6.0	24	16.0	19	12.7	24	16.0	74	49.3	150	100.0
Other	NO	9	6.0	24	16.0	19	12.7	24	16.0	74	49.3	150	100.0
	Total	9	6.0	24	16.0	19	12.7	24	16.0	74	49.3	150	100.0

Source: field survey, 2018

4.14 Common Diseases in ZONE A (<200 metres) and ZONE B (>200 metres).

From Table 4.12 it was realized that a little above half of the respondents within 200 metres (zone A) indicated they had cholera(63%,n=42), diarrhea(49.3% n=74), malaria(48.7% n=73) and respiratory diseases(49.3% n=74) as compared to those who reside above 200 metres (ZONE B) from the site said they did not experience cholera. Also, over half (27.3%, n=41) who reside above 200 metres said they had experience with typhoid fever and (22% n=33) had no experience with typhoid.



TABLE 4:12 Common Diseases in ZONE A (<200 metres) and ZONE B (>200 metres)

		0-200m		>200m		Total	
		Frequency	%	Frequency	%	Frequency	%
Cholera	NO	12	8.0	11	7.3	23	15.3
	YES	64	42.6	63	42.0	127	84.7
	TOTAL	76	50.6	74	49.3	150	100
Diarrhea	NO	7	4.6	0	0.0	7	4.7
	YES	69	46	74	49.3	143	95.3
	TOTAL	76	50.6	74	49.3	150	100
Malaria	NO	0	0	1	0.7	1	0.7
	YES	76	50.7	73	48.7	149	99.3
	TOTAL	76	50.7	74	49.3	150	100
Typhoid Fever	NO	51	33.9	33	22.0	84	56.0
	YES	25	16.7	41	27.3	66	44.0
	TOTAL	76	50.7	74	39.3	150	100
Respiratory Diseases	NO	4	2.7	0	0.0	4	2.7
	YES	72	48.1	74	49.3	146	97.3
	TOTAL	76	50.8	74	49.3	150	100
Others (Skin Diseases)	NO	75	50.0	74	49.3	149	99.3
	YES	1	0.7	0	0.0	1	0.7
	TOTAL	76	50.7	74	49.3	150	100

Source: Field survey 2018



CHAPTER FIVE

DISCUSSION OF THE STUDY RESULTS

5.0 INTRODUCTION

This chapter is devoted to the discussion of the result presented. The discussion is done in line with existing literature that support or dismiss the findings of the study. The discussion was done in such a way that it addresses the study objectives since the results presentation was presented with the aim of achieving the study objectives.

5.1 Socio-Demographic Characteristics of Respondents

With regards to the socio demographic variables of the study, women were the majority because of the nature of the topic. As stated by Opara, Eberendu and Uloneme (2015) that in discussing sanitation related issues, women are more vocal because they see to the sanitation needs of the house hold. It was also important to engage more female in this study because they were noted to have a better knowledge and awareness of health issues affecting their family. This resonate well in the study conducted by Opara, et al., (2015) which suggest that men only play the role of financing health care and sanitation related issues but do not have a good idea about the health status of their family and also how the sanitation within the house hold is manage and maintained.

The study also revealed that most of the respondents had no or low level of education which will make them expose to a lot of health challenges because they have poor knowledge on personal hygiene, health promotion, prevention and education. This study resonates well with the study



conducted by Omoniyi (2014), which reported that an individual level of education connotes his or her understanding of waste management and also directs him or her where to site his or her building.

An individual level of education has a direct link with the waste management practices and the health seeking behavior of the people. The low level of education among the respondents in the Gbalahi community has a direct link with the high prevalence of environmental related diseases in the area.

5.2 Distance to Landfill Site and Length of Stay within the Vicinity

With regards to distance from the landfill site to the houses in the community. About 50.7% of the respondent's houses were between 0 to 200 meters away from the landfill. The fact of the matter is that most of the community members had their plot of land for residential purposes before the site was set aside as landfill. The study revealed that the landfill site was established in the year 2004 by which time some of the residents were already residing in the community for some years. This tells us that majority of residents have a fair acquaintance with the operations, maintenance and nuisances created at the dumpsite and could consequently provide valuable information since they knew the conditions that existed before the dumpsite operations commenced in 2004. However, Coffie, 2010; Owusu et al., 2014 stated that a radius of 200m, which have been found as the distance that residents are highly affected by landfill sites. World Health Organization (WHO 2000), current statement recommended that any possible contact is probable to be restricted to 1 km from the landfill sites by the air pathway and 2 km by the water pathway. This presents a reasonable, composed and wide variety of opinions or ideal from respondents on their perception of the possible dangers or threats originating from the landfill site which they have experienced over the years.



5.3 Health Problem Posed by the Landfill to the Residents (exposure to health and environmental hazards)

The residents are exposed to all kind of diseases as a result of the citing of the landfill. The air they breathe, the food they eat and the water they drink are all polluted, exposing them to all kinds of diseases. Some of the health and environmental risks stated includes air pollution due to smoke, fire, and odour from the landfill site, surface water pollution due to leachate from the site, presence of mosquitoes and other infectious insects and presence of reptiles and snakes. There are a lot of big black flies making life in the area uncomfortable. This support the finding of Adu-Boahen (2012) who reported that the black flies within the landfill site exposes the people to all kind of morbidities. All these make the people of the area vulnerable.

The results revealed that most people less the 200 metres (zone A) was exposed to a lot of health problem as compared to those residing more than 200 metres (zone B) away from the landfill site. In accordance with the World Bank criteria on the selection of a landfill site, most impact of landfill operation on residential land use should be experienced within 250 metres of any dumpsite. (Nwambuonwo and Mudhole 2012).



5.3.1 Air Pollution Due to Smoke, Fire and Odour

Majority of the resident acknowledged they were exposed to a high level of risk due to the location of the land fill site been close to their residence. This is in affirmation with Ohwo, 2011 who affirmed that unmanaged long-standing waste causes serious hazard and exude offensive odour which leads to serious health conditions to the resident that lives close to the landfill site. In addition, open Burning of waste is a poor waste management practice and environmentally

unfriendly option that emanates hazardous cancer-causing compounds as well as toxic substances into the environment (United Nations Environmental Program Agency 2006).

Fire from the land fill site may either be self-ignited from the waste as a result of the gases produced from the waste or by fire in waste transported from the points of collection in towns and cities in central common containers. The smoke generated from the fire travels a long distance into the community during the day as well as at night affecting the air the resident's breath because that was the only way the landfill site could be managed. However, open fire is not unusual. The Department of Environments (1997) acknowledged that smoke emanating from fire in wastes at the landfill sites is rare. According to Adu-Boahen (2012) fire at landfill site may result from self-gas ignition at the landfill site or by fire in waste transported from the points of collection in towns as a result of hot ash put in central public basins. Coffie (2010) observed that smoke from the Oblogo landfill site spread to the residence at an intolerable level. Landfill sites fire and smoke is dangerous to people living in nearby communities including ash and particulate matter. Hence it must not be handles in a lackadaisical way rather as a possible emergency. Pukkala and Pönkä, 2001; Gouveia, Prado, 2010, proposed that the location of landfill site can occasionally expose the resident who live close to the landfill site to momentous challenges.



Flintoff (1976), stated that landfill sites has two basic requirements to satisfy in order to diminish odour: the waste should be repositioned and compacted into a thin layer of about two meters in depth, and the surface of the deposited waste should be covered with appropriate soil of 15cm in thickness every working day. One of the challenges faced by the residents in the community is odour from the land fill site which get into their rooms. This odour is as a result of waste decomposition and poor management of the landfill site. Flintoff 1976, stated that odour is one

of the reason residents resist the citing of landfill in their communities. According to the U.S Department of Health and Human Services (2003) in a study carried out at the Alliance Landfill, recognized that an improperly designed and managed landfill site can produce a high level of air contaminants that could adversely affect residents nearby.

5.3.2 Surface Water Pollution Due to Leachate from the Site

Most of the resident acknowledged that during raining season the liquid waste from the landfill site is washed by flood waters through drains into their only source of drinking water and their water was highly contaminated and make them sick, which is very significant in this study. Ojo 2010 stated that unhygienic disposal of waste leads to environmental degradation thereby increasing the volume and range of hazardous waste as well as water contamination.

Indiscriminate waste disposal is harmful to humans and leads to contamination of surface and ground water through leachate, air pollution by burning of wastes, soil contamination through direct waste contact, uncontrolled release of methane by anaerobic decomposition of waste or spreading of diseases by different vectors like birds, insects and rodents (Visvanathan and Glawe 2006).

5.3.3 Presences of Mosquitoes and Other Infectious Insects

All the respondent stated that they were affected by mosquitoes and other infectious insect, this was irrespective of the distance of their houses from the landfill site. This study is in support of previous study carried out by coffie 2010 in Accra that inappropriately managed or citing a landfill site close to residences is detrimental to the health of the population. Waste in the landfill site serve as food and breeding ground for mosquitoes, fly, rodents and rats which transmit diseases to human beings either from the landfill site or otherwise (Rao, 2007). This study seeks to differ from the observation reported by Research Triangle Institute (1994) and Rushbrook and



Pugh (1999). It was very clear from the study that almost all the people in the area reported to be suffering from malaria and other environmental related diseases.

5.3.4 Presence of Reptiles Such as Snake

About half of the respondent said reptiles such as snakes is found at the landfill site and even move into their homes. The presences of the landfill site have increased reptiles in the area such as snakes. One of the respondents stated “for those we eat, we kill and eat but there are others which are also very dangerous to humans”.

Research Triangle Institute, 1994 stated that rodent migrates to the landfill site from the surrounding in search for food, shelter and water among the waste or are part of the waste brought to the site and if they get what they want they remain at the landfill site. Usually, Vectors do not prey on a properly managed and kept landfill. That is why there are two main requirements that a landfill site must meet to avoid vectors preying on it, which is the daily compaction and covering of the waste with a proper material to prevent vector from coming around as well as spreading vector borne disease (Flintoff, 1976).

5.4. Common Sicknesses in the area

A Greater proportion of the respondents stated that they suffer from malaria, respiratory disease, diarrhea, cholera and typhoid fever as a result of their proximity to the landfill. This is in line with the study conducted by Oduro 2014, which states that due to the huge level of nuisance and environmental challenges created by this waste and it will continue to create, it also serves as a point of contamination of underground water used by the humans, leading to several diseases like Malaria, diarrhea, intestinal worms and upper respiratory tract infections which are the topmost diseases reported in our health facilities and periodic widespread epidemics of cholera due to poor waste disposal. Both in the developing and developed countries, Studies that have



been conducted revealed that there are numerous serious health risks that are related with living close to landfill site. Lewis-Michl, et al.,1998; Jalaludin, 1998; Elliott, et al, 1996, 2000; Vrijheid, 2000 they found out that diverse kinds of cancers were associated with living close to landfill site.

World Health Organization, 2000 stated that the exposure of humans to these diseases possibly occurs via inhalation of polluted air, ingestion of contaminated water, or skin contact with contaminated water or soil have all been found to pose significant health risks to people.

It was noticed that the resident less than 200 metres (zone A) to the landfill site suffer more disease compared to those who reside above 200 metres (zone B) from the landfill site, hence the closer the resident to the landfill site the higher the exposure of residents to health problems.

This finding is consistent with that of Sankoh, et al., 2013, which acknowledged that the closer the residence to the landfill site the higher the frequency of the residents having health problems.

Thada, 2012 and Adeola, 2000 earlier research revealed that people who reside close to the landfill site are prone to a lot of medical challenges like asthma, cuts, diarrhea, stomach pain, reoccurring flu, cholera, malaria, cough, skin irritation, cholera, diarrhea and tuberculosis as compared to people who reside far from the landfill sites. Hence, member of the different household suffers from diseases such as cholera, chest related problems, malaria, skin disease

and diarrhea. Further research can be carried out by comparing the common sickness in Gbalahi community and another community without a landfill site to know the actual disease burden if it is actually due to the presence of the landfill site in the community or not.

5.5 Frequency of Ailment of the Residents

This current study revealed that almost every member in the community visit the health facility or sought health care at least once a monthly or every two months this is due to the disease they



suffer from as a result of the presence of the landfill. Some also see it to be normal because they are fed up with visits to health facility due to the ineffectiveness of the health insurance. The finding is consistent with that of Sankoh et al., 2013, which acknowledged that the closer the residence to the landfill site the higher the frequency of the residents having health problems.

5.6 Health Status Current Evaluation of the Residents

Majority of the respondents acknowledge that after the establishment of the landfill site their health is very deleterious as against when the site was not present hence the landfill site has enormous impact on their health. Coffie (2010) studied the effect of the Oblogo waste landfill site in Ghana on the resident living around those communities and noticed that due to the position of the landfill sites and the inappropriate management of the landfill site in the communities leads to prevalence of infectious disease like malaria, cholera, diarrhea, typhoid fever thereby reducing their quality of life.

5.7 Extent of Effect of Pollution from Landfill Site on Residents

The severity to which residents are affected by Numerous nuisances from the landfill sites were given to respondents to evaluate the extent in terms of “most severe, severe, moderate and less”.

The most severe one is smell or odour from the site, surface water and household water contamination, dust, pest (flies, vermin etc.), litters from the refuse, poisonous gases, and noise from machines from the landfill. This finding supports finding from previous studies done in other part of Ghana as well as other developing countries. The high composition of organic leftover in the entire waste collected as well as the non-segregation of the waste is responsible for the odour emanating from the site (Adu-Boahen, 2012). Odour produced by waste is from different sources and some of these are gases, fresh refuse, malodorous chemicals, agricultural and sewage sludge (Adu-Boahen, 2012). Odour emanating from the Dompouse Landfill was



reported by some resident to be responsible for a wide range of non-specific health symptoms, like nausea, headaches, drowsiness, fatigue and respiratory problems (Owusu-Sekyere et al., 2013a). Coffie (2010) found that odor/ stench emanating from the Oblogo landfill sites spread into the residence of the people living in the communities around Weija.

Flies and mosquitoes are most likely to be found in an improperly managed landfill sites and these two insects are of great public health importance because of the numerous disease they spread. Flies spread a lot of bacteria food borne diseases. Mosquitoes, on the other hand, breed on stagnate water or leachate collected in depressions on the landfill surface and in uncompact and uncovered wastes such as piles of tires and other bulky items. Mosquitoes spread diseases such as encephalitis, dengue fever and malaria. Rats and rodents carry diseases like rabies, rat-bite fever, leptospirosis, typhus, and bubonic plague and a high level of environmental nuisance in most landfill is due the presence of flies and vermis which are potential public health risk and should not be permitted to breed in landfill sites (Adu-Boahen, 2012).

5.8 Knowledge of Waste Dumped and the Means of Transportation of the Waste to the Landfill Site

All respondents knew the type(content) of waste dumped at the landfill site as well as how the waste was transported (vehicle) to the landfill site. Apart from human corpses, all types of waste that are generated in the metropolis are dumped at the site. In all the communities, domestic waste, manufacturing waste and development waste are generated by human which increases the variety, diversity and the quantum to be collected and disposed. (Rushbrook et al.,1999). It is imperative the managers of the landfill site get more information on the biochemical composition of the manufacturing waste been generated in the area in order to put measures in place for their



appropriate disposal (Rushbrook et al.,1999). A study by Hawawu Hussein, Baba Musah and Emelia Guo, 2014 revealed the same disturbing pattern where a majority of respondents attested to the fact that hospital waste was being indiscriminately dumped in the location.

At the Gbalahi landfill site, different compartment is to be created for the disposal of the different kind of waste brought to the site. Chlorinated lime and a layer of cover material are used to cover the health care waste and corpse but this is not the case at the Gbalahi landfill site.

5.9 Source of Water, Distance from the Landfill Site, Water and Food Pollution

Water is the world's most abundant natural solvent. All respondent stated that their source of water was the dam which is about 200 meters from the landfill site. Almost all the respondent stated that the landfill has effect on their water and food which is similar to the findings of Fatta, Papadopoulos and Loizidou (1999). One of the major threats to groundwater resource is the landfill site. Also, Taylor and Allen (2006). declared that landfills are mostly identified as a source of pollution of the groundwater by waste-derived liquids. Further research should be carried out in the area of collecting and analyse food and water samples from the community to identify the possible organism present.

5.10 How the Assembly Is Responding to the Challenges

Unfortunately, the Assembly does not respond to the challenges lodged by the community members. According to Rushbrook et al., 1999, another technique to dowse low fires involves digging a fire hole where waste that has fire are not exposed to air, or be overwhelmed with sand. Periodic inspection for the discovery and devastation of rodents and implementation of anti-fly procedures like spraying for fly's destruction, earth cover and removal of reasonable preventable condition, keeping all drains clean, crack sand rough areas corrected to avoid blockages and mosquito breeding (The Ghana Landfill Guidelines (2002).



CHAPTER SIX

6.1 SUMMARY, CONCLUSION AND RECOMMENDATION

This dissertation is aimed at contributing to the emerging body of knowledge about landfill and health linkages. It explored multiple ties between sanitation, waste management and human morbidity in Ghana with a focus on the only landfill that serve both the Tamale metropolis and the Sagnarigu municipality in the northern region of Ghana. Several studies (for example, Al-Rekabi, 2009; Guida, 2012) have so far given attention primarily to the waste generation and its environmental effects, with only cursory remarks on the health effects of the landfill on the populace. This study fills this gap by examining the health effects of citing the landfill in Gbalahi. It has provided both empirical and theoretical clarification on the sanitation and health dynamics, the common morbidity of the people, and the multiple factors that hinder access to health with spin-off effects on the achievements of the health needs of the people.

Despite the fact that poor treatment and disposal of waste at the landfill at Gbalahi in the Tamale metropolis poses potential risks to physical environmental, the population and public health in general, it has attracted little attention within the spectrum of the stakeholders in the metropolis environmental risks and public health professional. This study seeks to analyze the health effects of the location of the landfill on the residents of Gbalahi in the Tamale metropolis. The management system of the landfill site needs a complete overhaul, with improvements during collection, segregation, transportation, temporal storage and treatment.

Residing close to a poorly managed landfill and waste disposal site can be a major underlying factor for poor child health and human health in general, especially as it enhances respiratory,



intestinal and skin infections. The high relative risk for respiratory infection can be associated with the emissions resulting from the uncontrolled and frequent burning of waste in the open pits and poor incinerators. The relative risk for intestinal infections was high too, and possible explanation is linked to demographic, behavioral, cultural, socioeconomic and environmental factors. In the world today, waste generation is a huge challenges and issues contributing unfavourably to ecological pollution. Landfill site will always be mentioned when talking about solid waste management, because all waste cannot be reused, recycled, reduced or composed. Solid waste landfill sites are contaminated by heavy metals and gases which are usually harmful and fatal to humans. Hence there is the need to employ appropriate management of the landfill site to minimize the health and environmental hazards.

In conclusion, the set objective of the study was achieved and the Result revealed that;

Majority of the residents knew the type of waste dumped at the landfill site which includes health care waste, solid waste, liquid waste, human excreta and gaseous waste.

The residents (62.7%) residing close to the landfill site attested that since the inception of the landfill site their health has deteriorated seriously compare to when the landfill site was not inexistence.

The landfill site was a source of Water and food pollution in the community.

The effect of the landfill site on water and food pollution include Abdominal pain, brownish coloration of the water, scent from the water, filth in the water and feacal matter in the water. In addition, wind blows particles and filth on the populace food in their houses and big black flies' perches on their food during cooking or eating.

The presence of the landfill site was responsible for the following health problems such as malaria, respiratory disease, diarrhea, cholera, and typhoid. Environmental naissance like odour, dust, smoke, flies, fire, litters from the refuse, mosquito, insect and reptiles.



There were no measures put in place by the Assembly to mitigate the health effect of the landfill site on the residents.

Those residents close to the landfill site zone A (<200 metres) suffer more health problem than those residents far off zone B (>200metres) from the landfill site.

Some people purchase the land for residential property prior to the establishment of the proposed fertilizer factory which has become a landfill site. Today the number of residents close to the landfill site is on the increase, hence there is need for stringent proactive measures to prevent outbreak of diseases and huge level of mortality which may occur from a preventable cause.

Hopefully, when the Recommendations below are implemented, it will ameliorate the health and environmental effects the residents are exposed to in the community.

6.2 RECOMMENDATIONS

To minimize the health and environmental hazards associated with the Gbalahi landfill site, the following recommendations are offered;

1. The Tamale Metropolitan Assembly should make funds available to acquire good equipment and training of staffs for the proper management of the landfill site and make soil creeps available for covering the waste to minimize odour and flies from the landfill site into the residence.
2. The public health department of the Tamale Metropolitan Assembly should embark on public health education that would target entire community on way to protect themselves from the hazards they are exposed to.
3. The Tamale Metropolitan Assembly through the Ghana Water Company should provide pipe borne water for the community so they can stop drinking from the Dam.
4. A new vast acre of land should be acquired by the metropolis with no residential facility given approval to be sited within one kilometer from the boundary of the landfill site.
5. The Tamale Metropolitan Assembly should take a look at the prospect of waste recycling plants in the metropolis and encourage investors to invest in landfill management.



6. The Tamale Metropolitan Assembly (TAMA) should embark on an aggressive educational campaign on waste management at home.
7. The Environmental Protection Agency (EPA) should exercise its monitoring and sanctioning roles efficiently and effectively by ensuring the right standards are observed at the landfill site. This will help reduce environmental hazards.
8. The Tamale Metropolitan Assembly (TAMA) should consider the possibility of privatizing the management of the landfill site so that realistic fees would be charged the waste disposal company that empty their waste to generate enough funds that can be used to manage the landfill site and also employ the needed high caliber of technical staff which the TAMA lacks.
9. Government should impose taxes on carrier bags made of polyethene and make carrier bag made of paper tax free this will encourage the populace to patronize the paper carrier bag than the polyethene carrier bag.
10. Environmental Protection Agency should ensure the regular spraying of the landfill site and its environs to reduce the presence of flies, reptiles, odour.
11. Ghana standard Authority (GSA) should encourage manufacturers to produce goods that after it use little or no waste is generated.
12. The private waste collection company and the Tamale Metropolitan Assembly should uphold a standard landfill management in the community, in order to minimize the pollution and contamination of the community.
13. The Environmental Protection Agency (EPA) needs to collaborate with the Assembly to educate the populace on the need for change of habits.
14. The public health unit of the Ghana health service should intensify their education on the need for periodic health check and also intensify health education in the community.




15. Finally further research should be undertaken to look at the prospect of waste recycling in the Metropolis. This is to find out the viability of encouraging investment into the recycling business in the Tamale Metropolis.

16. Further research need to be carried out in the area of water and food pollution by taken samples of food and water in the community for laboratory analysis and comparing with another community where the landfill site is absent.



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APPENDIX A

QUESTIONNAIRE FOR HOUSEHOLD MEMBERS

THE EFFECTS OF LANDFILL ON THE HEALTH OF THE PEOPLE AT GBALAH

UNIVERSITY FOR DEVELOPMENT STUDIES

Introduction

I am a student from the University for Development Studies, Tamale Ghana, conducting a study on the effects of landfill on the health of the people in Gbalahi in the Tamale metropolis, Ghana. This study is part of my Master of public health Degree hence I would be most grateful if you could assist me by answering the following questions. All information given would be confidentially treated.

SECTION A:

Socio-Demographic Characteristics of Respondents

1. Household name: _____ Interview Date: ____/____/____ (dd-mm-yyyy)
2. Sex (a) Male (b) Female
3. How old are you?
4. Employment Status (a) Employed (b) Unemployed (c) Retired (d) Student
5. If employed, what work? (a) Salaried worker (b) Trader (c) Farmer (d) Seamstress/Hairdresser (e) Artisan (e.g. carpenter, mason etc.) (f) Driver (g) others (specify)
6. Ethnicity
7. What is your current marital status?
a. Never married b. Married c. Co- habitation d. Divorced/ Widow
8. Number of people living in this household.....



9. Level of Education:

- a. No formal education
- b. Primary
- c. Middle/JHS
- d. Vocational/Technical/SHS/O'level/ A 'level
- e. Tertiary.

10. What is your religious affiliation?.....

11. How long have you lived in this community/vicinity? (a) Less than 1 year (b) 1 -5 years
(c) 6-10 years (d) above 10 years

12. Distance of the residence from the landfill site: (a) Less than 50m (b) 50 – 99m (c) 100 – 149m (d) 150 –200m (e) 200m and above

Section B:

The Health Effects of Landfill on the People Living Close to the Site

13. . Does the location of the landfill site pose any threat or risk to you?

- (a) Yes (b) No

14. Does the location of the landfill site pose any health problem to you and your household?

- (a) Yes (b) No

15. If yes, what health problems does the landfill pose?

- (a) Air pollution due to smoke, fire and odour from the landfill site
- (b) Surface water pollution due to leachate from the site
- (c) Presence of mosquitoes and other infectious insects
- (d) Presence of reptiles such as snakes
- (e) Other (specify)

16. What sicknesses are common in this area, which can be attributed to the landfill site?

- (a) Cholera (b) Diarrhea (c) Malaria (d) Typhoid fever (e) Respiratory diseases (g) other, please specify.....



17. Have you or any member of your household ever suffered from any sicknesses before due to the location of the landfill site?

(a) Yes (b) No

18. If yes how frequent do you or household members fall sick?

(a) Once every week (b) Once in a month (c) Twice in a month (d) Once in three months (e) Above 3 months

19. Do you know of anyone in this surrounding or area who has also suffered a health crisis due to the land fill site?

(a) Yes (b) No

20. How will you evaluate your health status now as compared to when the landfill was not here?

(a) Very healthy (b) Normal (c) Less healthy (d) very deteriorated (e) the same

21. To what extend have you been affected by the following? Please indicate your level using the following scale:

1- More Severe 2- Severe 3- Moderate 4- Less 5- N/A---Not affected by the noise

NO	MoreSevere (1)	Severe (2)	Moderate (3)	Less (4)	N/A (5)
A	Smell or odour from landfill				
B	Pest such as flies, vermin etc				
C	Poisonous gases				
D	Noise from machine on site				
E	Litter from the refuse				
F	Surface water and household water contamination				
G	Dust				



SECTION C:

TYPE OF WASTE DUMP ON THE LANDFILL

- 22. Do you know what they dump on the landfill? (a) Yes (b) no

- 23. If yes can you share with me the type of waste? (a) solid waste (b) liquid waste (c) gaseous waste (d)health care waste (e) human excreta

- 24. Where are they transporting the waste from? (a) The city Centre (b) can't tell (c) from the Hospitals (d) Others please specify

- 25. How are the waste transported? (a) Vehicles (b) tricycles (c) trucks) (d) other please specify.....

SECTION D:

LANDFILL AND WATER AND FOOD POLLUTION

- 26. Where do you access your water for domestic use? (a) the stream (b) the Dam (c) the borehole (d) other specify

- 27. What is the distance from your water source and the landfill? (a) $\leq 200m$ (b) $\leq 250m$ (c) $\leq 300m$ (d) Others please specify.....

- 28. Does the landfill site have effect on your drinking water source? (a) yes (b) no

- 29. If yes can you please share your experiences with me about the effect of the landfill on water pollution.....
.....
.....

- 30. Can you tell me if the landfill location affects or pollute your food? (a) yes (b) no



31. If yes please share with me.....

Thank you very much for your time.

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APPENDIX B

FOCUS GROUP GUIDE

THE EFFECTS OF LANDFILL ON THE HEALTH OF THE PEOPLE AT GBALAH

Introduction

I am a student from the University for Development Studies, Tamale Ghana, conducting a study on the effects of landfill on the health of the people in Gbalahi in the Tamale metropolis, Ghana. This study is part of my Master of public health Degree hence I would be most grateful if you could assist me by answering the following questions. All information given would be confidentially treated

1. Can you describe the sanitation situation in this community?
2. When they were to cite the landfill here were you part of the decision and what was your inputs as youth in the area?
3. What type of waste are dump in the landfill? Help them to mention them.
4. Where are they transporting the wastes from? And can you tell me why this community and not others? (ask to find out the arrangement before the acceptance if any and their involvement in the decision to site the landfill site).
5. Please describe the mechanisms they adopt in transporting the waste? (note if the wastes are covered in the cars or not. Timing of transporting the waste in the night or during the day)
6. Are those wastes harmful to your health? If yes can you describe it?
7. Can you tell me the common disease people in this community face as a result of the presence of the landfill?
8. How does the sanitation situation affect your health – with emphasis on experiences from group members?
9. What are the common diseases that relate to the sanitation conditions here?
10. Can you describe the nature of the pollution of the environmental media in this Gbalahi community (air, water, sand and food)?



11. Have the metropolitan assembly put in some measures to mitigate your suffering? If yes can you explain what they have done to assist you?
12. Can you tell us how the citing of the land fill in this community affect your health? What was the prevalence of sanitation related diseases in this community before the citing of the landfill and how is the situation after the sitting? – Let individuals in group tell their personal experiences.
13. What are the health problems associated with the way people dumped their waste in the landfill site (both liquid and solid waste)? – pick up individual to describe how they dumped their waste and relate it to individual health problems.
14. Can you describe to me the effects of the landfill to the health of your children in this community? (Children go there to play and pick things) ask questions on that.
15. What measures do you as community members put in place to overcome the health challenges you are facing as a result of the landfill site?
16. Please if you have something to add about the health effects of the landfill on you as community members please kindly share with me so that it will help in policy direction towards your problems.

THANK YOU FOR YOUR TIME.



APPENDIX C

KEY INFORMANT INTERVIEW GUIDE

THE EFFECTS OF LANDFILL ON THE HEALTH OF THE PEOPLE AT GBALAH

UNIVERSITY FOR DEVELOPMENT STUDIES

Introduction

I am a student from the University for Development Studies, Tamale Ghana, conducting a study on the effects of landfill on the health of the people in Gbalahi in the Tamale metropolis, Ghana. This study is part of my Master of public health Degree hence I would be most grateful if you could assist me by answering the following questions. All information given would be confidentially treated.

1. Name of respondent.....
2. Institution
3. Position held.....
4. Number of years work in current position
5. Can you briefly explain to me the type of waste deposited at the landfill?
6. Can you please take me through how the waste is segregated at the landfill or before getting to the landfills?.....
7. Please take me through the processes of transporting the various waste to the landfill site?
.....
8. Are there some arrangement between your institution and the residence here with regards to the siting of the landfill in this community? If yes please can you take me through the arrangement plan and modalities
.....
.....
.....
9. Can you share with me some of the health effects of the landfill on the people here?
..... (ask further question on water



pollution, air pollution, noise and food contaminations. Take each of them and ask question on them. (the environmental media)

10. What are the common diseases the people are most likely to suffer from?
..... list them in order of the most common and severity.
11. Can you tell me what compensation plan you put in place to mitigate the effects of the landfill on the health of the people?
12. What is\ are attitudes and the behavior of the people towards the landfill citing?
13. Please do your outfit put in place measure to purify the water for the residents here? If yes how is it done and how often?
14. How effective is community participation in addressing the health challenges the community members are facing with regards to the landfill and it health problems
.....
.....
.....
.....
15. What is the prevalence sanitation related diseases situation in the houses that are close to the landfill and that of those that are far from the landfill
.....
16. What was the situation before the citing of the landfill site in this community and what the current situation is.
.....
17. Can you share with me the level of acceptance or otherwise the citing of the landfill here? Were there agitations from community members if yes how was it solved?
.....
18. Was there effective community participation before the land was release? if yes, which people or stakeholder were actively involved and can you share with me their inputs?
.....
19. What was the level of involvement of traditional rulers and other opinion leaders in the citing of the landfill in Gbalahi here.



20. Please what recommendation do you suggest for better management of the landfill so that it will not compromise the health of the people and further elimination or reduction of sanitation related diseases in the area?

.....
.....
.....
.....
.....
.....
.....

THANK YOU FOR YOUR TIME.

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