KWAME NKRUMAH UNIVERISTY OF SCIENCE AND TECHNOLOGY, KUMASI

COLLEGE OF HEALTH SCIENCES
SCHOOL OF MEDICAL SCIENCES
DEPARTMENT OF COMMUNITY HEALTH

IMPROVING SOLID WASTE MANAGEMENT PRACTICES IN THE ASANTE AKIM NORTH DISTRICT OF THE ASHANTI REGION, GHANA

BY
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SEPTEMBER 2005

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A thesis submitted to the Board of Postgraduate Studies of the Kwame Nkrumah University of Science and Technology, Kumasi in partial fulfilment of the Requirements for the Award of Master of Science Degree in Health Education and Promotion

BY

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SEPTEMBER 2005

DECLARATION

I herby declare that except, for references to other peoples work which have been duly acknowledged, this work is the result of my own original research and it has neither in whole, nor in part been presented for any degree elsewhere.

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Signature

Asamoah Danquah Frederick

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Signature

Dr Easmon Otupiri

(Academic Supervisor)

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Signature

Dr Easmon Otupiri

(Head of Department)

DEDICATION

This dissertation is dedicated to my daughter Nana Afia Takyi-Asamoah Danquah

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DEFINITION OF TERMS

BIODEGRADABLE WASTE

These are types of solid wastes that take relatively more time to decompose naturally. Identified items in this category are fruits, seeds, newspaper, cartons and office paper.

COMPOSTING

It is a biological process in which solid waste containing organic matter are converted to useable stable material by the action of micro organisms already present in the waste.

INCINERATION

It is an engineered process in which combustible solids, liquids and gaseous waste are burned at high temperatures and changed to non combustible products.

LANDFILL

A disposal site, where solid wastes are deposited. The waste deposited is intermittently covered with earth to reduce fly populations and also reduce air pollution problems.

NON-BIODEGRADABLE WASTE

These are solid wastes, which even after a long period of time will not decompose by nature e.g. polyethylene.

OPEN DUMP

A land disposal site, where solid waste is deposited and left uncovered with very little regard to the environmental impact.

PLASTIC

These are made synthetically from by products of fossil fuels. They have come to replace things made of wood, paper and metals.

READILY BIODEGRADABLE WASTE

These are solid wastes that decompose quickly under normal temperature. In most cases such items decompose within some few weeks.E.g left over food, vegetables.

REFUSE BINS

These are specially designed cans or barrels made purposely for household and public refuse.

SOLID WASTE

Anything considered useless, unwanted or discarded material that is not liquid or gas. It is the complete range of material, which is no longer considered useful by a particular person. It include garbage, which is the animal and vegetable waste resulting from handling, cooking and serving food, and rubbish, which consist of combustible non food waste.

WASTE

This is portrayed as residue from production or consumption processes. It is in most cases seen as something that has been discarded by someone, thus implicating uselessness.

ACRONYMS /ABBREVIATIONS

AAND	Asante Akim North District
ACRR	Association of Cities and Regions for Recycling
AMA	Accra Metropolitan Assembly
APME	Association of Plastic Manufacturers in Europe
BW	Biodegradable Waste
DCE	District Chief Executive
DWST	District Water and Sanitation Team
DHMT	District Health Management Team
DEHO	District Environmental Health officer
EEA	European Environmental Agency
EHO	Environmental Health officer
GOV	Government of Ghana
GPRTU	Ghana Private Road Transport Union
ISWA	International Solid Waste Association
KMA	Kumasi Metropolitan Assembly
LG	Local Government
LRA	Local Refuse Authority
MSWM	Municipal Solid Waste Management
NBW	No Biodegradable Waste
OECD	Organisation for Economic Co-operation & Development
OPD	Out Patient Department
RDB	Readily Biodegradable Waste
UNDP	United Nations Development Programme
UNO	United Nations Organisation

WHO	World Health Organisation
WMD	Waste Management Department

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ABSTRACT

The generation of solid waste in urban environment in the developing world is becoming alarming making its management extremely difficult.

In Ghana, solid waste generation has increased to such an extent that its attendant public, occupational and environmental health hazards have become a national issue.

The Asante Akim North District is experiencing a similar problem hence this study. A descriptive cross- sectional study sought to examine the current waste management practices, which included generation, collection, transportation and disposal, and to make recommendation for the improvement of solid waste in the District.

One hundred and one (101) households were randomly selected. The District Environmental officer, the twelve Environmental Health officers, the twelve Refuse collectors, some hawkers and GPRTU Officials in the main lorry stations were purposely interviewed. Questionnaire and interview guide were used to obtain the needed data. The data obtained were post coded and analysed using EPI- INFO Statistical Package.

The study results revealed that solid waste management in the Asante Akim north District was very poor. The District Assembly was the sole organization responsible for Solid wastes management in the District. About 70% of the solid wastes were generated from households. Other areas where solid wastes were generated included lorry stations, market places, in front of stores and along the major streets.

The district generated 23,360 tons of solid waste annually between 2001 and2003 with an average of 0.5 kg/ person/day. The District Assembly spent about 550 million cedis annually in managing solid waste. In spite of the huge volume of solid waste generated the private sector had not been involved in solid waste management.

Plastic waste was seen to be generated in large volumes and could be seen in almost all places posing environmental threat in the District. All the households (100%) interviewed maintained that solid waste management was a major problem in the district. The entire district has twelve (12) environmental health officers and twelve (12) refuse collectors. All the 12 refuse collectors in the district were untrained. Moreover, they lacked the basic protective clothings. Society also did not give them the needed respect.

The entire District had only one refuse truck and two power tillers attached with a trailer responsible for public and household solid waste collection respectively. The district had approved 45 refuse dumps to cater for the large volume of solid waste.

The study revealed that the refuse dumps were either too close to some households or too far away from them making disposal of waste very difficult. Poor solid waste management was the cause of some major diseases in the district. Typhoid, 41.7% diarrhoea, 25.0% malaria 8.3%, cholera16.7% and worm infestation8.3% were readily identified. People's attitude towards solid waste was seen to be very poor. Indiscriminate dumping of solid waste into drains and other public places was very

common. Moreover, participation in communal labour in the district was very low. It was recommended that the private sector would be involved in solid waste management in the District. Organised bodies like the Ghana Private Road Transport Union (GPRTU) would be of great help. Unit areas should establish its own solid waste management committees and intensive house-to-house registration exercise carried out in order to cover all residents in the house- to- house collection exercise. Intensive education should also be carried out to sensitise the people on the need to maintain a clean environment.

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND INFORMATION

Waste management is a major issue the world over. The increasing amounts of waste that are being generated are a matter of concern to all countries in the world. Developed and developing countries are experiencing rapid increases in municipal waste streams due to changes in lifestyle and improved economic activities. Waste managers are often faced with many challenges in seeking to satisfy the wishes of society (Christian, 2000)

The development of cities and towns, with their concentration on population and land-use density, called for the creation of organized solid waste management. (ISWA, 2005). Religion, aesthetics, and concerns for public health lay the foundation for solid waste management systems in ancient cities as early as 2000 BC. (Melosi, 1998) By 500 BC, the Greeks had organized the first acknowledged 'municipal dumps' in the western world and issued the first known edict against throwing garbage in the street (Louis, 2002)

Municipal solid waste management (MSWM) in the United States is a system comprised of regulatory, administrative, market, technology, and social sub-components, and can only be understood in the context of its historical evolution (ISWA, 2005). American cities lacked organized public works for street cleaning, refuse collection, water treatment, and human waste removal until the early 1800s.

Recurrent epidemics forced efforts to improve public health and the environment (ISWA, 2005).

In the 1880s, emphasis was laid on solid waste management. Solid waste management became a local responsibility afterwards. George Warring of New York City organized solid waste management around engineering units. It was centered on street sweeping; refuse collection, transportation, resource recovery and disposal (ISWA, 2005).

The political will of governments of the developing world motivated research institutions to come out with scientific systems of waste collection and disposal. The result is that large volumes of both solid and liquid waste generated by industries and commercial activities are recycled, thus creating job for the ever-rapid increasing population (Samanta et al., 1998).

The generation of solid waste in urban environments in the developing world is increasing due to the inclusion of more people in the consumer economy and the uncontrolled migration from the countryside to the cities (ISWA, 2005).

The options for waste management in the developing world vary with the prevailing socio-economic and political atmosphere. Over the years, governments of most third world countries have concentrated on socio-economic issues doing everything possible to improve upon the living standard of the people by way of job creation and doing little by way of waste management (Samanta et al., 1998). This attempt has

resulted in various human activities ending up in the generation of volumes of waste especially in urban areas.

In Ghana waste management has been a major concern to many communities in recent years. In both rural and urban communities, large volumes of different kinds of waste are generated each passing day. According to Adjri Blankson (2005) urban sanitation and waste management appear to be the most complex and challenging urban problem in our time.

Amoako (2004) argued that urban wealth and urban waste are created the same way, that is through production and consumption. It is estimated that Accra and Kumasi metropolitan assemblies spend over 60-70% of their accrued revenue in waste management (Mensah, 2004).

Lack of proper waste management is a growing burden and environmental threat. Significant improvement on human health cannot be achieved without good environmental sanitation conditions and practices (Sherwood, 1995). Effective organization and management is required to sustain a proper solid waste management system. When planning towards improvement, attention needs to be placed on ensuring that institutional responsibilities are clearly defined and that institutions are both sufficiently resourced and accountable for their performance.

1.2 STATEMENT OF THE PROBLEM

Solid waste generation has long been a consequence of human activity. Food preparation, agricultural refuse, and the packaging of consumer products generate

large volume of solid waste. Solid waste is material that is no longer desirable to the generator in its existing form. Waste management essentially consists of material removal and treatment either for reuse, recovery or disposal (ISWA, 2005).

Littering of organic waste creates favourable conditions for rodents and other vectors of disease. Indeed, the plague or Black Death, in the fourteenth century in Europe may be partly attributed to the practice of littering of organic waste in the unpaved streets, roadways and vacant land in cities (Techobanoglous et al., 1978).

Epidemics, and the fear they engendered in the public, played a significant role in raising awareness about public health and the need for organized municipal sanitation services. Among such epidemics was the yellow fever outbreak in Philadelphia in 1973, which claimed more than 5000 lives. Pernick (1978) and the cholera epidemics in New York in 1832 and 1999 which claimed an estimated 150,000 lives nationwide (Neira, 1997).

Environmental issues have dominated earth's matters over decades now. However, never have these issues been given the needed political and social attention than in the 1990s. The earth and its beings are under severe threat from human mismanagement of the atmosphere and the sea. The land is rapidly being degraded by indiscriminate waste disposal (ACORD, 1998).

In Ghana, solid waste management has become a major problem. It is very common to see solid waste scattered across both urban and rural areas. So daunting has become the problem in Accra that the metropolitan authorities backed by the government have

taken the bold step, to divert the interest in waste management to private participation (Nyante, 2003).

The use of non standardized household bins is affecting waste management considerably in major cities in Ghana. At present households must provide their own container which in practice means a variety of boxes, baskets, bowls buckets and others etc. These have been found to be vulnerable to rain, to being knocked down by stray animals and also physical disintegration thus affecting the service level (KMA, 2004).

Sanitation and solid waste management practices are urgent health concerns for the residents of Accra Metropolitan Assembly. As the city grows, the strain on these services will intensify the problem. Waste not only contributes to the spread of diseases but also exacerbates flooding by blocking drains (AMA, 2004).

Sanitation inadequacies contribute to seventy percent of diseases in Ghana (Southern Links, 2002) Malaria, diarrhoea and intestinal worms and upper respiratory tract infections are among the most frequent health problems reported at Out Patient Department (OPD) facilities in the Greater Accra Region. Seasonal epidemic outbreak of cholera (coinciding with floods) and meningitis constantly occur (Southern Links 2002).

In Central Accra major health problems are diseases attributed to poor environmental sanitation, exacerbated by poverty and the lack of related health education information (Southern links 2002).

The generation of solid waste is a consequence of human activity. It is important to note that as long as man continues to engage in activities that will ensure his survival, solid waste will continue to be generated (Health policy and planning, 1998). Effective solid waste management can reduce health risk, save money and protect the environment.

1.3 RATIONALE FOR THE STUDY

Solid waste management in urban areas seems to be the most complex issue in recent times. The fact that 40% of solid waste generated in Accra is not collected at all and that this remaining volume of waste is disposed indiscriminately attest to this fact.

A solid waste management plan includes waste education which should be seen as an integral part of the broader process of environmental education, mandatory on-service training for those in charge of waste management and auditing of the volume of solid waste generated by various departments.

In order to improve solid waste management in our cities and urban areas, it is necessary to increase the amount of information on the hazardous effect of solid waste. A conscious effort must also be made to modify certain attitudes of the general public towards littering the streets.

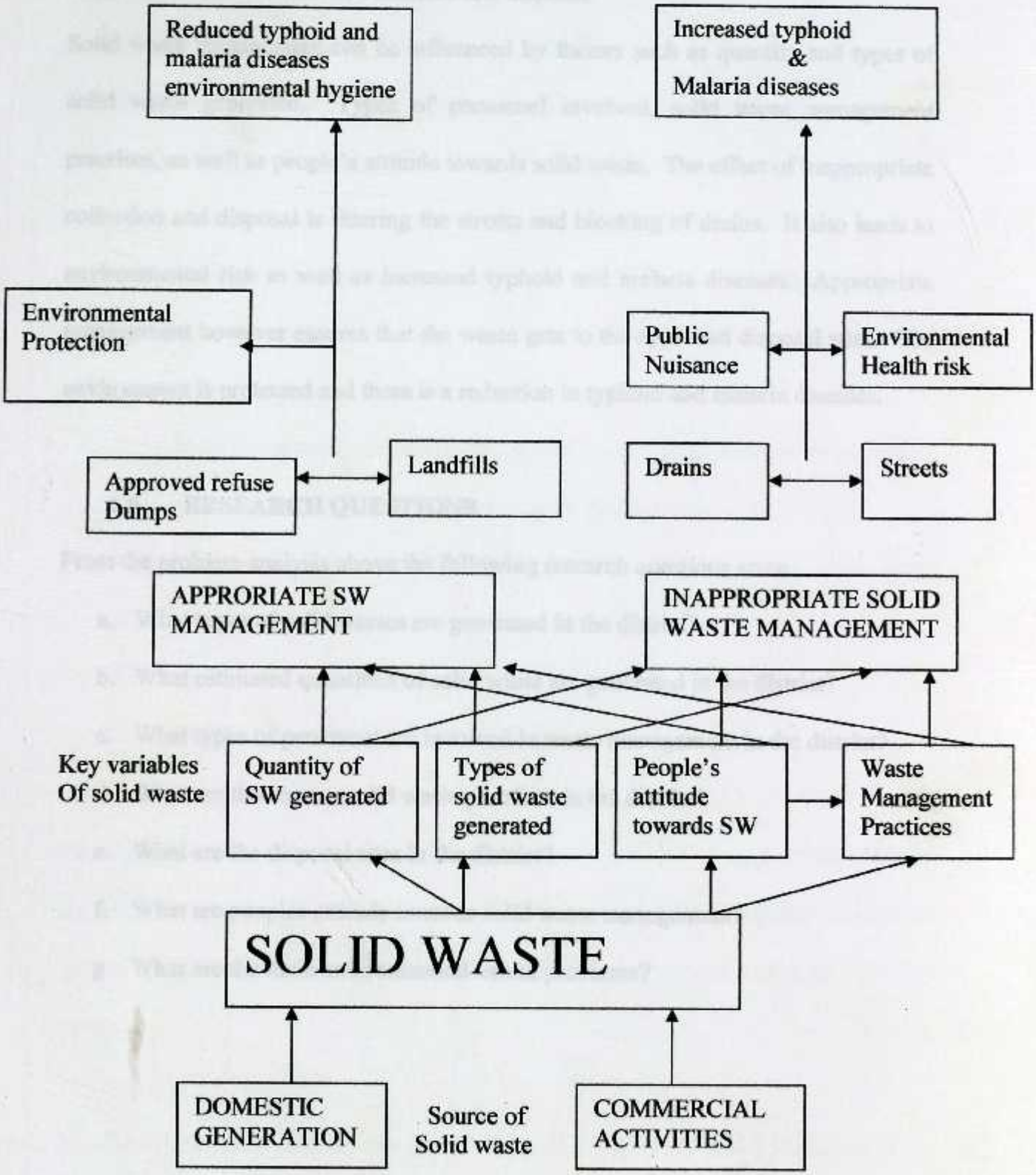
To be able to formulate appropriate policies and to improve solid waste practices, planners should know the magnitude of the problem, the extent of the inadequacies and the potential health risk.

Solid waste management survey, which is a valuable quality improvement tool, will assist environmental health planners to improve safety, reduce high risk of disease

associated with improper waste management. The result of this study could therefore be used to contribute to evidence-based guidelines for the management of solid waste. This study was designed to make recommendations to improve the existing solid waste management in the Asanti Akim North District.

1.4 CONCEPTUAL FRAMEWORK

The conceptual framework showing the relationship between the causes and effects of solid waste management.



Source: Author's Construct (2005)

As shown in Figure 1, domestic and commercial activities generate volumes of solid wastes. The solid wastes generated go through approved or municipal collection and disposal, as well as informal collection and disposal.

Solid waste management can be influenced by factors such as quantity and types of solid waste generated. Types of personnel involved, solid waste management practices, as well as people's attitude towards solid waste. The effect of inappropriate collection and disposal is littering the streets and blocking of drains. It also leads to environmental risk as well as increased typhoid and malaria diseases. Appropriate management however ensures that the waste gets to the approved disposal sites. The environment is protected and there is a reduction in typhoid and malaria diseases.

1.5 RESEARCH QUESTIONS

From the problem analysis above the following research questions arose

a. What types of solid wastes are generated in the district?
b. What estimated quantities of solid waste are generated in the district?
c. What types of personnel are involved in waste management in the district?
d. What are the current solid waste practices in the district?
e. What are the disposal sites in the district?
f. What are peoples attitude towards solid waste management?
g. What are the main environmental health problems?

1.6 OBJECTIVES

1.6.1 General Objective

To assess solid waste management practices in the Asante Akim North District, Ghana.

1.6.2 Specific Objectives

The following specific objectives were developed from the research questions.

1. To determine the amount of solid wastes generated in the district.
2. To identify the different types of solid waste generated in the district.
3. To determine the type of personnel involved in solid waste management.
4. To describe the current solid waste management practices, which includes generation, collection, transportation and disposal methods?
5. To identify the health hazards associated with poor solid waste management.
6. To describe people's attitude towards waste management in the district.
7. To use the findings to make recommendations for improving solid waste management in the Asante Akim North District.

1.7 PROFILE OF THE STUDY AREA

1.7.1 Background Information

The Asante Akim North District is one of the eighteen Districts in the Ashanti Region. It was carved out of the erstwhile Asante Akim District council in 1988 as part of the decentralization process and has Konongo-Odumasi as the twin capital town.

The district stretches over an area of 1.160 square kilometers constituting 4.5% of the size of Ashanti Region. The district is located on the eastern part of Ashanti Region

and lies between latitudes 6^0 30N – $6^0$60N and longitudes 1^0 15W -$0^0$45E. It is borded by the Kwahu South district in the Eastern Region; the North by the Sekyere East, the west by Ejisu Juaben, and the south by Asante Akim south district (AANDA ANNUAL REPORT, 2003).

1.7.2 POPULATION DENSITY

The population density of 41 persons per square kilometer for the district in 1984 increased to 109 persons per square kilometer in 2000. This figure is however, higher than the national density of 79.3 persons per square kilometer but lower than the regional density of 148.1 persons per square kilometer. Population is concentrated more in the southern portion of the district than in the north. This has had much influence on the pattern of development in the district. Majority of services and socio-economic infrastructure are concentrated in the south.

1.7.3 SPATIAL DISTRIBUTION OF POPULATION

The Distribution of the population in the District is highly skewed towards the southern portion, which has over 70% of the district population. The four urban towns, i.e. Agogo, Konongo, Odumasi and Patriensa alone having a population of 62,303 (56%). The twin towns of Konongo and Odumasi have a population of 37,317.

1.7.4 DEMOGRAPHIC CHARACTERISTICS

The population of Asante Akim District for the censual periods 1970, 1984 and 2000 were 66,248 91,466, and 126,477 respectively. According to the 2000 housing and population census, the district has a male population of 64,174 (507%) and a female

population of 62,303 (49.3%). The above population gives a growth rate of 2.3% between 1970 – 1984 and 2.03% between 1984 – 2000.

TABLE 1.1 URBAN POPULATION

Name of Town	Total Population	Male	Female
Agogo	28,271	13,650	14621
Konongo	26,735	13,519	13,216
Odumasi	10,582	5,209	5,375
Patriensa	5,068	2,446	2,622

Source: Office of the District Planning Officer, 2004

The densely populated towns in the district. (depicted by the above table). These towns are centers with much economic and social infrastructure and therefore serve as attraction to the youth.

1.7.5 TYPE OF HOUSING

The predominant type of housing in all the communities within the district can be described as compound houses. However there are a few self-contained houses mostly in the big settlements at Agogo, Konongo and Juansa. Inhabitants in most cases put up houses haphazardly without recourse to laid-down physical planning requirements and principles. Town planning regulations in the district are not followed strictly due to lack of effective monitoring and enforcement of the Assembly's bye laws of physical development.

1.7.6 CIRCULATION AND UTILITY SERVICES

Roads, drains streets in most settlements in the district are more incidental rather than by conscious design. Most settlements have one main road dissecting the town. All other streets or lanes are under developed in terms of tarring and construction of drains. As a result the open drains have been eroded into gullies while the roads are very dusty during the dry season and muddy and slippery during the rainy season.

1.7.7 HEALTH

A management team headed by the District Director of Health Service (DDHS) manages the District Health Administration. The district is divided into five sub-districts with unit heads and sub district leaders. The subs District are Konongo-Odumasi, Agogo, Juansa, Dwease-Praso and Nyinampenase. There are 8 public and 6 private health facilities serving 126,477 people in the district.

TABLE 1.2 HEALTH FACILITY

	FACILITY		TOTAL
Level	Public	Private	
C	1. Presbyterian Hospital, Agogo 2. Government Hospital, Konongo		2
B	1. Juansa Health Centre 2. Dwease Health Centre 3. Praso Health Centre 4. Nyinanponase Health Care 5. Ananekrom Health Centre 6. Bebome Health Centre	Adom Hospital –Konongo Life Land Clinic, Konongo Patience Clinic, Konongo Safety Life Clinic, Konongo Nyamebekyere Maternity Home, Hwediem.	11 **13**

Source: Office of the District Director of Health Services, 2004

1.7.8 ENVIRONMENTAL HEALTH

Environmental health and sanitation issues continue to be one of the major problems facing the district. The high incidence of disease in the district namely, malaria, typhoid schistosomiasis and diarrhoea are largely attributed to poor sanitation in the district. Over the past 3 years, malaria has continued to be on top of the top 5 reported diseases.

1.7.9 LIQUID AND SOLID WASTE MANAGEMENT

It is estimated that the major towns in the district generated 61.373kg of solid waste and 30, 686kg of liquid waste daily.

TABLE 1.3 SOLID WASTE GENERATION IN SUB DISTRICT

Sub District	Population	Solid Waste Kg/Day
Konongo-Odumasi	50,056	25,028kg
Agogo	47,260	23,630kg
Juansa-Dameabra	14,245	7,123kg
Dwease Praso	11,183	5,592kg
Total	**122,744**	**61,373**

Source: Office of the District Health Environmental Officer, 2004

1.7.10 LOCAL GOVERNMENT

The Asante Akim North District Assembly was established by legislative instrument 1418 on 23rd November 1988. For the purpose of decentralizing the local government representation, the district has one electoral constituency (i.e. parliamentary seat) sixty-one (61) member assembly composed of forty-two (42) elected and eighteen (18) government appointees with the Member of Parliament and the District chief executive as Ex Officio members. The Assembly works through its executive

committee and sub-committees all of which, are in place in accordance with sections 21 (1) 24 (1) of the local government Act, 1993 Act 462. The executive committee, which has the District chief executive as its chairman, exercises the executive and co-coordinating functions of the Assembly.

1.8 SCOPE OF THE STUDY

The study limited itself to solid waste management practices with respect to the influence of such factors as personnel involved in solid waste management, type of solid waste generated, Amount of solid waste generated, solid waste management practices, Health hazards associated with solid waste and people's attitude towards solid waste. The study was limited to the Asante Akim North District of the Ashanti Region of Ghana.

1.9 ORGANISATION OF REPORT

The first chapter gives vivid background information on solid waste management practices. Chapter two of the work was a write up of reviewed related literature, which was done in line with the specific objectives and research questions. The study method and design as well as data collection techniques and tools were explained in chapter three.

Results of the analyzed data were interpreted comprehensibly in chapter four. In chapter five the study results were discussed. Conclusions were drawn from the discussions and recommendations made to various stakeholders as part of chapter six. The report was adequately referenced and the author(s) of cited publications were duly acknowledged.

CHAPTER TWO

LITERATURE REVIEW

2.1 BACKGROUND INFORMATION ON SOLID WASTE MANAGEMENT

Solid waste management includes all activities that seek to minimize environmental and public health problems posed by solid waste. Solid waste can be defined as any material that no longer has any value to the person who is responsible for it. It is not intended to be discharged through the pipe. It does not normally include human excreta. It is generated by domestic, commercial industrial, health care, agricultural and mineral extraction activities, and accumulates in streets and public places. The word garbage trash, refuse and rubbish are used to refer to some forms of solid waste (Buckle & Smith, 1998).

Solid wastes are generated by many different activities. Very large quantities are produced by agric and mining but these wastes will not be considered. Wastes from houses, streets, shops, offices, industries and hospitals are usually the responsibilities of municipal or other governmental authorities (UNDP, 2000).

2.2 ESTIMATED QUANTITIES OF SOLID WASTE GENERATED

At the end of the nineties, municipal waste represented about 14% of all solid waste yearly produced in Europe (except agricultural waste). This represents 500kg per person. In 1960 it was closer to 200kg. Total waste generation in the Organization for Economic Co-operation and Development (OECD) countries increased by nearly 10% between 1990 and 1995 and it is expected to continue growing despite a slight

tendency to decouple waste generation from economic growth. With such trend, it is expected that by 2010, there will be a 15% - 22% rise in household waste in Organization for Economic Co-operation and Development (OECD) countries. 40 – 60 % rise in paper and cardboard, glass and plastic waste compared to 1990 levels (EEA, 2003).

With rapid urbanization in many countries, the generation of solid waste in cities is increasing while possible disposal areas for solid waste are diminishing. As a result, cities and towns in both developing and developed countries are facing the challenge of managing Municipal Solid Waste (MSW) (Morgan, 1999).

In developing countries, the per capita generation of solid waste has increased by 50% - 100% over the last 20 years. Solid waste collection systems in many cities cannot cope with the increasing volume of solid waste. Collection service coverage of 70% is not uncommon in developing countries, and more collection vehicles and workers, which are required, would increase the cost of collection services (WHO, 2003).

2.3 TYPES OF SOLID WASTE GENERATED

Solid wastes are generated by many different activities. Volumes of solid wastes are generated in households, streets, shops, offices, industries and hospitals (ISWA 2005). Waste characterization in many locations enables one to understand the different composition and categories of the waste. This ultimately helps to identify the management options appropriate for the waste (ISWA 2005).

2.3.1 READILY BIODEGRADABLE WASTE (RBW)

This is the type of solid waste that quickly decomposes by nature within approximately two weeks under average tropical temperature. This waste is termed Readily Biodegradable Waste (RBW). The major items found in this category are leftover food, vegetables, fruits beverages (tea powder and tea leaves) and plant residues (grass, leaves and flowers).

2.3.2 BIODEGRADABLE WASTE (BW)

This type of solid waste consists of materials that take relatively more time to decompose naturally than RBW under appropriate temperature conditions – perhaps a few months. The major identified items in the Biodegradable Waste (BW) category include fruit seeds, shells, paper (newspaper, office paper, cartons and napkins) torn or old clothes (woolen and cotton) rags, and firewood residue.

2.3.3 NON-BIODEGRADABLE WASTE (NBW)

Non-Biodegradable wastes are those waste items, which even after a long period of time do not decompose by nature. This waste is considered a real enemy of nature since it is continually accumulating on the earth's surface and can adversely affect human life, livestock, vegetation and temperature. The major identified NBW items are polythene bags (polyethylene), plastic, glass metal, bone, egg shells, coal residue, broken crockery, nylon cloth, hair, processed leather, stone and brick as well as ash and fine earth (ISWA, 2005).

2.3.4 CHARACTERISATION OF SOLID WASTE IN GHANA

In Ghana the characteristics of solid waste includes 40 – 80% organic debris. Accra which is the capital city of Ghana is currently generating million tons of refuse. Plastic content varies from 0.3 – 8% in rural and urban centers by weight respectively. By volume, the percentage could be above 30%. The rate of plastic consumption is increasing and the indiscriminate disposal calls for remedy to address the problem in order to avoid a possible environmental disaster to the ecology. (Awuah, 2005).

TABLE 2.1 CHARACTERISTICS OF SOLID WASTE GENERATED IN CERTAIN PARTS OF GHANA

	PERCENTAGE BY WEIGHT (%)			
Component	Accra	Bame Awudome	Kumasi	Winneba
Organic (food waste)	65	68	44.0	78
Plastic & Rubber	3.5	4.2	3.52	4
Paper or Cardboard	4.2	6.6	3.10	58
Fabrics / Textiles	-	-	3.20	2
Metals	1.8	-	0.64	0.2
Bottles / Glass	-	-	0.64	2
Wood	-	-	-	2
Ashes and Residues	23.6	7.8	44.64	6
Textile, Wood, Glass Metals	-	5.12	-	-
Other Waste	-	8.28	-	-

Source: Awuah, (2005)

The amount of waste generated varies according to the income group from which it originates. For example in Accra, the per capita waste generation for high income group is greater than middle-income groups, which is also greater than low-income groups and is 0.6, 0.4 and 0.3kg/capita /day respectively (AMA, 2004).

2.3.5 MANAGING PLASTIC WASTE

Plastics are probably one of the most engineered materials and have experienced a spectacular growth in both usage and adaptation. The raw materials used for plastic manufacturing have changed from coal, milk, and cellulose to petroleum. The latter is currently the main raw material (APME, 1999).

Plastic waste constitutes the third largest waste volume in Malaysian municipal solid waste (MSW) next to putrid waste and paper. The plastic component in MSW from Kuala Lumpur averages 24% (by weight) whereas the national mean is about 15%. The 144 waste dumps in the country receive about 95% of the MSW including plastic waste (ISWA 2005).

The use of plastic materials in the packaging of almost all consumable items is a great threat to third world countries where recycling is not widely practiced. In Kenya (UNO, 2005) the United Nations has recommended a ban on the use of plastic film bags because they pose public health hazard. The report stressed that Nairobi alone creates a big chunk of the plastic waste and yet the authorities are not able to collect even one fourth of the waste (UNO, 2005). In Ghana, most cities face similar problem. People are making money out of the plastic items they sell but they are not prepared to contribute towards efforts to deal with the problems that their products pose to society. Business people and advertisers try to impress on the people that plastic materials are disposable, yet it is known that it takes decades for plastic waste to degrade. Sachet water producers have however decided that they would contribute some money towards managing the plastic waste (AMA 2005).

2.4 TYPES OF PERSONNEL INVOLVED IN SOLID WASTE MANAGEMENT

Solid waste management the world over, is a system comprised of regulatory, administrative, market, technology and social subcomponents. The complex nature of solid waste management therefore makes it obvious that personnel involved are highly professional and with the requisite technical know-how (Morgan, 1999).

Many people feel that solid waste management is a simple affair. Simply putting waste into a vehicle and unloading it at a dump. However many towns continue to suffer from uncollected refuse that block streets and drains, habouring flies and rats and degrading urban environment. Successful solid waste management is rarely achieved without thought, effort and much learning (Buckle et al, 1994).

The complex nature of waste management has also compelled some city authorities to set up Local Refuse Authorities (LRA). The LRA's have instituted selective collection schemes for specific waste streams and they conduct extensive information campaigns to sensitize the people on the need to ensure good sanitation (ISWA, 2005).

Solid waste management requires commitment and dedication from persons at all levels, according to WHO (1999), although the technology is necessary, the human element is equally important.

Solid waste handling personnel's knowledge regarding the handling of solid waste remains very minimal especially in low income Africa where refuse collectors, and

street sweepers receive little or no training (Samanta, 1998). Clearly the level of awareness and training regarding solid waste management needs utmost priority.

A study conducted by Messing (1998) revealed that the work of refuse collectors and other sanitary workers is not given the needed attention. There is lack of respect for cleaners as their work is seen as undemanding and thus occupies the bottom level in the hierarchical structure of waste management staff.

In the developing world, the conditions under which refuse collectors and other sanitary workers work are very deplorable. Basic protective clothing such as hand gloves, boots, masks are lacking (Messing, 1998). Sanitary workers are seen working without gloves while authorities do little about this problem.

In Ghana the current Local Government Act 1993 (act 462) gives the District Assembly statutory responsibility for dealing with waste management problems through the adoption of bye laws (Osei, 2003). It has however become obviously difficult over the years for the assemblies to cope with the ever increasing waste.

Lack of people with technical- know – how in the management of solid waste in the various District Assemblies is a major problem (Osei, 2003). In the United States sanitary engineers made impressive gains in the construction and implementation of water and sewage systems across the country in the last three decades of the nineteenth century. Their accomplishments gained recognition and respect for the profession and cities turned to sanitary engineers to take control of the refuse problems (Melosi, 2000). In the same way, network for the supply of pure water and

removal of sewage received top priority as sanitation reforms brought in qualified engineers to tackle the problem of water pollution (ISWA 2005).

The health hazards associated with poor solid waste management definitely calls for professionals to handle this area. Southern Links (2000) observed that metropolitan waste management faces a major technological challenge. There is therefore the need to utilize appropriate technology in solid waste collection, transportation, treatment, recycling, and final disposal under most friendly and sanitary conditions and internationally acceptable standards (Michael, 1998).

2.5 WASTE MANAGEMENT PRACTICES

Refuse management at the end of the nineteenth and early twentieth centuries consisted primarily of collection and removal of material from one location and its placement in another location usually away from human senses. A philosophy of "out of sight out of mind" prevailed here. Waste was either applied to the land by indiscriminate dumping, burial or application as landfill (ISWA, 2005).

Food and animal waste were fed to animals and used as fertilizers respectively. The practice of feeding raw garbage to swine declined drastically in the 1930s but experienced resurgence in 1942 during the Second World War. There was clear evidence that this practice was responsible for the infection of pigs with trichinosis. (ISWA, 2005).

2.5.1 GENERATION AND COLLECTION OF SOLID WASTE

By 5.00 am, most residents are up sweeping in front of their houses preparing for the day's activities. Historically residents clean their homes and neighbourhood in preparation to receive the first visitor of the day. However waste management resources cannot meet the growing needs of most residents making the daily cleaning effort useless. In 2001, waste disposal methods in Accra afforded house- to- house services to only 11% of the 1.5 million residents while the remaining 89% disposed of their waste at community dumps in open spaces, in water bodies and in storm drainage channels (Boating, 2001).

Approximately 1,250 tons of solid waste is collected daily in Accra. The majority 85% to 90% is hauled to a landfill site at, Oblogo 17 km west of Accra. The facility is a disused quarry, which has not been well developed as a landfill site. With good compaction, this landfill site will be able to serve the region until 2006. There is another landfill at Kwabenya 30 km from Accra. This landfill however can serve Accra for the next 30 years (Laryea, 2003).

The insufficient capacity and lack of internal resources are the greatest problems facing most Metropolitan Assemblies in Ghana. Throughout most parts of Accra and Kumasi, central waste containers can be seen brimming over with trash from several days of no collection. This situation is compounded by the fact that 40% of solid waste generated in Accra and Kumasi are not collected at all (Nyante, 2000).

Individuals dispose of the waste they generate wherever they can because it cannot be handled by the existing waste management system. The lack of waste collection capacity has resulted in direct and indirect dumping by the 40% of individuals who

are not served by the current waste management system. Direct dumping occurs when persons dump solid waste directly into water sources or drain structures (Nyante, 2000).

2.5.2 DISPOSAL METHODS

Solid waste management includes all the activities that seek to minimize the health and environmental impact of solid waste. Various disposal methods are therefore in place to ensure a healthy environmental condition.

2.5.2.1 Open dump

This is a land disposal site where solid wastes are deposited and left un-covered with very little regard for the environment (Awuah, 2005).

2.5.2.2 Landfill

This is located with little, if any regard for possible pollution of ground water and surface water. Waste is intermittently covered with earth to reduce fly populations and reduce scavenger, aesthetics, disease, and air pollution problems.

2.5.2.3 Sanitary Landfill

This is located to minimize water pollution from run off and leachates. It is an engineered land disposal site where solid waste materials from municipal and industrial sources are buried. Landfill is designed to avoid the leakage into surface and ground water. It is spread in thin layers compacted and covered with a fresh layer of earth to reduce scavenger aesthetic, disease and air pollution problems.

2.5.2.4 Secured Landfill

This is used for storing hazardous wastes, which are normally stored in containers and then buried. The site has restricted access and is continually monitored. It is located above a geological stratum that should prevent any waste from leaching into ground water.

2.5.2.5 Incineration

It is an engineered process, in which combustible solids; liquids and gaseous waste are burnt at high temperatures and changed to non-combustible products.

2.5.2.6 Composting

It is a biological process in which solid waste containing organic matter are converted to useable stable material by the action of microorganisms already present in the waste.

2.6 HEALTH PROBLEMS ASSOCIATION WITH SOLID WASTE

In most developing countries solid waste is disposed in open dump sites with waste pickers. This inadequate municipal solid waste management system causes environmental and public health problems. Since the mid 1980's WHO has been supporting countries to strengthen their national capacity in municipal solid waste management (WHO, 2003).

The repercussions of poor sanitation and waste management practices are poor health. Sanitation inadequacies contribute to seventy percent of disease in Ghana (Southern Links, 2002). Malaria, diarrhoea and intestinal worms, and upper respiratory tract infections are among the most frequent health problems reported at out patient

facilities in the Greater Accra Region, and seasonal epidemic outbreak of cholera, coinciding with floods and meningitis consistently occur (Southern Links, 2002).

Garbage is known to generate a lot of flies. Flies are in turn perceived as disgusting and revolting creatures and the promotion of good health practices connects them with the spread of diseases. In this way the flies facilitate the spread of diseases (Southern Links 2002).

Mosquitoes breed in blocked drains and in rainwater that is retained in discarded cans, and other objects. Mosquitoes spread diseases including malaria and dengue.

Waste collection workers face particular occupational hazards. Dangerous items such as broken bottles, glass, razor blades, hypodermic needles and chemicals from industries may cause injury. Strains from lifting heavy load as well as traffic accidents may also occur (Buckle, 1995).

Metropolitan waste management in recent years has become a major problem worldwide. If solid waste management is left in the hands of the private sector, indiscriminate dumping of solid waste will continue among the very poor people.

2.7 PEOPLE ATTITUDEB TOWARDS SOLID WASTE

People's attitude towards solid waste has not been the best. Individuals dispose the Waste they generate anywhere because the existing waste management systems in their localities cannot handle the waste they generate. This situation is compounded by the fact that 40% of solid wastes generated in low income Africa are not collected at all (Nyante, 2000).

Littering of streets by pedestrians, hawkers, and passengers on moving vehicles is not uncommon in major cities in Ghana. Most offenders know the environmental threat such negative attitudes pose yet; they continue to engage in such acts with impunity. Individuals dispose of the waste they generate into drains, nearby bushes, open spaces, and into rivers that serve as drinking sources for other inhabitants.

In Ghana, most households are not prepared to pay for the waste they generate so that they will enjoy municipal collection. The use of non-standardized containers as refuse bins is very common. Such bins can not stand the test of time and children who are responsible for waste collection to dump sites sometimes dump waste indiscriminately as they find carrying of the waste uncomfortable (Laryea, 2000).

This negative attitude coupled with lack of internal resources has contributed to a tremendous increase in street waste especially plastic materials. Accra, the capital of Ghana faces a plastic waste menace as plastic waste is found in almost every community while residents care less about what is going on (AMA, 2005). The repercussions of poor sanitation and waste management practices are poor health. Sanitation inadequacies contribute to 70% of diseases in Ghana. Malaria, diarrhoea and intestinal worms and

Upper respiratory track infections are among the most frequent health problems (Cairncross 1999)

CHAPTER THREE

METHODOLOGY

3.1 RESEARCH METHODS AND DESIGN

The study was a descriptive cross-sectional one. It involves the collection of primary data and secondary data. Qualitative and quantitative methods were used to collect data. The variables were classified into categories and relationships between them were described.

3.1.1 STEPS FOLLOWED IN THE DESCRIPTIVE CROSS-SECTIONAL STUDY

- The main /objective of the study was defined
- The study population was defined
- Sampling scheme and sample size were determined
- Study instrument / data collection instruments were designed.
- Study instruments were pre-tested to determine their validity
- The overall study methods including staff, training supervision logistics technical aspects, data inputs, data processing and data analysis were designed
- Data was collected
- Data coding, entry and processing was done
- Data was analyzed
- Results were discussed and recommendation given
- Results were disseminated to district assembly waste management team for feedback.

3.2 DATA COLLECTION TECHNIQUES AND TOOLS

Questionnaire and key informant schedules were used. The interviewer administered method was employed. Open and closed ended questionnaires were administered to the District Environmental Health Officer, the Environmental Health Officers. Time was given to them to respond to the questions provided. Questionnaire to households were administered by the help of field assistants. Residents either provided answers verbally or in written form. Hawkers and GPRTU officials were interviewed personally using the key informant schedules.

3.3 STUDY POPULATION

Households in Agogo, Konongo – Odummasi, Juansa, Dwease and Patriensa in the Asante Akim North District constituted the study population. All the Enviromental Health Officers refuse collectors, some hawkers as well as GPRTU officials formed part of the study population.

3.4 STUDY VARIABLES

Table 3.1 Table of study variables

Variable	Operational Definition	Scale Of Measurement	Tools
A. Quantity of Solid Waste Generated	The total estimated quantity of solid waste generated at the end of the day	Continuous in Kilogrammes	Questionnaire, Records
B. Types of solid waste generated	Classification of solid waste listed by experts including, Readily biodegradable waste, Biodegradable waste and non-readily biodegradable waste.	Nominal	Questionnaire
C. Solid waste management practices.	Solid waste management practices including, generation, collection, transportation and disposal methods.	Nominal	Questionnaire and non-participant observation
D. Health hazards associated with solid waste.	Health problems identified by WHO as associated with improper solid waste management.	Nominal	Questionnaire Records
E. Peoples attitude towards solid waste management.	How people manage domestic and public waste.	Responses to questionnaire	Questionnaire
F. Types of personnel involved in solid waste management	Personnel's educational level and training received on solid waste management	Nominal Ordinal	Responses to Questionnaire

Source: Authors Construct, 2005

3.5 SAMPLING

Five towns classified as the sanitation zones in the District were purposively selected for the study. A total 0f 101 households were systematically selected to solicit their views on household solid waste management. The District Environmental Health Officer, the 12 Environmental Health Officers and the 12 Refuse Collectors were all purposively selected for the study due to their direct involvement in solid waste management in the District.

Ten GPRTU officials who operate in the five main lorry stations were conveniently selected to solicit their views on solid waste generation and collection in the lorry stations. Forty hawkers were also conveniently selected to seek information on their activities.

3.5.1 Sample Size

With a total population of 92,038, it has been estimated using the EPI INFO Statistical Calculation that at 95 % confidence interval and an expected frequency of 50 % with a worst acceptable of 42.62%. A sample size of 176 community members was used for the study.

3.6 PRE TESTING

Four communities namely Juaso, Morso, Atwedie and Asankare were purposively selected (besides the sampled population) for the pre testing. The pre testing was done with the help of two research assistants who were recruited and trained for the study.

3.7 DATA HANDLING

At the end of each data collection day, the interview guides were checked to ensure completeness and accuracy. Questionnaire to the various respondents that is the district environmental officer, the environmental health officers, households, and the refuse collectors were sorted and kept separately.

3.8 DATA ANALYSIS

The data gathered were entered into a computer and analyzed using the EPI INFO statistical package. Data analysis was on-going and data check programmed was run to ensure correctness of data. The results were presented in terms of frequency and percentages.

3.9.1 ETHICAL CONSIDERATION

Permission was sought from the District Director of Health Services – Asante Akim North. In addition to this, the District Chief Executive Asante Akim North was duly informed about the study. They authorized the District Environmental officer to inform his staff members about the study and also to give the needed help and support to the study. Prior information was obtained on the culture, working hours and daily activities of the various departments in charge of sanitation and appointment booked in order to ensure it was respected during the data collection period.

3.10 LIMITATION OF STUDY

1. Lack of logistics and time did not permit the coverage of the entire district.
2. Lack of logistics and time made it impossible to include other areas of interest such as schools and health centers.
3. Some selected household hawkers especially did not want to be interviewed for reasons best known to them.
4. Lack of experts on waste management in the district made the work extremely difficult.

3.11 ASSUMPTION

The study conducted in the five towns classified by the District Assembly, as the sanitary zone is a reflection of the solid waste management practices in the entire District. All those interviewed, the information gathered from the various stakeholders represented the true picture of solid waste management in the Asante Akim North District.

CHAPTER FOUR

RESULTS

4.0 INTRODUCTION

This chapter deals with background data information on results of the study variables. The data collected from the District environmental health officer, the twelve environmental health officers, the one hundred and one households, the twelve refuse collectors, the ten GPRTU officials and the forty hawkers and traders are analyzed and the results explained. Figures are given where necessary.

4.1 BACKGROUN DATA ON AMOUNT OF SOLID WASTE GENARATED IN THE DISTRICT

Statistics from the District environmental officer indicated that the solid waste generated in the five major towns in the district namely Agogo, Konongo- Odumasi, Juansa – Domeabra, Dwease – Praso and Patriensa is 23,360 metric tones annually with an average of 0.5 kg/ person /day.

The study revealed that this figure is a representation of what the Assembly collects from households, lorry parks, market, streets and other open places. The wastes that were not collected were not quantified. It came out that huge piles of solid waste are left uncollected as they are dumped indiscriminately.

TABLE 4.1 Estimated Distribution of Solid Waste Generated in the Five Major Towns

Name of Town	Population	Waste Generated Annually in Tons	Percentage
Agogo	28,271	7,259.4	31.08
Konongo – Odumasi	37,713	8,882.6	38.02
Juansa – Domeabra	14,245	3,499	14.98
Dwease – Praso	6,741	2,230	9.55
Patriensa	5,608	1,489	6.37
TOTAL	92,038	23,360	100

Source: District Environmental Health Office (DEHO) 2003

The above table shows that Agogo with a population of 28,271 generated 7,529.4 tones of solid waste annually representing 31.08 percent. Konongo Odumasi with a population of 37,713 generates 8,882.6 tons representing 38.02%. Juansa Domeabra with a population of 14,245 generates 31,499 tons. Dwease Praso with a population of 6,741 generates 2,230 representing 9.55 % and Patriensa with a population of 5,061 generates 1,489 tons representing 6.37 percent of the total annual solid waste generated.

Two power tillers attached with a trailer, everyday conveyed eight (8) trailers full of refuse from households to open dumps. One refuse truck conveyed four (4) trucks full of refuse from central containers to dump sites. Large quantities of solid waste are sent to open dumps directly by households that manage their own waste. According to the refuse collectors such wastes found their way into the dumps at odd times and that children in most cases were responsible for these practices.

Households that have been supplied with refuse bins have their bins always full to the brim. Collection is done at two days interval. Household waste represents 70% of the total waste generated in the District.

4.2 DIFFERENT TYPES OF SOLID WASTE GENERATED IN THE DISTRICT.

Table 4.2 TYPES OF SOLID WASTE GENERATED IN THE DISTRICT.

Type of waste	Frequency
Plastic Waste	5
Used Paper & Cardboard	2
Garbage	3
Broken Bottles &Glass	1
Textiles & Wood	1
Total	12

Source: Author's construct (2005)

All the refuse collectors admitted that different types of solid waste were generated in large quantities in the District. Five (5) of the refuse collectors mentioned plastic waste as the type of solid waste generated. Three (3) of them talked about garbage, Two (2) mentioned used cardboard and paper while one each said broken bottles and glass, and textiles and wood are produced in large quantities. It came out that different people generated different types of solid waste.

4.3 PEOPLE AND THE TYPE OF WASTE THEY GENERATE.

The study revealed that different people in various sectors of the economy are responsible for the generation of waste in the district.

Table 4.3 People who generate waste in the district

Type of People	RESPONDENTS
Hawkers	4
Storekeepers	3
Market	2
Household	2
Lorry Station	1
TOTAL	12

Source: Author's construct (2005)

Four of the refuse collectors said hawkers generated a lot of solid waste. Three mentioned store keepers while two each mentioned market women and households. One however said most of the wastes came from lorry stations.

Table 4.4 Type of Solid waste generated in households

Type of Waste	Respondents
Plastic	6
Paper and empty milk tins	2
Garbage and sardine tins	2
Garbage and metal pieces	1
Plastic and used clothing	1
TOTAL	**12**

Source: Author's Construct (2005)

Six of the refuse collectors mentioned plastic waste as the one generated in large quantities. Two mentioned paper and empty milk tins. Garbage and sardine tins were also mentioned by 2 of them. One of them each mentioned garbage & sardine tins as well as plastic & used clothing as being generated in large quantities in households.

4.4 TYPE OF PERSONNEL INVOLVED IN SOLID WASTE MANAGEMENT

The District had an Environmental health officer who had received training at the Kintampo School of hygiene and had been attending workshops on urban waste management. There are twelve (12) environmental health officers who have received training at the Kintampo school of hygiene and who are responsible for ensuring good public sanitation by educating the public on general cleanliness There are also twelve (12) refuse collectors who had not received any basic formal education. The District has a district management team responsible for the overall management of solid waste in the district.

Table 4.4 Educational Levels of Environmental Health Officers

Level of Education	Frequency
Ordinary level	2
Certificate in Environmental Health	9
Certificate in Health Education	1
TOTAL	12

Source: Author's construct 2005

Majority of the environmental health officers had received education on environmental health. Two had ordinary level certificate while one had obtained a certificate in health education.

Table 4.5 Composition of Solid Waste Management Team

Waste Management Team	
Designation of Personnel	Number
District Environmental Health Officer	1
District Planning Officer	1
Deputy Coordinating Director	1
District Community Development Officer	1
District Water and Sanitation Team	1
Refuse Collectors	2
TOTAL	7

Source: Author's construct 2005

As shown above the District environmental health officer, the deputy coordinating director, the district community development officer, a representative of the district water and sanitation team and two refuse collectors constituted the waste management team.

The waste management team has put up a waste management plan known as systematic expansion of door to door refuse collection. The aim of the waste management team was to ensure a coordinated effort that will ensure a better waste management process in the District. All the 12 environmental health officers were engaged in waste management education that included house-to-house education. This was done periodically.

Table 4.6 The Rate at which Waste Education is organized

Rate at which Education is Done	Frequency
Once Every Month	9
Once Every Three Month	2
Twice Every Month	1
Total	12

Source: Author's construct 2005

All the twelve environmental officers organized education on waste management at different intervals. Nine of them said they organized waste education once every month. Two (2) had been doing it once every month three month while one said he organized it twice every month as indicated by Table 4.6.

4.5 SOLID WASTE MANAGEMENT PRACTICES WHICH INCLUDED GENARATION, COLLECTION. TRANPORTATION AND DISPOSAL METHOD

The study revealed that the District Assembly by law (Act 1961) is the sole institution responsible for the management of waste in the District. The Assembly deals with the entire waste in the District, which includes household waste, street waste; market waste as well as managing disposal or dumpsites.

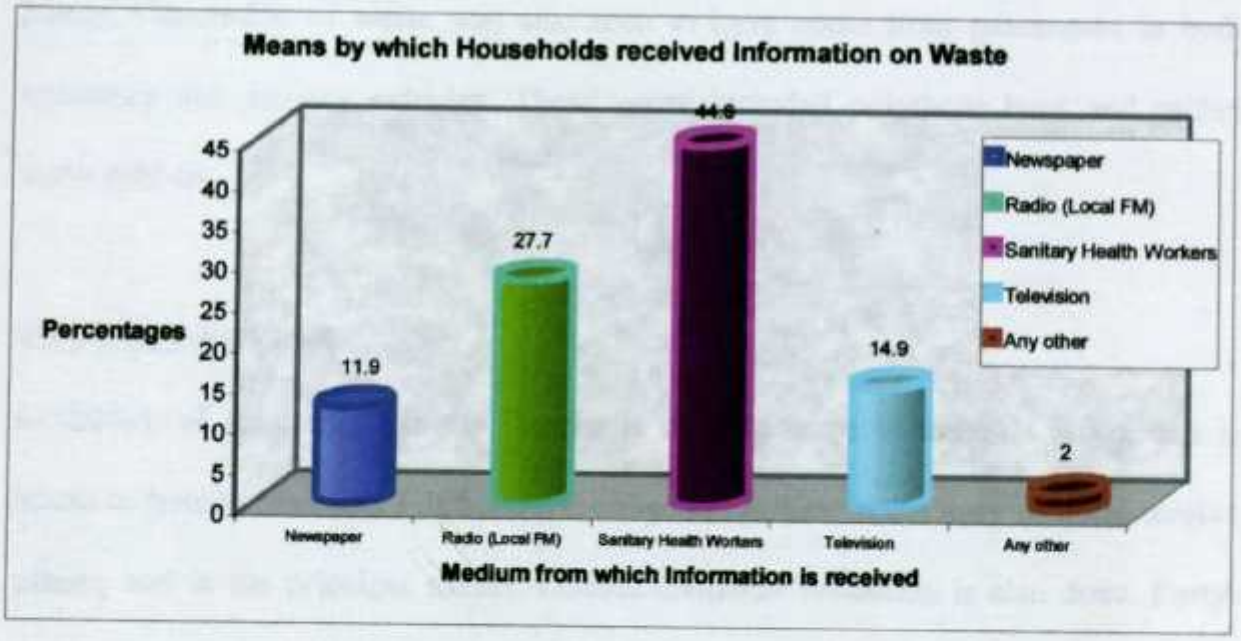
The private sector is yet to be incorporated into waste management in the District. The District Assembly depends solely on the statutory laws on sanitation. Environmental health officers are responsible for the enforcement of these laws as stated by the District environmental health officer. The District has a waste management plan titled "systematic expansion of door- to -door refuse collection.

The District also has a waste management team that is tasked to ensure good sanitation in the District.

The District Waste Management is manned by the District Environmental Health Officer, twelve environmental health officers, and twelve refuse collectors. House-to-house collection is done in 101 households. An amount of ¢ 15,000 is paid monthly.

The study revealed that most households (81.2%) were aware that the District Assembly was responsible for waste management while 18.8% said they were not aware of who was responsible for waste management. Waste management was not centered on collection and disposal alone but also wastes education.

Fig 4.1



Source: Author's Construct (2005)

Education on waste management reached the people by diverse ways, 44.6% received it through the environmental health workers. 27.7% received theirs through the radio (Local FM). 14.9% received it through television while 11.9% received it through the newspapers.

4.5.1 GENERATION OF WASTE

Huge volumes of solid waste were generated from households, hawkers on streets, market places, lorry stations and open places. All the 12 environmental health officers, together with the twelve (12) refuse collectors said plastic wastes were generated in large quantities by hawkers at market places.

All the refuse collectors 12 said people who sold various food items in the night generated volumes of waste. Most of the waste found its way into drains and open places. Generation of waste was also seen to have come from passengers in both stationary and moving vehicles. These waste included polythene bags and sachet water rubbers.

4.5.2 COLLECTION

Collection of solid waste in the District is done in some households (100), that is house-to-house collection. Furthermore, collection is done at the lorry stations, market places, and in the principal streets. Central container collection is also done. Forty-five (45) refuse bins located at various places were collected on daily basis.

Table 4.8 The Rate at which Refuse Bins in Households are Collected

Emptying Interval	Frequency	Percent
Daily	41	40.6
Thrice a week	9	8.9
Two days interval	48	47.5
Any other	3	100
Total	101	100

Source: Author's construct 2005

The study revealed that daily emptying of refuse bins took 41%. Two days interval took 48 % and thrice in a week took 9 %. Other collections took 3.0%.

People had varied opinion with regard to the emptying of the household bins.

Table 4.9 Peoples Perception about the Way the Bins are Emptied

Perception of People	Frequency	Percent
Poor	56	55.4
Satisfactory	27	26.7
Good	18	17.8
Total	101	100

Source: Author's construct 2005

Table 4.9 shows that more than half, (55.4%) saw the emptying of household bins to be poor. Twenty- seven (27) representing 26.7% said it was satisfactory. 17.8% said such service was good.

Households that had not registered with the District Assembly collected their own refuse and dumped them directly into the refuse dumps.

All the twelve 12 Environmental Health officers and the refuse collectors said majority of the waste collected in the unregistered household found their way into open places, drains and in nearby bushes.

4.5.3 TRANSPORTATION

The District Assembly is responsible for the carting of waste from registered households, streets, market places, lorry stations and other places to dump sites. The district has one (1) refuse truck responsible for the carting of solid waste from the 4 central containers to disposal sites. The District also has two power tillers attached with trailers that cart refuse from 100 households and 15 dustbins around the major towns. Households and the refuse collectors' expressed different sentiments about the citing of the refuse dumps. To some they were too far away from homes while others said they were too close. All the hawkers were quick to say waste disposal was a major problem and the absence of refuse bins in most public places was a contributory factor to indiscriminate dumping.

TABLE 4.10 LOCATIONS OF DUMPSITES FROM HOUSEHOLDS

Distance From House	Frequency	Percent
About 50 Meters (too close)	25	24.8
About 100 Meters (manageable)	12	11.9
About 150 Meters (manageable)	31	30.7
200 Meters (manageable)	6	5.9
400 Meters (far)	5	5.0
500 Meters (far away)	4	4.0
1 Kilometer (too far)	13	12.9
Any Other	5	5.0
Total	101	100

Source: Field Survey (2005)

Table 4.10 shows the distance from households to refuse dumps. Twenty five households representing 24.8 percent of households said they were too close to the dump sites. Offensive smell was their major problem. Thirteen Households said they had to travel for about one kilometer before dumping their waste. Those who were 100 meters, 150 meters and 200meters away from the dumpsite said transportation of waste was manageable.

4.5.4 DISPOSAL METHOD

The Asante Akim District used three methods in disposing off its solid wastes All those involved in solid waste management – The District Environmental Officers, and the refuse collectors said the district has 3 disposal sites namely 45 open dumps, four landfills and one incinerator yet to be used.

Wastes disposed in the open dump were left to the mercy of the weather to decay. Domestic animals also fed on the dumping sites thus reducing the amount of garbage but facilitate disease transmission and spread.

As to whether the refuse dumps were adequate, eight of the environmental health officers said they were woefully inadequate while four said they were manageable.

TABLE 4.11 RESPONSES AS TO WHETHER THE REFUSE DUMPS WERE EVENLY DISTRIBUTED

Response	Frequency
Yes	3
No	9
Total	12

Source: Author's construct 2005

Nine of the environmental health officers said the refuse dumps were not well distributed while three (3) however said the refuse dumps were evenly distributed. This assertion supports the 62 households who said the refuse dumps were not well located.

All the households expressed their gratitude to any effort that would change solid waste into something useful. They however had different opinion with regard to contributing for this venture.

TABLE 4.12 VIEWS EXPRESSED BY RESIDENTS WITH REGARD TO CONTRIBUTION TOWARDS RECYCLING

Views On Payment	Frequency	Percentage
Full Payment	5	5.0
Will Not Pay	42	41.6
Partial Payment	54	53.5
Total	101	100.0

Source: Author's construct 2005

As indicated in Table 4.12, 5.0% were prepared to pay fully towards recycling. Forty-two (42) representing 41.6% were not prepared to pay anything at all, while fifty-four (54) representing 53.5% said they would pay partially. All the Environmental health officers said composting and recycling are some of the best methods of waste disposal. It came out that most residents would not dispose their waste in the approved dumps.

4.6 DISEASES AND OTHER HEALTH HAZARDS ASSOCIATED WITH POOR WASTE MANAGEMENT

All the respondents (100%) households and hawkers interviewed on negative effects of poor waste management said they were fully aware of such repercussions. They mentioned diseases such as malaria, typhoid, cholera, diarrhoea and worm infestations as some of the diseases that resulted from poor sanitation.

TABLE 4.13 TYPES OF DISEASES ASSOCIATED WITH POOR SOLID WASTE MANAGEMENT

Type Of Disease	Frequency	Percentage
Cholera	21	20.8
Diarrhoea	17	16.8
Malaria	11	10.9
Typhoid	52	51.5
Total	101	100

Source: Author's construct 2005

As indicated by Table 4.13 20.8% mentioned cholera as a health problem. Seventeen representing 16.8% said diarrhoea is a major problem, while 10.9% stated malaria. Fifty two (52) representing 51.5% said typhoid is the major health problem due to poor solid waste management.

4.6.1 OTHER HAZARDS ASSOCIATED WITH POOR SOLID WASTE MANAGEMENT

All the twelve refuse collectors said that households generated different types of wastes, which were not separated. Dangerous objects such as used blades, metals, broken bottles, glass, electric cables, broken cutlass and knifes and at times dangerous chemicals are put into dustbins. With the use of worn out protective clothing, all the refuse collectors complained that they had been sustaining some injuries due to lack of protective clothing.

All the environmental health officers said rainwater deposited in empty cans left in gutters and in refuse dumps accumulate rain water and the result is the breeding of mosquito. Domestic animals were left to feed on refuse dumps and wild dogs in most cases would not allow refuse workers to work at such refuse dumps.

4.7 ATITUDE TOWARDS SOLID WASTE MANAGEMENT

The attitude of people towards solid waste management was critically observed. All the 12 environmental health officers and the 12 refuse collectors gave their views as to people attitude towards solid waste management.

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TABLE 4.14 PEOPLE ATTITUDE TOWARDS SOLID WASTE

Attitude Of People	Frequency
Poor	18
Satisfactory	4
Good	2
TOTAL	24

Source: Field Survey (2005)

Eighteen of the respondents said people's attitude towards waste was poor. Four (4) mentioned satisfactory. Two said people's attitude was good. With regard to how approved dumps were patronized, seven said the people did not patronize the approved refuse dumps. Five however, said the people patronized the refuse dumps. Five others maintained that people dumped their refuse indiscriminately in unauthorized places, especially into drains.

TABLE 4.15 THE PEOPLE'S INVOLVEMENT IN COMMUNAL LABOUR

Whether Communal Labour Is Done	Frequency
No	8
Yes	4
Total	12

Source: Author's construct 2005

Table (4.15) established the fact that communal spirit with regard to waste was encouraging. Eight said communal labour was not done at all while four said it was done. As to when and how it was organized, four said communal labour was done twice in a year.

4.7.1 Separation of Waste into Different Bins

TABLE 4.1.6 SEPARATING DIFFERENT WASTES INTO DIFFERENT BINS

Whether Separation of Waste is Done	Frequency	Percentage
No	95	94.1
Yes	6	5.9
Total	101	100

Source: Author's construct 2005

Ninety four percent indicated that they never separated the different waste they generated. Six percent however said they separated it. The environmental officers suggested heavy fines as answer to people's poor attitude towards solid waste management. Furthermore, majority of the people were not prepared to pay for the waste they generated All the GPRTU officials maintained that they could maintain sanitation in the various lorry station. As to how this was going to be done, they

explained that the hawkers were always with them at the lorry stations. They could therefore control their activities. As to how they would get funds to do this, they said they would levy the hawkers and use the money to employ casual labourers.

CHAPTER FIVE

DISCUSSION

This chapter provides a discussion of the results obtained from a solid waste management survey conducted in the Asante Akim North District in relation to the specific objectives set, and literature reviewed.

5.1 BACKGROUND INFORMATION ON THE AMOUNT OF SOLID WASTE GENERATED IN THE DISTRICT

The current volume of solid waste generated annually in the district with a population of 126,477 is 23, 360 metric tones. With a population growth rate of 2.3% coupled with rapid urbanization and increased commercial activities, the quantity of waste generation is likely to increase tremendously. Households generate volumes of solid waste. This constitutes about 70% of the total solid waste generated in the District.

Other areas where large quantities are generated are market places, lorry stations, streets, and other open places. The district's only refuse truck conveyed 4 trucks full of refuse from unit areas and central containers to disposal sites daily while the two power tillers with trailers attached conveyed 8 full trailers each from households to the approved dumps.

The Large volume of solid waste generated in the Asante Akim District confirms the World Health Organization's report that collection of solid waste in many cities in the developing world cannot cope with the increasing volume of solid waste generation (WHO, 2003).

Solid waste collection in the district covers only 45% - 50%. The remaining 50% is not collected at all. This explains the huge pile of refuse on the streets. The District Health Management Team (DHMT), in a report said the District was at a threshold and required responsive strategies to deal with the menace. (DHMT, 2005). Solid waste collection in Accra is estimated at 1, 250 tons per day, which far outweighs what is generated in the Asante Akim North District. The difference could be due to the fact that the population of Accra is over 1.5 million with series of commercial activities (Laryea, 2003).

5.2 TYPES OF SOLID WASTE GENERATED IN THE DISTRICT

Different solid waste generated in the District attest to the fact that different people in the various commercial enterprises generate different waste. In the market places, garbage which is the animal and vegetable waste resulting from handling, cooking and serving food were generated in large quantities. Furthermore rubbish which consisted of non-food waste was also common. Plastic materials were also very common in market places.

In lorry stations, the common solid waste found were used papers and plastic waste, which included polythene bags. The major streets had been littered with used polythene bags, used papers and cardboards. Polythene bags stuffed with other waste were found in gutters thus blocking the free flow of drains. Households generated large quantities of organic materials. Leftover food and other materials as plastics and rubber, torn cloths as well as broken bottles and glass could also be found.

Prepared food sellers and iced water sellers were said to generate polyethylene bags and other rubber materials in large quantities. The use of plastic in commercial activities is increasing in the district and the indiscriminate disposal calls for remedy to address the problem.

According to Awuah, (2005), Plastic waste generated varies from 0.3 to 8.3% in rural and urban centers by weight. By volume the percentage could be above 30%. Thus the rate of plastic consumption is increasing and the indiscriminate disposal calls for remedy to address the problem otherwise we stand a chance of creating a major environmental nuisance to the ecology if immediate effort is not made to check the menace.

Broken bottles, glass and other materials are produced by stores that deal in drugs and cosmetics. Such items are also produced and they found their way into streets and gutters, as storekeepers did not patronize the few refuse bins produced by the District Assembly. Most households did not separate the various types of solid waste they generated thus making collection and disposal difficult for the refuse collectors. Waste characterization in many locations is seen to enable one to understand the different composition and categories of the waste. This ultimately helps to identify the management options appropriate for waste (ISWA, 2005)

5.3 PERSONNEL INVOLVED IN SOLID WASTE MANAGEMET IN THE DISTRICT

Many people feel that solid waste management is a simple affair. Thus simply putting waste into a vehicle and unloading it at a dump site. If this were true, then why do so many towns suffer from uncollected refuse that block streets and drains, harbouring flies and rats, and degrading urban environment? (Sam anta et al., 1998).

Successful solid waste management is rarely achieved without thought, effort and much learning. The Asante Akim North District Assembly like all other District Assemblies is by law responsible for waste management in the District. The complex nature of solid waste management handling calls for highly qualified professionals to handle this area. The District lacked men and women with the requisite qualification and skill in solid waste management. All the environmental health officers in the district though had received training on environmental health were not specialized in waste management. Their special area is public education that will ensure good sanitation in the District. The World Health Organization strongly argued that although the technology is necessary, the human element is equally important (WHO, 1999).

Maintaining good public and household sanitation that include intensive education is a major problem. Enforcement of sanitation laws is a major problem, as they have to battle it out with people who do not see poor sanitation as a threat to their health. The refuse collectors had not received any basic education. They were employed on the bases of their physical fitness and not on whether they have knowledge in waste

management. There is lack of respect for the refuse collectors who are sometimes referred to as "cleaners'. Cleaning is seen as a job that could be done by anybody.

The refuse collectors occupy the bottom level in the hierarchical structure of the personnel in the waste management department. They as such, receive little help from administrators and other employers. This evidence is given by the lack of motivation for the refuse collectors. They worked with damaged protective clothing with authorities looking on unconcerned. Twelve environmental health officers and 12 refuse collectors were woefully inadequate for the district. Limited staffing according to Laryea, (2003) was a major problem confronting both the Accra and Kumasi Metropolitan Assemblies.

Metropolitan waste management however, faces a major technological challenge and there is the need to utilize appropriate technology and solid waste collection, transportation, treatment, recycling and final disposal under most hygienic and friendly sanitary conditions that will be acceptable internationally (Southern links, 2002).

5.4 SOLID WASTE MANAGEMENT PRACTICES WHICH INCLUDED GENERATION,COLLECTION, TRANSPORTATION AND DISPOSAL METHOD

5.4.1 SOLID WASTE MANAGEMENT

In Ghana, waste management has been the responsibility of metropolitan, municipal and district Assemblies. (The Local Council Act 1961) With their constraints in

logistics, personnel and other needs, it has become extremely difficult for them to manage the ever-increasing waste in our cities.

The Asante Akim North District assembly is solely responsible for solid waste management without the involvement of the private sector as is being done in some Assemblies. Starting in 1997, solid waste collection and haulage was privatized in Accra, and contracted out to 15 different companies (laryea, 2003)

Even though there is a waste management team in the District, the members lacked the technical know-how that will handle solid waste in an internationally acceptable manner. Moreover none of the 12 environmental and refuse collectors had received any training on solid waste management. The volume of waste generated is so huge that the 12 men could hardly cope with the workload.

The 12 environmental officers who are responsible for public education as well as to enforce sanitation laws also could not cope with the size of the population. Residents therefore flouted the laws on sanitation with impunity. Majority of households (97.0%) have dustbins in their homes.59.0% provided their own refuse bins. 3.0% did not have any refuse bin.

Majority of the household 59.0% provided their own dustbins. These dustbins are household containers such as cane baskets, leaking metal buckets and broken plastic buckets. This confirms the observation made by Mensah (2004) that, households that provided their own refuse bins used variety of boxes, baskets, and bowls which are

vulnerable to rain, to being knocked down by stray animals and also by physical disintegration.

The major sanitation threat is the upsurge of plastic waste in the district. However, there is no effort to tackle the problem holistically. Sachet water producers and other plastic producers have not been incorporated in the waste management process in the District. In Accra, sachet water producers have agreed to contribute substantially to support waste management in the Accra metropolis (AMA, 2005).

5.4.2 GENERATION

Large quantities of solid waste were seen to be generated in large quantities from households, streets, shops, lorry stations and market places. The refuse collectors said most of the refuse that found their way into open places came from households. Household generated about 70% of the total waste generated in the District.

People sell various items in the night and they also generate volumes of solid waste that are left in the streets and other open places and in uncompleted buildings. Hawkers who hovered in lorry stations and other public places have not been properly registered in the District. They move from place to place and disposed plastic and polyethylene that contribute 70% of all street solid waste.

Plastic and other rubber products have been found to belong to the non-biodegradable waste (NBD). These wastes will not decompose even after a very long period in the soil (ISWA, 2005). The few saw mills in the District generated some amount of solid waste in the form of wood products such as sawdust. Most households' use saw dust

as source of fuel but some of the sawmills direct the sawdust into drains that caused floods in some areas of the Districts.

5.4.3 COLLECTION OF SOLID WASTE

Waste collection from most households (100%), streets, lorry stations, market places, open places, gutters and other places of interest are done by the 12 refuse collectors. Households or house-to-house collection is very tedious as the 12 refuse collectors start work as early as 5.30 am making sure they cover the entire households some of which are scattered.

Some of the refuse bins were found to be too small. Waste spilled over creating a situation where refuse collectors have to collect refuse deposited on the ground. Collection materials such as brooms and shovels were also lacking in the Assembly and cardboards were in most cases used to collect refuse into the bins.

House-to house bins were emptied at two days interval. A situation that most households (55%) said it was poor. The collection process in general was very bad Seventy per cent of the people were not satisfied at all with the entire collection as huge volumes of solid waste could be seen in open places uncollected over long period of time.

Even though refuse bins at public places such as lorry station were supposed to be emptied and cleaned daily, lorry stations were found to be filthy. Collection was seen to be a major problem to the small number of collectors. Mensah (2004) stated that solid waste management had always been a public "good" and as such has been provided for free by city authorities. However, city expansion both spatially and in

terms of population has outstripped resources in meeting the demand for the ever-growing environmental quality assurance.Nyante (2000) supported this fact when he said that 40% of solid waste in Kumasi and Accra are not collected at all.

5.4.4. TRANSPORTATION OF WASTE

Solid wastes generated in the various places are transported to Disposal sites. The District has only one refuse truck to convey the volumes of solid waste generated in the District. Frequent breakdown of the only truck was a major problem. Furthermore, the District has two (2) power tillers each attached with a trailer which were responsible for house-to-house collection in 100 households as well as to convey waste from public refuse bins.

The trailers attached to the power tillers were too small in size. Drivers therefore have to transport waste several times daily to dump sites. The trailers were sometimes overloaded. Some of the wastes sometimes spilled over littering the streets thus compounding the problem. Unit area and central container collection was not the best. The frequent breakdown of the only refuse truck caused such containers to be filled to the brim. No wonder four of such containers have been buried into the ground by rubbish.

5.4.5 DISPOSAL METHODS

The District has three disposal systems. There are forty-five open dumps, five landfills and an incinerator, which is yet to be used. The major problem confronting solid waste managers is how to dispose of waste in a more efficient way. It is said

that sanitary engineers still faced the challenge of solving the complex problem of solid waste collection and disposal (ISWA 2005).

Waste were put into refuse bins and transported to disposal sites. The District could boast of 42 refuse dumps. There is one incinerator yet to be used. Most households used the refuse dumps directly. Others depend on the central containers, which were transported to the refuse dumps by the refuse trucks. Refuse collectors worked occasionally on the refuse dumps ensuring that the wastes were gathered and polyethylene bags and other combustible materials burnt.

5.5 HEALTH HAZARDS ASSOCIATED WITH POOR SOLID WASTE MANAGEMENT

Majority of the people (97%) in the District were aware of the repercussions of poor solid waste management practices.

All the respondents, including residents without any basic formal education mentioned one or two diseases associated with poor sanitation. 41.7% of the people mentioned typhoid as a sanitation problem. 25.0% mentioned diarrhoea while 16.7% mentioned cholera; malaria and worm infestation also came out. This confirms the fact that, people actually knew the effect of poor waste management.

Melosi (2000) stated that the generation of solid waste is a consequence of human activity but the improper management of organic waste could pose a threat to human

health through possible direct contact with disease causing bacteria as well as the fostering of human disease vectors such as rodents and insects (ISWA, 2005)

All the refuse collectors maintained that they normally encountered severe and minor injuries due to lack of protective clothing. It came out that households 100% and users of public bins did not separate the waste, which sometimes contained dangerous materials such as broken bottles, electrical wire, nails and needles. The International Solid Waste Association (2005) strongly argued that waste characterization helps to identify the management options appropriate for waste.

It came out that human excreta are put into polythene bags and dumped into refuse bins. With lack of motivation, refuse collectors hardly cope with the enormous waste generated in the District.

Farm animals such as sheep, goats and cattle also feed on open dumps compounding the health problems. All the refuse collectors insisted these animals were a threat. The feeding of swine with raw garbage in the 1930's contributed to the infection of pigs with trichinosis. (Melosi, 2002)

5.6 PEOPLE'S ATTITUDE TOWARDS WASTE MANAGEMENT IN THE DISTRICT

Majority of the residents' attitude towards waste management in the District was very poor. 9 of the refuse collectors and 10 of the Environmental Health Officers stated clearly that people's attitude towards waste management was very bad.

Most residents (75.2%) did not patronize the refuse dumps approved by the District Assembly. They therefore dumped their waste indiscriminately. This proves the fact that individual's dispose of the waste they generate wherever they can because it cannot be handled by the existing waste management system (Nyanteh 2000).

Fifty nine per cent of residents did not pay for the waste they generated. They were also not prepared to pay for the waste they generated so that they would be part of the house- to- house waste collection exercise. The work of refuse collectors was compounded by the fact that most residents 94.1% never separated the waste they generated making them prone to injuries from such dangerous materials as broken bottles, glass, metals, used razors and blades. Buckle and Smith (1994) reported that waste collection workers face particular occupational hazards that include strains from lifting objects, injuries from sharp objects and traffic accident

Communal labour on sanitation was not done as was presented by 66% of the respondents. This compounded the problem as the waste generated was too much for the 12 refuse collectors. The law on sanitation was not deterrent enough as 10 of the Environmental Health Officers saw it to be too flexible thus allowing victims to go away with little punishment.

Due to the nature of the law, 6 of the environmental health officers thought offenders should be prosecuted so that they would serve longer prison terms. Due to poor attitude towards sanitation, the District Assembly spent a colossal sum of 500 Million Cedis annually on solid waste management. Also an average of a hundred people was victims to the sanitation law.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.0 INTRODUCTION

From the interpretation and discussion of the results on solid waste management practices in the Asante Akim North District, the following conclusion can be drawn.

6.1 CONCLUSIONS

6.1.1 Estimated Quantity of Solid Waste Generated

The District estimated solid waste generation stood at 23,360 metric tones. With a growth rate of 2.3% and the increase in commercial activities, the population as well as waste generation would likely increase tremendously. The daily carting of 4 full refuse trucks together with 8 trailers full of solid waste is voluminous.

Aside the quantity that is collected and transported to dump site, large volumes are sent directly to open dumps by households that did not patronize the house- house collection exercise, while quantities of wastes were disposed indiscriminately into drains, open places and nearby bushes. Large volumes of solid waste were generated in the night by traders who sell all sorts of consumable items. These sellers would not make any attempt of collecting the waste they would generate thus compounding the work of the 12 refuse collectors.

6.1.2 Type Of Solid Waste Generated

Different types of solid wastes were generated by the different commercial activities, and the various households. Solid wastes such as food waste, paper and cardboard, broken bottles, wood and plastic wastes were found to be common. The main streets, lorry stations, market places and in front of stores, various solid wastes are found uncollected. Households produced large quantities of garbage and plastic waste while sachet water producers also produce volumes of rubbers that are left in the streets.

6.1.3 Personnel involved in Solid Waste Management

Personnel involved in solid waste had received some amount of training. However, the refuse collectors (100%) who were responsible for the collection and transportation of waste to dump sites had not received any training. There was lack of respect for those responsible for waste management especially the environmental health workers and the refuse collectors. The refuse collectors unfortunately occupy the bottom level in hierarchical structure of the waste management staff. Refuse collectors were not well motivated. They lacked basic protective clothing such as Wellington boots, gloves and masks.

6.1.4 SOLID WASTE MANAGEMENT PLACTICES

The District Assembly based on the local council Act (1961) was solely responsible for the management of waste. With lack of logistics and technical- know- how, the District is not able to cope with the ever-increasing waste. The entire District has one refuse truck with two power tillers attached with a trailer. Transportation of waste to dump sites was a big problem to the 12 refuse collectors. 59% households provide

their own refuse bins, which are non-standardized. The poor distribution of refuse dumps provided room for indiscriminate dumping. The 45 open dumps, with 5 landfills were not able to support the huge volume of waste. Some of the refuse dumps were becoming artificial mountains.

6.1.5 Health Hazards Associated with Poor Solid Waste Management

Hazards associated with poor solid waste management included typhoid, diarrhoea, cholera and worm infestations. Typhoid leads the list of diseases that were prevalent in the District.

6.1.6 People's Attitude Towards Solid Waste in The District

People's attitude towards waste was seen to be very poor. Residents expressed their unwillingness to pay for the waste they generate (59%). They were also not prepared to pay fully towards any effort that would change solid waste into something useful. The non-separation of waste into different bins was another problem that put the lives of the refuse collectors at risk. 75.2% did not patronize the approved refuse dumps thus dumping indiscriminately. Respect for refuse collectors was very low leading to low morale.

6.2 RECOMMENDATION

Based on the conclusion, the following recommendations can be made.

The District waste management Department should collaborate with the Accra and Kumasi metropolitan waste departments so that the technical know-how could be obtained from these areas to enable them deal with the huge volume of waste. Modern methods of waste management can easily estimate the amount of waste generated at any point in time for efficient management.

The District Assembly as a matter of urgency should liaise with the Civil Engineering Department of KNUST so that the Department organizes refresher courses and seminars for the Assembly waste management staff.

The refuse collectors should not be left out as these courses would equip them with current methods of waste handling and put them abreast with time.

The District Assembly waste management team should involve all stakeholders such as market queens, GPRTU personnel's in lorry stations, representatives of storekeepers to use this study as a basis to develop safe and effective guidelines for managing Solid waste in the District.

The Assembly as a matter of urgency should motivate the people to establish unit area management committees. Managing waste by the people themselves would enhance compliance hence efficiency. The waste management unit should be well resourced. Trained personnel's who have the requisite knowledge in waste management should be recruited to help manage the waste in a more scientific manner.

There should be intensive registrations of houses as well as hawkers. Such an exercise would enable the waste management team to know the exact number of households that should be covered by the house- to -house collection exercise and the income that would be generated from the house- to-house collection. Registration of hawkers and issuance of special identification tags would enable the Assembly to levy them for the waste they generate.

Education on Sanitation should be intensified in the District. Such education should take place in schools, churches, lorry stations, market places and in durbar grounds to sensitize people on the dangers of poor waste management.

The assembly should put more resources into waste management so that modern methods of waste disposal such as incineration, composting and recycling could be used conveniently.

REFERENCES

Adjiri, B. (2005) Managing Sanitation in Accra. A Paper Presented by AMA (Unpublished. Daily Graphic. Graphic Communication Group LTD. Issue No. 149485. April 2005. Page 9.

AMA (2005) Accra Metropolitan Assembly Report on Solid Waste Management. Daily Graphic. Graphic Communication Group LTD. Issue No. 149274. June, 2005. Page 5.

AMA Waste Management Annual Report (2004). Accra Metropolitan Assembly Waste Management Department (AMWMD) 1-40.

Amoako T. J. (2005), Sanitation, a threat to national development: A Paper Presented To AMA (Unpublished) Daily Graphic. Graphic Communication Group LTD. Issue No. 149485. April, 2005. Page 9.

APME (1999), Association of Plastic manufacturers in Europe. Analysis of plastic consumption and recovery in Western Europe. APME Brussels; (www.apeme.org)

Asian Center For Organization Research And Development, Accord (1998). Solid Waste Management. Gov. Of India, 1-8

Awuah, E. (2005). Environmental Science For The Tropics 1st Edition. Esther Smith Publishers, Kumasi, Ghana 2005. 83-78.

Cairncross, S, (1998). Environmental Health Engineering in The Tropics; An Introductory Text. 2nd Edition. John Willy And Sons, Chichesta-New York, (2000) 16 – 17.

Buckle, S. [1995). Waste And Wealth: Needed Reforms in The Collection and Disposal Of City Refuse. University Of Illinois Press, Urbana. 47-50.

E.E. A.-European Environmental Agency. (2003). Avoiding Municipal Waste.

Government Of Ghana (1999). Environmental Sanitation Policy. Ministry Of Local Government And Rural Development Publications.

Health Policy And Planning, (1998]. Vol. 13. Oxford University Press. 81-86.

International Solid Waste Association, ISWA (2005). Waste Management Research, vol. 23, No. 2, Sege Publications LTD. London, 2005. 93 – 101.

International Solid Waste Association, ISWA (2205). Waste Management Research. Vol. 23, No. 1, Sege Publications LTD. London 2005. 173 – 197

International Solid Waste Association, ISWA , (2005). Waste Management Research vol. 23, No. 3 Sege Publications LTD. London 2005. 306 – 319.

Ishwar, P, (1999). Solid Waste Disposal And Refuse In The United States. Vol. 11. CRC Press Inc. 200 Corporate Bud, Florida. 126-130.

KMA Annual Report (2004) Kumasi Metropolitan Assembly; Waste Management Department (WMD)

Laryea, B. (2000), Accra Metropolitan Assembly (AMA) Solid Waste Management. Annual Report. City Printer; 2000: 14 -18.

Louis, G.E. (2005). Municipal Solid Waste Management. US Environmental Protection Agency, Washington D.C. 95-97.

Melosi, S, (2000). Waste In The Inner City; Asset Or Assault; Local Environment, 6 No. 2. 50-55.

Michael, D. Et Al (1998). Hazardous Waste Management. Mcgraw-Hill Inc. New York. 1998. 2-3.

Mensah, A. (2004) Waste Management In The Kumasi Metropolis: Annual Report 2004

Messing, K. (1998), Hospital trash cleaners speak of their role in Disease Prevention.

Med. Anthropology Q. Jun; 12(2): 168 – 187.

Michael D. (1998). Hazardous Waste Management. Mcgraw-Hill Inc. New York. 1998. 2 – 3

Morgan, P. (1999). Rural Water Suppliers And Sanitation. Macmillan Education Ltd. Hong Kong. (1999). 270-274.

Neira, P. (1997). A History of Public Health in New York. 1625 – 1866. Russell Sege Foundation, New York. 14 – 30.

Nyante, S. (2003), Management Waste in Urban Ghana, The way forward. Esther Smith Publishers. Kumasi 2003. 15 – 18.

Osei, E, (2003) Managing Solid Waste In Greater Accra: The Way Forward. City Printers, 2003.

Pennick, W. (1978), Focus on sanitary disposal of MSW. Oxford University Press. 1978: 48 – 51

Samanta B., Van, W (1998), Health policy and planning. Vol 13. Oxford University Press: 80 – 86.

Sherwood, C. (1995). Natural Systems For Waste Management And Treatment, 2nd Edition. Mcgraw-Hill, Inc. New York, San Francisco. 1995.

Southern Links (2002), Criteria for successful sanitation programme in low income countries. Pub med. Citation.

Techobanoglous, V., Duffy, J., (1997), The Sanitarians. A History of American Public Health. University Of Illinois Press Urbana, IL.

UNDP (2000), World Bank Water and Sanitation Programme for Africa; The role of participatory Urban Appraisal. University of Illinois Press, Urbana IL.

UNO (2005). United Nations-backed studies on solid waste in Kenya. WHO/VBC/SM/VCT/87.8.2

WHO (1987), Application Of Environmental Management Measures For Disease Vector Control In Urban Areas. WHO/VBC/SEM/VCT, 87.8.2 (Geneva: World Health Organization).

WHO (2003) Health Care Waste Management, Geneva 2003. 4-9.

WHO, (1999) Safe Management of Waste. World Health Organization Bulletin: 77(10)

WHO, (2003), Sanitation in low income Africa. World Health Organization Bulletin, Kenya 2003.

Waste Management Research, ISWA, (2005). International Solid Waste Association Vol. 23, No. 1, Sege Publications LTD. London 2005. 173-197.

Waste Management Research, ISWA, (2005). International Solid Waste Association Vol. 23, No. 2, Sege Publications LTD. London, 2005. 93-101.

Waste Management Research, ISWA, (2005) International Solid Waste Association Vol. 23, No.3, Sege Publications LTD. London 2005. 306-319.

APPENDICES

APPENDIX A

QUESTIONNAIRE FOR DISTRICT ENVIRONMENTAL HEALTH OFFICER

PLEASE TICK [/] FOR AN ANSWER IN THE BOX OR WRITE THE ANSWER IN THE SPACE PROVIDED.

1. Who is responsible for waste management in the district?

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

2. Do you have a waste management team? Yes [ ] No [ ]

   a) If yes, please list the members by designation.

	Designation	Number
Team leader	.....	.....
Team members	.....	.....
Waste handling staff	.....	.....

   b) If No, what is the designation of person(s) responsible for waste collection and disposal in the district?

3. What is the level of education of designated person (in-charge)?
   1. Primary
   2. Secondary
   3. Tertiary / professional
   4. No formal education

4. Has he/she received training on waste management? Yes [ ] No [ ]
   If yes what type of training and of what duration?

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

5. Is the private sector involved in waste management in the district?
   Yes [ ] No [ ]

   a) If yes kindly name the company involved?

   b) If No, don't you think their involvement will be of help? Yes [ ] No [ ]

6. Do you have a waste management plan? Yes [ ] No [ ]

   If yes, kindly give title of the document

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

7. Apart from the statutory laws on sanitation, does your outfit have its on bye laws on waste management? Yes [ ] No [ ]

8. Who is responsible for the enforcement of laws on sanitation in the district?
   1. Environmental health officers
   2. The police
   3. Assemblymen
   4. Any other personnel.....

9. What is done to those who go against the law?
   1. They are fined by the EHO
   2. They are warned

3. They prosecuted
4. Any other punishment .....

10. Who finances waste management in the district

1. Central government [ ]
2. District Assembly [ ]
3. Private bodies [ ]

11. Do you face any of these constraints?

1. Finance [ ]
2. Equipment [ ]
3. Technology [ ]
4. Labour [ ]
5. Any other [ ]

12. How many refuse trucks do you have for the district?

1. One [ ] 4. Four [ ]
2. Two [ ] 5. Five [ ]
3. Three [ ] Any other number .....

13. How many refuse dumps do you have officially

1. One [ ]
2. Two [ ]
3. Three [ ]
4. Four [ ]

Any other numbers.....

14. Do you have dust bins in some parts of the town? Yes [ ] No [ ]

If yes kindly mention the numbers that you have.

.....

15. What types of disposal sites do you have in the district?

1. Open dump [ ]

2. Landfill [ ]
3. Sanitary landfill [ ]
4. Secured landfill [ ]
5. Incineration [ ]
6. Composting [ ]
7. Any Other .....

16. Kindly mention the volume of solid waste generated annually in the district.

.....

.....

.....

17. Do you recycle waste in the district? Yes [ ] No [ ]

18. Which type of solid waste is generated in large quantities in the district?

1. Household waste [ ]
2. Public or general waste [ ]
3. Health care waste [ ]
4. Industrial waste [ ]
5. Any other.....

19. How do you manage household waste?

1. House to house collection of waste [ ]
2. Unit area collection [ ]
3. Any other .....

20. Who is / are responsible for the in sanitary conditions in the major towns in the district?

1. Hawkers [ ]
2. Pedestrians [ ]
3. Passengers [ ]
4. Store keepers [ ]
5. Market women [ ]
6. Any other.....

APPENDIX B

QUESTIONNAIRE FOR ENVIRONMENTAL HEALTH OFFICERS

PLEASE TICK [/] FOR AN ANSWER IN THE BOX OR WRITE THE ANSWER IN THE SPACE PROVIDED.

1. Sex Male [ ] Female [ ]

2. level of education
   1. 'O' Level certificate [ ]
   2. SSCE certificate [ ]
   3. Tertiary [ ]
   4. Professional [ ]

3. Have you received any special training on waste management?
   Yes [ ] No [ ]

4. What is our main schedule?
   1. Ensuring good public sanitation [ ]
   2. Ensuring good household sanitation [ ]
   3. Educating the public on general cleanliness [ ]
5. Any other .....

6. Do you organize waste education for the people in the locality?
   Yes [ ] No [ ]

7. If Yes how often
   1. Once every month [ ]
   2. Once every three month [ ]
   3. Once every six month [ ]
   4. Once every year [ ]
   5. Any other .....

8. Do you do house to house education on waste management?

Yes [ ] No [ ]

If Yes how often

1. Once every three moths [ ]
2. Once very six months [ ]
3. Once every year [ ]

Any other .....

9. How will you describe people's attitude towards waste management?

1. Poor [ ]
2. Satisfactory [ ]
3. Very good [ ]
4. Excellent [ ]

10. Are there adequate refuse dumps in the locality? Yes [ ]No [

10. Are the refuse dumps well distributed in the locality? Yes [ ] No [ ]

11. Do the people patronize the approved refuse dumps? Yes [ ] No [ ]

12. Do the people do communal labour with regard to waste management?

Yes [ ] No [ ]

13. If No will you advocate for such a programme? Yes [ ] No [ ]

14. How many solid waste collectors do you have in the district?

.....

.....

15. Are the waste collectors up to the task? Yes [ ] No [ ]

16. What do you do to household that maintains poor sanitation?

1. Advice is given [ ] 2. They are summonsed [ ]
3. They are prosecuted [ ]

4. Any other .....

16. Do you have registered hawkers in the district? Yes [ ] No [ ]

If No how do you tax them.....

.....

17. What type of solid waste is generated in large quantities in the streets?

1. Plastic waste [ ]
2. Garbage [ ]
3. Used papers [ ]
4. Any other.....

18. Are you aware that those who sell various food items in the night generate lots of waste? Yes [ ] No [ ]

19. If yes how do you intend managing this problem?

1. Registering them [ ]
2. Moving round to levy them [ ]
3. Stopping them from selling [ ]
4. Any other.....

19. On the average can you estimate the number of people who fall victim to poor sanitation and thus face the law?.....

20. Is the law on sanitation deterrent enough? Yes [ ] No [ ]

If No can you suggest appropriate means to ensure good sanitation?

.....

What are some of the major health problems associated with poor solid waste management?

.....

.....

.....

APPENDIX C

QUESTIONNAIRE FOR HOUSEHOLDS

PLEASE TICK [/] FOR AN ANSWER IN THE BOX OR WRITE THE ANSWER IN THE SPACE PROVIDED.

1. Have you had any formal education? Yes [ ] No [ ]

2. What was the highest level of the education you had?
   1. Basic level [ ]
   2. Sen. Sec. School [ ]
   3. Tertiary [ ]
   4. Any other [ ]

3. Which organization is responsible for the management of domestic waste in this locality?
   1. District assembly [ ]
   2. Private company [ ]
4. Any other .....

5. Do you have a refuse bin in your house? Yes [ ] No [ ]

6. If yes, who provided it?
   1. District assembly [ ]
   2. Private company [ ]
   3. The household [ ]
   4. Any other .....

7. Do you separate the waste you generate into different bins Yes [ ] No [ ]

8. How often is your refuse bin emptied?
   1. Daily [ ]

2. Two days interval [ ]
3. Thrice a week [ ]
4. Any other .....

9. Are you satisfied with the way the bin is emptied Yes [ ] No [ ]

10. How will you rate the satisfaction with regard to the collection
    1. Poor [ ]
    2. Very good [ ]
    3. Satisfactory [ ]
    4. Excellent [ ]

11. Have you ever had any education or information on safe methods of waste disposal?
    Yes [ ] No [ ]

12. From which of the following ways do you receive information about waste management?
    1. Television [ ]
    2. Sanitary health workers [ ]
    3. Newspaper [ ]
    4. Radio [ ]
    5. Any other .....

13. Is waste disposal a major problem in this locality? Yes [ ] No [ ]

14. Are you comfortable with the location of the refuse dump? Yes [ ] No [ ]

15. How far is the refuse dump from your house?
    1. About 50 meters [ ]
    2. About 100 meters [ ]
    3. About 150 meters [ ]
    4. Any other .....

APPENDIX D

SPECIMEN OF KEY INFORMANT SCHEDULE ON SOLID WASTE MANAGEMENT.

1. Which agency is responsible for the collection and transportation of solid waste in the district?
2. How is solid waste managed in public places?
3. Who controls the activities of hawkers especially those who operate in the lorry stations?
4. Where do the wastes generated in public places transported to?
5. Are there adequate refuse bins in public places especially in lorry stations?
6. Can the GPRTU manage solid waste in the lorry stations?
7. How will the GPRTU generate funds to maintain waste in the lorry stations?
8. How does the general public treat refuse workers?
9. Are refuse workers adequately protected from work place risk?
10. Do you have training programmes for refuse workers?
11. Have you sustained any injuries in the course of your work?
12. Will you appreciate privatization of some aspect of waste management in the district?
13. Do you have any relevant information on solid waste management you will wish to share?

APPENDIX E

AN OBSERVATION CHECK LIST TO DETERMINE PEOPLE'S ATTITUDE TOWARDS SOLID WASTE MANAGEMENT PRACTICES IN THE ASANTE AKIM NORTH DISTRICT OF THE ASHANTI REGION

(Tick the Appropriate boxes or record observation where necessary)

1. People dispose waste at refuse dumps. [ ] Yes [ ] No.
2. There are enough refuse bins in public places. [ ] Yes [ ] No.
3. People closer to refuse bins patronize the bins. [ ] Yes [ ] No.
4. Households maintain their refuse bins properly. [ ] Yes [ ] No.
5. Disposal of waste is handled by matured household members. [ ] Yes [ ] No.
6. Waste is put at the right place at the dump sites. [ ] Yes [ ] No.
7. People talked freely about environmental health. [ ] Yes [ ] No.
8. Refuse workers are well received by households. [ ] Yes [ ] No.
9. Refuse workers handle waste carefully. [ ] Yes [ ] No.
10. Refuse bins are emptied frequently. [ ] Yes [ ] No.
11. Dangerous materials are deposited into refuse bins. [ ] Yes [ ] No.

APPENDIX F

MAP OF ASHANTI REGION

Source: Kumasi Metropolitan Assembly 2000

APPENDIX G

MAP OF ASHANTI AKIM NORTH DISTRICT