

**PATTERN OF SOLID WASTE MANAGEMENT IN WUSE AND
NYANYA DISTRICTS OF ABUJA MUNICIPAL AREA COUNCIL,
FEDERAL CAPITAL TERRITORY, NIGERIA**

BY

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CERTIFICATION

This is to certify that the Masters in Public health thesis with the topic: “Pattern of Solid Waste Management in Wuse and Nyanya Districts of Abuja Municipal Area Council, Federal Capital Territory, Nigeria” is the original work of Dr. Gbadamosi, Abdurrazaq Lawal.

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Date

DEDICATION

This work is dedicated to Almighty Allah, AzawaJal, for the gift of life, without Whom nothing is possible and all praises are due to Him as the Lord of the universe, Who created man, and thought him what he knew not; to my late parents, AlhajiGbadamosi Lawal Akande and Hajiya Fatima Binta G. Lawal, for their love, care and upbringing; and to the man on the street, for whom only Allah provides sustenance.

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LIST OF ACRONYMS

- ABU – Ahmadu Bello University
- AEPB– Abuja Environmental Protection Board
- AMAC – Abuja Municipal Area Council
- EPA – Environmental Protection Agency
- ERC –Expert Review Committee
- FCDA – Federal Capital Development Authority
- FCT – Federal Capital Territory
- FCTA – Federal Capital Territory Administration
- FREQ – Frequency
- GNP – Gross National Product
- HHS – House Hold Survey
- IDI – In-Depth Interview
- IWMP – Integrated Waste Management Plan
- ISWM – Integrated Solid Waste Management
- Kg – Kilogram
- PPP – Public-Private-Partnership
- SPSS – Statistical Package for Social Sciences
- USA – United States of America

SUMMARY

Municipal Solid Waste is one of the consequences of development, related industrialization and population growth. Phenomenal increase in this waste, both in volume and variety, has continued to pose serious challenges of management to the authorities, with negative environmental impacts and significant risks to public health. Several factors, including political exigencies, competing and inadequate budgetary allocations and exponential increase in population have continued to hinder efforts at proper waste management in major cities of Africa and other developing countries, including Abuja, Nigeria. In spite of the planned and structured nature of most parts of the Abuja Municipal Area Council, concerted efforts at ensuring proper solid waste management continue to defy a single effective pattern for all areas of the city.

This cross-sectional descriptive community-based study was conducted in two districts of Abuja Municipal Area Council (AMAC). The districts were selected through a multistage sampling technique to ensure engagement of an urban district (Wuse) and a slum district (Nyanya). Bias in the selection of Heads of households as respondents was minimized using simple random sampling technique by balloting. A representative sample size was determined, taking into cognizance the 2006 census figures of the two districts, as well as previous studies on problems of solid waste management in the FCT. Structured Interviewer Administered Questionnaires and In-Depth Interview Guides were used as data collection tools for the study. Descriptive analysis of data was done using the SPSS software, version 20.0, while qualitative data was content analyzed, summarizing it into key thematic areas, based on the objectives of the study.

Results of the study highlights varying levels of knowledge and attitudes of residents and waste managers in the two districts, with higher knowledge, attitude and practices observed among residents with higher educational levels. Socio-economic variables appear to have minimal

bearing on solid waste handling practices by the respondents. The proportion of residents served with proper and adequate solid waste management facilities are relatively small, and reside mostly in the urban district of Wuse. Garbage is the commonest type of waste generated in the two districts.

The study recommended strong political will and commitment at the highest government level; more effective and efficient governance mechanisms by the AEPB, through provision of proper regulatory laws and policy framework for the Board to operate; expansion and improved partnership with the private sector, which should be extended to the Local Government authorities; proper planning, which should be at par with pace of expansion and development, and improvement in funding. Finally, the AEPB must create more awareness and public education on regular basis, while enforcing environmental sanitary laws, including laws on prohibition of indiscriminate waste disposal.

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND INFORMATION

Rapid economic development and related industrialization have led to increased urbanization and sizes of cities, as well as changing consumption habits. The consequences of these, with associated population growth, have been phenomenal increase in the amount of all sorts of wastes generated globally. Solid wastes are particularly large in volume and variety for these reasons.

Solid wastes can be defined as useless, unwanted or discarded materials that arise from man's activities (domestic, commercial, industrial, agricultural, institutional and construction/demolition) in the human environment and are not free flowing (WHO Expert Committee; 1971). Prompt and proper handling (or management) of these wastes is absolutely necessary to minimize its negative environmental impacts and significant risks to public health. Unfortunately, this process has continued to pose the greatest challenges the world over, more seriously in cities and other urban settlements, especially where these are not planned. Management of solid waste is a global issue resulting in varying degrees of successes and also posing varying challenges, depending on several factors, including level of development.

In developed countries, cities continue to generate staggering amounts of municipal solid waste (MSW); but because there are established solid waste management systems in place, the challenges posed by these wastes are minimal and less stressful. For instance, the USA generated 243 million tons of Municipal Solid Waste in 2009 alone, which showed the average person

produced 1.9kg of waste per day.¹ However, recycling levels only increased by 0.4% between 2008 and 2009. Most (55% to 65%) of the waste generated was from residential areas, while the rest(35% to 45%), was waste from commercial and institutional locations like schools, hospitals and businesses.

In recent times, China has now surpassed the USA as the largest producer of wastes, with the volume of MSW that it produces increasing at the rate of 8% each year. Seventy percent (70%) of this waste is disposed of in open dumps. Nevertheless, the country is committing huge resources to upgrading its waste infrastructure, with the aim to have 30% of its waste treated through waste to energy technologies by 2030.¹

The realization that health and the quality of life of the urban dweller are related to his surroundings guide waste management in these developed countries, through proper planning, with adequate and appropriate necessary resources made available to ensure effective and affordable systems. This is as opposed to the situation in developing countries, where political exigencies, competing and inadequate budgetary allocations, exponentially increasing population and efforts at increased industrialization have hindered proper system of waste management.

For instance, in India, more than 90% of Municipal Solid Waste that is generated is directly disposed of on land in an unsanitary manner.²The problem is already acute in cities and towns as disposal facilities have not been able to keep pace with quantum of wastes generated. Again, in Iran, municipal solid waste is a serious environmental hazard and social problem. Currently, a high volume of solid waste is generated every day in the district towns of Iran, while, unfortunately, management of these wastes has continued to deteriorate due to the limited resources to handle the increase.³

For most part of the past decades, the quantity and composition of municipal solid waste in the cities of Africa and other developing economies have changed considerably, while the methods of collection, transport, and disposal still remain generally primitive, with open dumping as a common method in practice. As a result, most cities are facing serious environmental problems.⁴

Like in most developing countries in Africa and other parts of the world, management of solid waste in Nigeria continues to constitute one of the greatest challenges facing States and local authorities who are responsible for it. Nigerians, like other peoples in different parts of the world generate solid waste from various anthropogenic activities. The volume of solid waste being generated continue to increase in quantity, variety and composition, at a faster rate than the ability of these authorities to cope and improve on the financial and technical resources needed to parallel this growth.⁵ For instance, while the Nigerian population is increasing by about 2.8% per annum, the rate of urban growth is much higher, at 5.7% per annum.⁶ Consequently, the output of solid waste per day in Nigeria is 69,000 tons based on generation rate of 0.49kg per capita per day.⁷ The situation is further compounded by the lack of appropriate and adequate political will and commitment, bad governance, the lack of proper institutional arrangements, grossly insufficient financial resources, absence of by-laws and standards, inflexible work schedules and insufficient information on quantity and composition of waste.⁸

Generally, we do more of just waste disposal rather than waste management in the developing world. This is reflected in the final treatment and disposal methods of solid waste in most cities there, which are commonly open indiscriminate dumping (due to lack of transfer stations), or uncontrolled landfills, where a waste collection service is only partly organized. For example, Lagos city in Nigeria had incinerators but lack of maintenance soon caused them to break down. This open and uncontrolled dumping method of waste disposal that is common place in most

cities in Nigeria has many catastrophic consequences. Threats to land and underground water, resource degradation in the vicinity of dumps and landfill sites, as well as disease outbreaks in the area surrounding the sites, are common. For instance, rain water that runs over the solid waste at dump sites tends to infiltrate through waste extracts and dissolve suspended constituents, which becomes contaminated liquid called leachate. This is often washed into surface water such as wells and streams, which are commonly sources of drinking water in suburban settlements of many cities and other communities in the developing world, causing seasonal outbreaks of diarrhoeal diseases, especially cholera.

Additionally, the waste stream is mostly made up of garbage and then partly non-biodegradable materials, constituting a problem in itself, especially regarding choice of method of disposal. The waste is often denser because of its large organic content, greater moisture and smaller particles sizes, thus requiring the use of technologies and management systems that are different from systems used in developed countries.⁶ Higher density reduces the effectiveness of compaction vehicles for waste transfer. For instance, the density of solid waste in Nigeria ranges from 280kg/m^3 to 370kg/m^3 , higher than solid waste densities found in developed countries.⁹

Inappropriate designs of cities make the challenges of solid waste management worse, especially in developing countries. Because these cities are differently structured and often partly characterized by unplanned, uncontrolled and haphazardly constructed, sprawling slums with narrow access roads, the rate of solid wastes generated varies between cities and even parts of the same city. Thus, a single pattern of waste collection and general management are often not uniformly applicable to all cities and indeed an entire city.⁶

In the Federal Capital Territory of Nigeria, while the city centre of Abuja is well structured and planned, there are some of the suburbs which are typified by the unplanned and haphazardly constructed, uncontrolled slums with narrow access roads, characteristic of cities in Africa and other developing countries. There is thus a clear difference in environmental quality between the two areas, with the rate of solid wastes generated varying between these parts of the same city. This situation is worsened by inadequate, ineffective and inefficient facilities provided for refuse disposal and general management, leading to poor environmental sanitation and quality. The ever increasing population and rapid urbanization of the city both pose serious challenges to the handling of pile up of solid wastes, which increase exponentially in total quantity and quality. Litters and open dumping are still common in some areas of the city.¹⁰

Numerous significant risks and problems to individual and public health are associated with improper solid waste management and its negative environmental impacts. Various medical and health conditions have been found to be related to different methods of waste management, particularly associated with the substances, gases, volatile organic compounds and other pollutants emitted in the process.^{11, 12}

Finally, knowledge, awareness and attitudes of the populace on solid wastes, the attendant environmental and health implications, as well as proper disposal methods, are generally poor and lackadaisical. The people may be more concerned about the more pressing problems of poverty, hunger and survival. These in themselves constitute major obstacles to effectiveness of any solid waste management system put in place.¹³

1.2 PROBLEM STATEMENT

The problems and challenges of solid waste management in cities in Africa and other developing countries of the world are very visible and not amenable to cover-ups or management pretensions. The situation clearly exposes the pathetic state and hopelessness of the institutional arrangements put in place for solid waste management in most urban areas of countries in sub-Saharan Africa, including Nigeria. Generally, waste generation rates range from 0.66kg/capita/day in urban areas to 0.44kg/capita/day in rural areas in Nigeria, as opposed to 0.7-1.8 kg/cap/day in developed countries. In Lagos alone with a population of 9.1 million people (2006 census), over 4 million tons of municipal solid waste are generated annually, translating to about 1.1kg/capita/day.⁷ These figures are comparable with figures in Tehran, Iran, where, with a population of about 10 million people and 22 different districts, (about 1/7 of Iran's total population), the city generates 7,000 metric tons of municipal waste per day that culminates into a total of 2.5 million tons annually.¹⁴ This generally suggests similar solid waste situations in all developing countries.

Institutional arrangements place the management of solid waste on the shoulders of Local Government Authorities in Nigeria. Historically, these services are provided to the populace at no cost to them. However, dwindling financial resources to government and other ever emerging competing development priorities and needs have further made capacity for solid waste management a much larger challenge.¹⁵

Today, our model capital city of Abuja has begun to suffer from all these problems associated with inappropriate solid waste management. Attempts to introduce user fees have been largely ineffective, as residents see solid waste management as one of the social responsibilities of

government that must be provided at no cost whatsoever to the individual. Partnerships with the private sector have also not been able to fully address the challenges.

The Abuja Municipal Area Council (AMAC), of the new Federal Capital Territory (FCT), can be said to be the best planned and structured urban settlement in Nigeria. It is the seat of government and its related structures. While concerted efforts are always being made to keep pace with, and also meet the numerous challenges posed by this status, management of solid waste continues to defy a single effective pattern for all areas of the city.

1.3 RATIONALE FOR STUDY

Although the Abuja city has been painstakingly planned to meet standards of modern cities the world over, solid waste management still constitutes a major challenge. The proportion of the human population of the Municipal Council of Abuja with access to proper and adequate refuse disposal method is quite small. These are the privileged proportion that lives in the highbrow, well-structured districts and settlements of the Municipality of the Federal Capital Territory, including Asokoro, Maitama, Wuse, Garki, Gwarinpa etc. Government is generally and usually more anxious to ensure cleanliness and proper sanitary conditions in these areas because they also house the Diplomatic Community. Additionally, the residents are appropriately aware, knowledgeable and enlightened about solid waste and its management.

The Karshi Development Area of the Municipal Area Council such as Nyanya, Karmo, Karu, etc. are all semi-urban unstructured and squatter settlements inhabited by middle and low income earners. They still depict solid waste situation characteristic of most cities in developing countries. This may be because these areas are yet to be properly structured for application of a uniform solid waste management system. Additionally, the areas are densely populated with poor

road network, which make waste collection and management cumbersome. This may then mean that if care is not taken, these areas of the AMAC may be subsumed by mountains of refuse.

The attendant consequences of this situation would include general environmental degradation, especially air, water and land pollution, blockage of roads and drainages. This may in turn result in floods, traffic challenges, odour nuisance and poor aesthetics. The menace of flies and rodents, as well as emission of gases into the air, has far reaching health and environmental implications.

All these therefore prompted this study, to examine the patterns of solid waste management practices in selected districts (Wuse and Nyanya) of Abuja Municipal Area council of the Federal Capital Territory, and the factors responsible for the situation.

1.4 RESEARCH QUESTIONS

- i) Why is solid waste management a major challenge in the FCT?
- ii) What are the solid waste management practices in the FCT and the proportion of residents served with proper and adequate solid waste management?

1.5 GENERAL AND SPECIFIC OBJECTIVES

1.5.1 General Objective

The main objective of this study is to assess the pattern of solid waste management in Wuse and Nyanya districts of Abuja Municipal Area Council of the Federal Capital Territory.

1.5.2 Specific Objectives

The specific objectives are to:

- a) Assess the level of knowledge of residents and waste managers on solid waste management in the study areas of Abuja Municipal Area Council;

- b) Determine the proportion of residents served with proper and adequate solid waste management facilities in the study areas of Abuja Municipal Area Council;
- c) Determine the types of solid waste generated and the management practices in use in the study areas of Abuja Municipal Area Council;
- d) Identify factors militating against proper solid waste management in the study areas of the Abuja Municipal Area Council.

1.6SCOPE OF STUDY

The study was limited to only two districts in the Abuja Municipal Area Council, one each of urban and slum districts, selected using simple random sampling after the stratification of the districts of AMAC into urban and slum groupings. The sample size was limited to Four Hundred Heads of Households. The study focused only on solid waste.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

The activities of living things in general, and man in particular, involve the utilization of the abundant resources in their environment for sustenance and to satisfy their needs. In the process, they produce wastes as by-products. The World Health Organization (WHO) refers to waste as something which the owner no longer wants at a given time and space and which has no current or perceived market value.¹⁶

Urban human settlements constitute major areas of waste generation, made up of residential, commercial, industrial and institutional wastes, as well as street sweepings and yard waste. A high proportion of this is solid waste. Solid waste thus comprises a wide range of materials and comes from a variety of sources.

Municipal solid waste is produced as a result of economic activities and consumption patterns. The amount and variety of these wastes vary from place to place, mostly determined by the population density, level of income and industrialization. For example, industrialized countries with higher incomes produce more waste per capita and per employee, while in low-income countries, there are less commercial, industrial and institutional activities, which thus results in lower waste generation rates.

Globalization is another phenomenon, which has fueled urban growth, bringing along with it, some serious challenges, including the management of municipal solid waste. It has particularly played very negative roles in this respect in African cities. In addition to increased volume and variety of waste that result from increased flow of goods and services, changed lifestyles and

consumption patterns, the situation is further compounded by the transfer of globalized or internationalized waste management methods and ideologies, which are mostly ill-adaptable to the settings in developing African cities.⁶

Africa is known to be the least urbanized region in the world, with only 38 percent being urban. According to the United Nations Population Division Report of 2002 however, it is catching up fast with the world's most rapid urban growth rate of nearly 4 percent per annum. The largest million cities are known to be Cairo (14.5m), Lagos (8.0m), Kinshasa (6.3m) and Addis Ababa (4.5m) among others.^{4, 17} This trend explains the enormous burden of urban solid waste, especially in these major cities and also explains why there has been increasing attention paid to the environmental impact of solid waste globally, consequently making solid waste management a very important issue.

Nigeria on its part, has witnessed a rapid rate of urbanization in the last two decades. It is estimated that over 40% of the Nigerian population now live in urban areas. The rapid rate of urbanization has brought with it some significant problems including shortage of housing, overcrowding, traffic congestion, environmental degradation, inadequate infrastructure and services, including poor capacity for solid waste management.¹⁸ The trend of solid waste issues is therefore not much different in most Nigerian cities, including Abuja. This is so much so that the problem of solid waste management in terms of collection, disposal and environmental sanitation in our cities and urban areas throughout the country have occupied the attention of the Federal, States and Local Government authorities for many years. Public concerns on these issues have continued to be subjects of discourse, but with little or no significant improvements or effective control and management methods achieved. This calls for greater attention as it is a major public health concern in Nigerian cities

Table 2.1 below shows estimated and projected volumes of solid wastes generation in some Nigerian cities over a 4-year period. The data was generated in 1991 and reflects yearly increases for all the cities captured.

TABLE 2.1: ESTIMATED AND PROJECTED VOLUME OF SOLID WASTES GENERATION IN SOME NIGERIAN CITIES¹⁹

URBAN AREA	TONNES OF SOLID WASTE GENERATED PER YEAR			
	1982	1985	1990	2000
Lagos	625,399	681,094	780,079	998,081
Ibadan	350,823	384,224	440,959	559,882
Kano	319,935	348,560	402,133	535,186
Kaduna	257,837	280,925	324,084	431,314
Onitsha	242,240	263,929	304,477	386,593
Port-Harcourt	210,934	229,821	265,129	352,852
Oshogbo	131,903	143,712	173,720	253,841
Aba	131,903	143,712	169,919	236,703
Jos	99,871	111,905	135,272	197,660
Warri	67,477	75,607	91,396	133,531
Gusau	44,488	48,471	57,243	79,835
Potiskum	15,434	16,816	19,399	21,347
Uyo	12,508	13,628	15,721	20,923
Suleja	9,283	10,514	13,311	21,336
New Bussa	5,690	6,200	7,152	9,518

Findings in various other studies further highlight the solid waste situation. A research study on refuse disposal practices in three major motor parks in Ibadan municipality, Oyo State, South-

West Nigeria, revealed a generally poor environmental hygiene, as the waste is disposed of in open dumps, into streams or by open burning, practices that are obviously unhygienic and inimical to the health of the people and the environment. The waste problems in the motor parks are neglected by the various tiers of government.²⁰ Such situations contribute to the recurring Ogunpa flood disasters in Ibadan, Nigeria, the worst of which occurred on 31st August 1980.

In another study carried out retrospectively in the commercial city of Kano, Nigeria, it is estimated that Kano metropolis generates about 3,085 tonnes of solid waste per day. The waste consisting largely of organic and other biodegradable matter (43%), constitutes 68.26% by weight of total solid waste generated in the study area. The household sector in the city metropolis produces the largest amount of the waste, accounting for 62.5%, while the waste generated by various institutions accounts for only 5.8%. Industries located within residential areas contribute 2.9% of wastes. The results also indicate that that solid waste is not properly managed since there is no ideal landfill, while recycling is limited. The paper highlighted the implications of the result for the environment. For example, because of poor management, the waste emits dangerous gases into the atmosphere and bacterial isolates were found, including Coliform bacteria (*E. coli*, *Klebsiell*esp. and *Shigell*asp.), in the waste samples.²¹

2.2 SOLID WASTE COMPOSITION AND GENERATION

The composition and variety of solid wastes are largely affected by the two factors of the income level of the country and the extent of industrialization. Income level affects the main ingredients in solid waste, particularly the level of packaging (i.e., paper, plastic, carton, cans, and bottles), as well as the extent of containment that is affordable at the household level (i.e., covered bins, plastic bags, cartons, open piles), which in turn affects the amount of soil and ash within the waste and the moisture content.⁷ The moisture content of solid waste of high-income countries is

usually low and the calorific value relatively high because there is less food material, yard wastes, and other putrescible organics in the waste. Also, because hazardous wastes are carefully regulated to be source-segregated and separately managed in secured transport and disposal facilities, as well as tracked through cradle-to-grave, composition of solid waste in high-income countries is relatively less harmful.

On the other hand, the wetter waste of developing countries does not have sufficient calorific value to self-sustain incineration; that is, it will not burn without the addition of fuel. Also, despite the lower level of commercial, industrial, and institutional activities in developing countries, their solid waste is not necessarily devoid of hazardous wastes because the regulatory framework and enforcement system to segregate and separately collect such wastes are nearly non-existent or dysfunctional. Bloodied clothes/bandages, cotton swabs, Intravenous fluid bags, used syringes and other infectious medical wastes from hospitals are commonly found within the mixed municipal solid waste collected. Hazardous solvents, adhesives, plating materials, and pesticides from industries, as well as hazardous asbestos products from construction/demolition activities, are also common. Such wastes are often placed in piles within large bins or rooms, requiring manual emptying by workers and with shovels. Additional reason for this dangerous situation is that private sector collection contractors feel they can save money by illegally combining healthcare wastes with their nonhazardous municipal loads.²²

This phenomenon of uncontrolled and non-segregated wastes, with its poor management, is not uncommon even in planned cities like Abuja. By virtue of its status as the new Federal Capital of Nigeria, Abuja is attracting massive migration, leading to huge population growth. This results in the emergence of a number of squatter settlements and slums in the midst of affluence,²³ with attendant growth in wastes generated and hence the challenges.

2.3 WASTE STORAGE

Solid waste storage is the first step in the management process once it has been generated and it represents a temporary confinement to prevent environmental and health impact. The containers used for storage of solid wastes vary and include; plastic containers, galvanized steel drums, baskets, communal bins and waste depots. Plastic bins are mostly used at household levels in residential areas and are usually between 120-240 litres in volume. Communal bins (1.1m^3) made of galvanized metal, and waste depots (13m^3) on the other hand, are used where the generation rate is high such as markets, commercial roads, shopping malls and other similar public places. For instance, in some parts of Nigeria, dust bins (0.4m^3) and large bins (less than 1m^3) have been used for waste storage prior to collection²⁴ and the use of 120 litres and 240 litres plastic bins and 1.1m^3 metal bins is common in the nation's capital city, Abuja.²⁵

2.4 WASTE COLLECTION AND DISPOSAL SYSTEMS

The collection and disposal of solid wastes in developed and high income countries are well organized and almost total. This is because the systems are backed by strong regulatory framework to ensure occupational health and safety. The systems are also highly mechanized as much as possible, thus minimizing occupational health and injury risks. All wastes are required to be fully contained, either in a covered metal or plastic bin, or within a plastic bag. Occupational health and safety regulations limit the size and weight of each container or bag. Potentially infectious healthcare and other hazardous wastes are not normally discharged with municipal solid waste. Essentially all collected wastes go to safe sanitary landfills, composting, and materials recovery, or incineration facilities that are designed and operated to meet high environmental protection standards. In these countries, hazardous wastes are handled separately

from municipal solid waste, and subject to stringent rules. Landfill is still the primary method of disposal used by most high-income countries, because it is a relatively low cost method compared to other disposal options. Shortage of land licensed for waste disposal in some of these developed countries has compelled them to maximize the amount of waste recycling and composting possible, prior to landfill of those materials that are unsuitable for resource recovery. In 1998, landfill system of waste disposal in the USA accounted for 55.4% of the nation's municipal solid waste disposal (down from 83.2% in 1986). Incineration and materials recovery, and to a lesser extent composting, shared the remaining 44.6%.²⁶

With most developing and low-income countries, the experience is one of low level of refuse or solid waste collection service. Typically, only 30% to 60% of the municipal solid wastes are collected. Service levels in middle income countries are slightly higher, with 50% to 80% of the wastes collected. Because the uncollected wastes accumulate near homes and work areas, city dwellers and their domestic animals have much more direct contact with wastes than city dwellers in high-income countries. Periodic clearing of the wastes accumulated in open piles is accomplished with wheeled loaders and open trucks, which raise significant dust and bio-aerosol exposure levels. Municipal solid waste in developing countries is commonly collected through labor-intensive systems, sometimes using hand or animal drawn carts. The waste discharged for collection is generally seldom stored in a plastic or metal container, or covered with a lid. In few instances, unsuitably large oil drums are used. More typically, the waste is placed on the ground directly, thus requiring being shoveled by hand; or it is left in an open carton or basket to be picked up by hand. In either case, the waste awaiting collection is readily available to insect and rodent vectors and scavenging animals.

In these low and middle-income countries, probably less than 25% of collected wastes are deposited in controlled landfills, and probably less than 15% are deposited in modern sanitary

landfills. The rest is discharged to open dumps, most of which burn openly and have hazardously steep side slopes. In low-income countries in particular such as in Asia, nearly all of collected wastes are deposited within open dumps.²⁷ The cost and resources required to implement waste technologies are often regarded as too prohibitively high to be sustained. In most developing countries, hazardous waste facilities have not yet been implemented and these hazardous wastes are thus co-mingled for disposal with municipal solid wastes, despite laws to the contrary.²⁶

In Nigeria, sanitation law dates back to 1909, when the Environmental Sanitation Public Health Act was enacted. The Township Ordinance Act No. 29 of 1917²⁸ on sanitation and environmental management was also enacted, as a consequence of the poor sanitary conditions of most Nigerian towns at that time. These laws were only effective for a short period. With phenomenal population growth in major cities such as Lagos, solid waste disposal and general sanitation under these laws became grossly inadequate, to the extent that the situation led to the outbreak of Bubonic Plague in 1928. The 1928 Lagos Ordinance Act was then set up, followed by the Town and Country Planning Ordinance of 1946. Since then, several other sanitary laws have been passed in Nigeria, to improve the general sanitary conditions and management of solid waste in cities and towns, with limited success²⁹ The solid waste situation in developing low and middle-income countries highlighted earlier above, aptly apply to most cities in Nigeria.

In a study involving nine Nigeria cities spread over northern and southern parts of the country, different waste management problems and challenges were identified with each city, depending on its size, commercial nature and administrative role. In most of these cities, informal waste collection methods exist in parallel with official agencies. In most of these urban areas too, stationary containers system is adopted for waste collection, with the containers remaining at the point of waste generation, where residents deliver wastes as means of storage. This system is less expensive than house-to-house service, which is quite rare in most Nigerian cities. The different

types of vehicles commonly used for collection of the solid waste in the Nigerian cities include: i) compactor trucks, ii) side loaders, iii) rear loaders, iv) mini trucks, v) tippers, vi) skip trucks and vii) open back trucks.³⁰

2.5 PROPER AND ADEQUATE SOLID WASTE MANAGEMENT

The sole aim of solid waste management is to ensure environmental sanitation and public health protection. This is because solid wastes among others can cause health problems.

Sanitation in this sense is defined as the hygienic means of promoting health through prevention of human contact with the hazards of wastes, as well as the treatment and proper disposal of sewage wastewater. Environmental sanitation on the other hand is defined as the control of environmental factors that form links in disease transmission such as Solid Waste Management, water and wastewater treatment, industrial waste treatment and noise and pollution control. (Wikipedia).

The WHO also defines sanitation as generally referring to the provision of facilities and services for the safe disposal of solid waste and human urine and faeces, including the maintenance of hygienic conditions, through services such as garbage collection and wastewater disposal.

Proper and adequate solid waste management can therefore be defined as a system of solid waste management that meets the objectives of sanitation to protect public health as well as the environment.

In developed countries, there are laws guiding each of these stages of waste management. The nature and types of wastes are clearly defined as well as the methods of handling them in a proper and adequate manner. For instance, in defining regulations governing the handling, storage, collection and disposal of waste, town of Brookline, USA, domestic waste, comprising garbage and rubbish, and which is the largest proportion of solid waste generated by households, is clearly defined. Responsibilities of owners and occupants of residential houses are then

explicitly stated in respect of each of the stages of solid waste handling, to provide for proper and adequate management. These responsibilities partly include that generated wastes are properly stored in specified receptacles, which must be watertight, with tightfitting covers (or dumpsters in commercial premises). Both the receptacle and its cover are to be made of metal or other durable, rodent-proof material. Proper Container as defined above prevents scavenging, especially in countries where it is even prohibited. Secondly, the owner or occupant of any dwelling shall be responsible for providing enough receptacles for the storage of garbage and rubbish, as are sufficient to contain the accumulated waste, before final collection or ultimate disposal. This is to avoid spillage or overflow, or ensures that refuse is not deposited or cause to be thrown unto streets, parks or other public or private ways as litters. Additionally, the receptacles are also to be so located that no objectionable odours enter any dwelling and they must be easily accessible by collectors and their vehicles. Generally, the laws provide that it is the responsibility of residents to maintain their dwellings in clean and sanitary conditions, free of refuse. These include parcels of land, vacant or otherwise, since dumps cannot be arbitrarily established, but only by relevant authorities and Permits.

There are equally rules and regulations guiding the frequency of final collection or disposal of stored waste, including construction of storage facilities, such as fencing and screening, as approved by the Planning and Building Departments, and meeting the requirements of zoning by-laws. It is said that the frequency of collection or disposal shall be at sufficient frequent intervals to prevent a nuisance. In some countries, even domestic and commercial wastes placed for collection by relevant authorities or private collectors are subject to compliance with rules established by supervising agency.

There are also rules and regulations guiding mode of transportation of collected waste through the streets, or even the types of collection vehicles to be used, such that contents shall not spill,

leak, fall or be blown unto the street, or otherwise create a nuisance. The vehicles are often required to be fully enclosed unless the material is transported in watertight containers equipped with tight-fitting covers. There is often specific timing limiting hours of transporting refuse.

All types of wastes, such as trees and landscaping waste, construction waste, manufacturing or trade waste, incinerator wastes etc. each have specific rules and regulations guiding their storage, handling and final disposal. In countries where there is waste segregation at point of storage, these rules are better enforced and compliance better monitored.

In these organized societies, the authorities responsible for collection may refuse to collect any wastes if any of these rules are violated. Multiple violations may even lead to total termination of the provision of the municipal collection service to any dwelling or commercial establishments.

Facilities for proper final disposal of waste are also well classified to serve various categories and types of wastes in developed countries to ensure proper and adequate disposal. For instance, in Rules of Tennessee USA, Department of Environment and Conservation, Division of Solid Waste Management: Solid Waste Processing and Disposal, there are four classes of waste disposal facilities, depending on source and type of waste.

2.5.1 INTEGRATED SOLID WASTE MANAGEMENT

One of the approaches to proper and adequate management of solid waste to minimize its negative impacts is the Integrated Solid Waste Management (ISWM). The ISWM is a strategic initiative involving sustained and comprehensive waste prevention, recycling, composting, combustion and disposal programme. An effective ISWM should most effectively protect human health and the environment.^{31,32} The Waste Prevention (or Source Reduction) activity seeks to prevent waste generation through strategies involving the use of less packaging, designing longer lasting products, and reuse of products and materials. These steps ultimately lead to reduced disposal costs and the generation of methane. Recycling on the other hand involves collecting

reprocessing and recovering certain waste materials to make new materials or products, while composting entails the conversion of waste materials into soil additives. These two last steps generate many environmental and economic benefits. Disposal on its part is done through landfill and combustion to manage wastes that cannot be prevented or recycled.

Some cities around the world that have established the ISWM system include, the California Integrated Waste Management Board, the Waste Management Plan for the Dublin Region, ISWM Plan for Raichur Municipal Council, India, and the ISWM Plan for Guam Environmental Protection Agency (EPA). In Africa, there is the Integrated Waste Management Plan (IWMP) for Cape Town in South Africa.³²The ISWM is not commonly practiced in most developing countries. Some of the needs for and advantages of the ISWM include better management of the increasing quantities of waste being generated as a result of increasing growth in population and GDP; increased quantity and changing/varied quality and composition of wastes, as a result of changing lifestyles and consumption patterns; increased amounts of hazardous and toxic wastes resulting from industrialization and economic growth. Intrinsic business opportunities contained in ISWM through extraction of valuable resources and safe processing and disposal of wastes with minimal negative impact on the local environment; and multi-stakeholder involvement in every stage of the waste stream, also call for an integrated approach to waste management.³²

2.6 HEALTH AND ENVIRONMENTAL IMPLICATIONS OF SOLID WASTE

2.6.1 SOLID WASTES AND PUBLIC HEALTH

Generally, urban waste constitutes a big source of air, water and soil pollution. Combustion of fuel materials contained in solid wastes in residential areas is a stationary source of air pollution, while organic, inorganic and suspended solids in Municipal Solid Wastes can also constitute sources of water pollution. Municipal solid waste can have very negative effects on health,

depending on the route of entry: inhalation, absorption, ingestion. The resulting unsanitary conditions from the indiscriminate dumping of waste also constitute a serious hazard to human health. For instance, the contamination of surface water by refuse renders it unsafe for human usage and may also disrupt the whole ecological balance through the elimination of some living organisms while creating favourable habitat for others.

The large numbers of substances emitted by different methods of solid waste disposal have been found to cause various medical and health conditions, leading to great potential impact on human health, due to their persistence in the environment. These include gases such as methane, Carbon Dioxide, Hydrogen Sulphide, Mercury vapour and a mixture of volatile organic compounds, from landfill sites. Other pollutants in this category include Cardium, Mercury, Arsenic, Chromium, Nickel, Sulphur Dioxide etc.³³

Results from large US cohort studies suggest that long term exposure to these substances have chronic health effects such as increased rates of Bronchitis and decreased lung functions, shortened life span, elevated rates of respiratory symptoms, lung cancers and other carcinogenic and non-carcinogenic health effects³⁴. Raised incidence of low birth weights and other reproductive disorders in deliveries among women resident close to landfill sites have been documented, and so has the occurrence of various congenital malformations.³⁵ Increased incidences of general morbidity and mortality (particularly cardiovascular and respiratory), and emergency hospital admissions, among community residents around incinerators and incinerator workers have also been documented.^{16, 36}

Microbial pathogens also constitute a potential source of health hazards, commonly associated with composting (and sewage treatment) methods of waste disposal, but may also be found in landfill. Vector-related diseases, especially at disposal sites are common and remain an important

public health threat throughout developing countries. The organic waste material provides good breeding sites for insects and rodents of varied species. Rodents also breed and feed in uncontrolled solid waste at open dump sites, while flies and rats are commonly seen in disposal sites. Higher risk and incidence levels of disease, especially respiratory, gastrointestinal, skin and musculoskeletal problems, accidents and injuries, and even death are associated with solid waste handling and disposal.³⁷ including among scavengers. The most common injury experienced by dumpsite waste pickers and waste recyclers is puncture wound. These risks are higher in waste collection workers and pickers in developing countries, because they routinely touch the waste they collect with their bare hands, unprotected, as against similar workers in high income countries, who routinely wear gloves and other Personal Protective Equipment (PPE) to handle the waste and dirty containers, thus seldom coming in direct contact with waste.

Even abandoned dump sites are not spared of this phenomenon. In Olinda, Brazil, 263 out of 270 squatters on a site previously used as a dump had intestinal parasites infestation. 150 of these had mixed infestation with three different types of parasites, while 93 had two types. The most common infestation was with *Ascarislumbricoides*. Diarrhoea is still one of the leading causes of death among children in most developing countries.³⁸ Diarrhoeal diseases are the most often encountered health consequence of contaminated water supply.³⁹

All the health issues reported from high-income countries are directly applicable to developing countries, but risk levels can be multiplied in the latter because protective measures are seldom implemented in poorer countries. The handling of wastes involves more manual contact too. Diseases such as Tuberculosis, Bronchitis, Asthma, Pneumonia, Dysentery, Parasitic infections, and malnutrition are the most commonly experienced among waste pickers in developing countries, thus making the job a high risk one,³⁵ as found in health studies conducted among

waste pickers in Bangalore, Manohar, and New Delhi in India³⁵ and in Metro Manila's main open dump.³⁹

For children in particular living around solid waste dumpsites, studies suggest that they are vulnerable to various health risks, some of which could easily disrupt development of their organs, especially nervous, immune, endocrine and reproductive systems.⁴⁰

Finally, cancer could be caused by a wide range of constituents released from solid waste into the air, water, or food chain. Volatile organic, heavy metals, and certain organic gases each have the potential to induce cancer.⁴¹ A study of cancer incidence among women living near one of the largest Municipal Solid Waste landfill in Quebec province, Canada in North America showed that rates of stomach and cervix uteri cancers were increased.⁴²

2.6.2 ENVIRONMENTAL IMPACT OF SOLID WASTE

Numerous negative environmental impacts are associated with improper solid waste management and compound the significant risks and problems to public health. The indiscriminate disposal of solid wastes in open dumps, along roads, or in vacant lots is one of the most noxious forms of land and water pollution. Global warming and depletion of the Ozone layer are said to be some of the effects of solid waste on the environment.⁴³

The problem of pollution from solid wastes can take several forms; gross or surface pollution, and pollution of subsoil, water and air. In reviewing these problems, it was found out that they were especially important in the fringe areas of many of the metropolitan areas of the Eastern and Western Pacific regions, Africa and Latin America, because of shortage of basic sanitary facilities.⁴⁴ In spite of efforts at environmental hazard control from indiscriminate waste disposal, pervading odour due to contamination of rotten organic component and faecal matter at

dumpsite is still a norm in most tropical cities of Africa.⁴⁵ The situation also creates an aesthetic eyesore.

2.6.2.1 SOLID WASTES AND LAND POLLUTION

The report of a World Health Organization Expert Committee (WHO, ERC (1965) Technical Report series on “Environmental health aspects of metropolitan planning and development”⁴⁴ states that the disposal of solid wastes (garbage and rubbish) is an expensive problem and of considerable public health significance. With increases in the volume and variety of solid waste in modern world as a result of development, inappropriate storage and handling causes the waste to harbour rodents and create a breeding place for flies. In addition, they are unsightly and a source of odour. While proper collection and disposal of refuse may cost as much as \$10 (U.S.) per capita per year, mishandling can be far costlier. The sum total of the attendant medical bills, fire and rodent damage, losses from air and water pollution, and the cost of makeshift use of insect sprays, traps, poisons, and exterminator fees, all of which can be staggering, is responsible for this extra cost.

2.6.2.2 SOLID WASTE AND WATER CONTAMINATION

The contaminated liquid called leachate that results from rain water that runs over solid waste infiltrating through waste extracts and dissolving suspended constituents, is a common cause of diarrhoeal diseases. These are the most often encountered health consequences of contaminated water supply and are still leading causes of death among children in most developing countries. In Conakry, Guinea in the 1990s, diarrhoea occurred largely in settlements within the immediate

vicinity of the city's solid waste dump site and it was believed to be associated with faecal contamination of the water supply by the leachate from the dump.³⁶

Like in most cities of developing countries, solid waste management in Nigeria is characterized by inefficient collection methods, insufficient coverage of the collection system (or even total lack of collection, especially in rural areas) and improper disposal. Because of lack of access to refuse collection services in rural areas, people dump waste at any vacant plot, public space and river. Most commonly, the waste is burnt in the backyard, thereby polluting the air. Even where there is collection service, generation of waste far exceeds collection capacity.¹⁶ Studies have shown that one to two thirds of solid waste generated in developing countries (including Nigeria), is not collected.⁴⁶

2.7 KNOWLEDGE, ATTITUDE AND PRACTICES OF SOLID WASTEMANAGEMENT

In developing countries, the management of refuse has become a problem because environmental laws are not well implemented, thus making the risk of unhealthy disposal of refuse one of the important problems in many societies. Knowledge, attitude and practices are therefore important factors in addressing issues related to management of refuse and quality living.⁴⁷ Several studies in the last two decades on correlation between socio-demographic variables and environmental perception have helped in understanding people's views and thinking about the environment, predicting environmental awareness and attitudes based on their socio-economic variables.⁴⁸ In a study surveying knowledge, attitudes and practices associated with waste management in Jos South metropolis, Plateau State of Nigeria, respondents with higher level of education were found to possess corrected level of knowledge of the impact of improper waste management on health than those with lower level of education.⁴⁹ The same study showed that higher age groups

exhibit more positive waste management practices, but not on attitudes. Level of education was said to have statistical significant influence on knowledge and practices of waste management. This corroborates a paper on socio-demographic and socio-psychological predictors of environmentalism, which reported that age, education and gender have shown strong and consistent relationships with environmentalism.⁵⁰ Another paper⁵¹ reported that environmental concerns among residents of Gaborone, Botswana, vary according to education and income levels, while age and gender do not seem to have any significant influence on the concerned variation. However, a study on knowledge, attitude and practice on waste management of people living in an university environment, South West, Nigeria,⁴⁷ showed that though respondents (majority of whom had tertiary education), had knowledge on refuse management, this was not adequate. Attitudes and practices among them were also not appropriate.

Issues relating to waste management services, its patronage and cost recovery methods have also shown that willingness to pay for waste management services is higher among the middle and high income socio-economic groups, with patronage shared among formal and informal operating service providers.⁵²

2.8 FACTORS MILITATING AGAINST PROPER SOLID WASTE MANAGEMENT IN NIGERIA

The poor state of solid waste management in cities in developing countries is fast assuming the scale of major social and environmental challenges. Three of the eight Millennium Development Goals have waste or resource efficiency implications to further highlight the gravity of this problem. While many developed countries have embarked upon robust environmental reforms, recording remarkable advances in best practices and sustainable management of their Municipal Solid Waste, the same cannot be said of most countries in Sub-Sahara Africa. This is as a result

of several factors/barriers militating against sustainable Municipal Solid Waste Management.⁵³ Some of the major issues responsible for waste problem in Nigeria for instance, are poverty, high population and urban growth rates, as well as weak and underfunded infrastructure. According to the Nigerian Federal Ministry of Environment, solid waste management remains one of the most daunting environmental challenges facing the country today, and it has continually remained at its lowest ebb, despite huge investments in many cities and towns.

On the local front, environmental management has also been identified as one of the major problems confronting the Federal Capital Territory. Measures put in place to ensure a clean, healthy and aesthetic environment in the FCT has not yielded desired result. Even with the AEPB in place, waste management is still a big challenge. Lack of modern waste management equipment, inadequate funding, nonchalant attitude of residents, faster generation of wastes than they are collected, transported and disposed of, are all among major factors militating against the success of the Board.⁵⁴

CHAPTER THREE

METHODOLOGY

3.1 BACKGROUND OF THE STUDY AREA

Abuja, Nigeria's new Capital City, was established as part of the new Federal Capital Territory (FCT) and created by Decree number 6 of 1976, to overcome the numerous challenges that had made Lagos very expensive and a nightmare in terms of population, administration, traffic, expansion, infrastructure development and other urbanization issues. Abuja finally became the nation's capital and seat of government on December 12, 1991. It is a purpose-built, planned city.

The territory was carved out of former Nasarawa, Niger and Kogi States. Abuja is located in the middle of the country, falling within latitude 7° 25' north and 9° 20' north of the equator and longitude 5° 45' and 7° 39'. It has a land area of 8,000 square kilometers, which is two and half times the size of Lagos. It is bounded on the north by Kaduna State, on the west by Niger State, on the East and South-East by Nasarawa State, and on the South-West by Kogi State respectively. This thus geographically places Abuja in the centre of Nigeria. Out of the 8,000 square kilometers land area of the Federal Capital Territory, the capital city covers an area of about 250 square kilometers.

Administratively, the Federal Capital Territory is structured into six Area Councils, which are equivalents of Local Government Areas (LGAs) in the States. It is essentially a civil service city with lots of social amenities, private and public hospitals, including 2 tertiary health institutions. The natives of FCT are predominantly farmers.²³

The FCT experiences three weather conditions annually, with a warm, humid rainy season, which begins from April and ends in October, and a blistering dry season, when temperatures can soar as high as 40°C. In between these two conditions, there is a brief interlude of harmattan, occasioned by the northeast trade wind, with the main feature of dust haze, intensified coldness and dryness. The high altitudes and the undulating terrain of the territory act as a moderating influence on its weather.

With a projected population of 1,446,671 as at 2013 (projected from 2006 Census figure of 776,298 at an annual growth rate of 9.3%), the choice of the site of Abuja, and indeed the entire FCT, is deliberate and strategic, taking particular cognizance of its central location, easy accessibility, pleasant climate, relatively low population density and availability of land for future expansion.

The Abuja Municipal Area Council (AMAC) is one of the Area Councils and indeed the Capital City. Bounded on the East by Nasarawa State, on the West by the Kuje Area Council, on the North by the Gwagwalada and Bwari Area Councils, the AMAC occupies a land mass of 1,200Km² (Appendix 6). It comprises of the City Centre, the Wuse, Gwarinpa, Garki, Kabusa, Jiwa, Gwagwa and Gui Districts. The Karshi Development Area of the AMAC on its part is made up of Karu, Nyanya, Orozo and Karshi Districts. Along the airport road are clusters of satellite settlements, including Lugbe, Chika, Kuchigworo and Pyakassa. Other satellite settlements are Idu (the main industrial zone), Mpape, Karimu and Dei-Dei (which houses the International Livestock market and the International building materials market).^{55, 56, 57} Each of the Districts is further structured into the wards and settlements as depicted in the table in Appendix 7.⁵⁸

These structures are also used by other organizations such as the Abuja Environmental Protection Board (AEPB) to administer its own activities, including Municipal Solid Waste Management.

The AMAC is majorly a Civil Service city, with trading, social services and agriculture to support residents. Administratively, the AMAC Executive Council is headed by a Chairman, supported by a Vice Chairman, a Council Secretary, Council Treasurer and five Supervisory Councillors, one each for Health, Education and Social Development, Agriculture and Natural Resources, Works and then Special Duties. It has a 12-member Legislative Council, one each representing each of the Districts. The Legislative Council is headed by the Honourable Speaker and supported by other principal officers and Chairmen of eight Committees. The Council is also structured into nine Departments, each of which is headed by a Departmental Head.⁵⁵ From the traditional perspective, there are six recognized villages, including:

- ❖ Karshi
- ❖ Karu
- ❖ Jiwa
- ❖ Garki
- ❖ Gwagwa; and
- ❖ Nyanya

Each of these villages is headed by an appointed Traditional Ruler for cultural and grassroot administrative convenience. It is also pertinent to state that the AMAC has a total of fourteen markets, some of which operate on daily basis and others only on specific weekdays.⁵⁸

The Abuja Environmental Protection Board (AEPB) is the authority solely responsible for solid waste management in the entire FCT, including the AMAC, either directly, or through its appointed agents, depending on the district involved.

It is equally important to note that there are presently two solid waste dumpsites in Abuja Municipal Area Council (AMAC), one each located in Goza area of the Gui District around the Idu Industrial layout and Kugbo in the Nyanya District respectively. A third one located in the Mpape area of Wuse District was shut down in 2007 due to overflow.

3.2 STUDY DESIGN

This was a cross-sectional descriptive community-based study conducted in Wuse and Nyanya districts of the Abuja Municipal Area Council of the Federal Capital Territory of Nigeria.

3.3 STUDY POPULATION

The Study population consisted of all eligible Heads of Households as respondents, irrespective of sex/gender or educational status.

Inclusion Criteria:

- i) All Households in the two study districts;
- ii) All Heads of Households who agreed and consented to participate in the study;
- iii) All persons who were above the age of 20 years as at the time of the study.

Exclusion Criteria:

- i) All Households outside the study districts;
- ii) All Heads of Households who declined or refused to participate in the study;
- iii) All persons that were below the 20 years of age as at the time of the survey.

3.4 SAMPLING TECHNIQUE

Multistage sampling technique was adopted for the study, starting with purposive selection of the AMAC as the study area in Stage I.

Stage II of the sampling was the stratification of the AMAC into Non-slum AMAC districts and Slum AMAC districts. Using Simple Random Sampling (SRS) by balloting, one Non-slum district, (Wuse district), and one Slum district, (Nyanya District), were selected as the study areas.

In stage III, comprehensive structured lists of all the respective wards of the two selected study districts (Appendix 8), were obtained. Three wards were then selected from each of the two districts, using simple random sampling, by balloting.

Stage IV entailed the numbering of the houses in each of the selected wards, and then lists of all eligible Household Heads obtained to form the sampling frame. Systematic sampling technique was used to select eligible respondents/households (HHS) to participate in the study, until the required sampling size was obtained. From the house of each Ward Head as starting point, a bottle was spinned and using the direction of the mouth of the bottle, alternate households to the right side were selected.

Where there were more than one eligible Household Head, only one was randomly recruited into the study. Proportionate allocation to each of the wards was made according to size of the population, in order to distribute the sample size.

3.5 SAMPLE SIZE DETERMINATION

With the population sizes of the two selected study Districts (2006 Population Census), and taking into consideration previous studies on problems of solid waste management in the FCT,¹⁰ it was decided to

take 0.5 as the maximum variability, as it was found that 50% of households in Abuja have good Solid Waste Management or disposal methods.

Using the formula:

$$\left\{ n = \frac{z^2 pq}{d^2} \right\}^{75}$$

where, n = sample size

p = proportion of houses with good solid waste disposal method = 0.5¹⁰

q = proportion of houses without good solid waste disposal method = 0.5

z = value of standard normal deviate at 95% Confidence Interval level = 1.96

d = degree of precision = 0.05

Therefore, n = [(1.96)² x 0.5 x 0.5/(0.05)²]

$$= [3.8416 \times 0.25/0.0025]$$

$$= [0.9604/0.0025]$$

$$= 384.16$$

The sample size (n) was therefore approximated to 400 households, which were used for the study.

3.6 DATA COLLECTION TOOLS

The major instruments for data collection were the Structured Interviewer Administered Questionnaire and In-Depth Interview Guides (Appendices 1, 2 and 3). The Structured Interviewer Administered Questionnaire was for the quantitative aspect of the study on the subject matter. As the tool used to

collect data from the Four Hundred (400) Heads of households as respondents, the questionnaire consists of various sections seeking information on: socio-demographic profile of respondents; source, composition and volume of waste generated; types and mode of solid waste storage; refuse collection, transportation and disposal methods; location, distance and types of dumpsites; general and health problems associated with various methods of waste disposal in use; knowledge, awareness and attitudes of respondents on solid waste management.

The In-Depth Interview (IDI) Guides were for the collection of qualitative data from the Abuja Environmental Protection Board (AEPB) management staff and its contractor agents, through direct questions that complemented the quantitative data obtained from the study population. The Guide for the AEPB management staff sought information on the legislative instruments empowering the Board, its operational strategies, organizational structure, funding mechanisms, staffing and equipment. The Guide for the contractors on the other hand, sought information on the partnership arrangement, Terms of Reference (TOR) for the contractors and areas of contractual coverage.

The tools were pre-tested in another community, entirely different from the study communities, to check for ambiguity and ease of administration.

3.7 DATA COLLECTION TECHNIQUES

The Structured Interviewer Administered questionnaires were administered by the researcher with the help of ten (10) Research Assistants (RAs), over a period of four weeks, from 20th April to 18th May 2013. They were responsible for direct contact with the Heads of Households. They filled in the questionnaires in one-on-one interview sessions with the respondents, ensuring proper understanding of information required from the respondents. The IDI Guides were also administered through direct

interview sessions with relevant AEPB officers and Solid Waste Management contractors respectively during the same period. The RAs are people with background experience in data collection in research and were given a 3-day intensive training to familiarize them with the survey techniques (questionnaires administration, clarifying grey areas, standardization etc.) through mock practice/exercises.

3.8 DATA ANALYSIS

Data collected were entered, validated and analyzed using Statistical Package for Social Sciences (SPSS) software version 20.0. For the descriptive aspect of the analysis, frequency distributions were generated for all categorical variables. Means, Standard Deviations and other descriptive measures were determined for quantitative variables. Chi square test was applied for the comparison of proportions and for evaluating associations of categorical variables in contingency tables. Statistical significance was said to be achieved where P-value is less than 0.05.

The qualitative data was content analyzed. There was triangulation of both quantitative and qualitative data. The IDI Guide guided the development of, and complimented quantitative methods of data collection. The IDI were summarized into key thematic areas, with the objectives of the study for analysis.

3.9 ETHICAL CONSIDERATIONS

Permission was sought and obtained from the Department of Community Medicine, ABU Zaria for the study to be carried out. Letters of introduction were also obtained from the Department to all relevant stakeholders and authorities, including the Abuja Municipal Area Council (AMAC) and the Abuja Environmental Protection Board (AEPB). The various Community Leaders were engaged one-on-one for advocacy. These facilitated necessary permission and cooperation for the study. Informed consent of

respondents (Heads of Households (HHs) was also sought and the confidentiality of information provided was assured.

3.10 LIMITATIONS TO THE STUDY

One of the major limitations encountered in this study was the absence of the Heads of Households from their houses as at the time visits were scheduled. This meant that repeat visits had to be paid to some of the houses to enable the administration of the questionnaires on the Heads directly. However, where Heads of Households were still absent at repeat visits, telephone calls were made in advance of a third visit to secure direct contact. Where this still failed, the household was skipped for the next house.

Secondly, there was initial reluctance on the part of some of the respondents to divulge some information, which they considered too personal. These included their levels of education, income, and some diseases affecting members of their households. However, after being educated on the nature and importance of the research most of them became comfortable in providing needed information.

Thirdly, preparedness to participate in the survey at all was sometimes limited by fear of the use to which the survey may be put. Again, this was addressed by properly educating the respondents on the importance of the research. On the whole, extra concerted efforts were made to overcome these limitations and others that were encountered in the course of the survey. These efforts were to ensure reliability and validity of the data collected during the survey.

CHAPTER FOUR

RESULTS

4.1 PREAMBLE

The outcome and results of the data collected from the field through the Structured Interviewer Administered Questionnaire, and the oral interviews conducted through the In-Depth Interview (IDI) instrument for the collection of qualitative data from the Abuja Environmental Protection Board (AEPB), as well as the private solid waste management contractors, are hereby presented and appropriately analyzed.

Out of the four hundred questionnaires distributed in the two study districts, a total of three hundred and ninety four (394) were successfully completed and duly retrieved from the respondents, giving a response rate of 98.5%.

Table 4.1: Socio-Demographic distribution of respondents by Study Areas

	NYANYA DISTRICT		WUSE DISTRICT		GRAND TOTAL		n	
	n = 196		n = 198		= 394			
AGE GROUP Yrs.					TOTAL	%		
20-29	22		5		27	6.85		
30-39	70		40		110	27.92		
40-49	82		85		167	42.39		
50-59	16		52		68	17.25		
60-69	6		14		20	5.08		
70+	0		2		2	0.51		
OCCUPATION								
	FREQUENCY		%		FREQUENCY		%	
Civil Servant	106	26.9	134	34.0	240	60.9		
Private Professional	20	5.1	18	4.6	38	9.7		
Coy Executive	2	0.5	8	2.0	10	2.5		
Businessman	14	3.6	21	5.3	35	8.9		
Trader	32	8.1	9	2.3	41	10.4		
Farmer	8	2.0	0	0	8	2.0		
Artisan	10	2.6	0	0	10	2.6		
Retirees	4	1.0	8	2.0	12	3.0		
FAMILY SIZE								
2-4	76	19.3	68	17.2	144	36.5		
5-7	108	27.4	126	32.0	234	59.4		
8-10	12	3.1	4	1.0	16	4.1		

ABOVE 10	0	0	0	0	0	0
EDUCATIONAL STATUS						
Secondary Cert.	25	6.3	0	0	25	6.3
Diploma/'A Level	96	24.4	12	3.0	108	27.4
HND/Univ. Degree	75	19.0	186	47.3	261	66.3
MONTHLY INCOME						
< 18,000	4	1.0	0	0	4	1.0
18,000 – 50,000	10	2.5	0	0	10	2.5
51,000– 100,000	26	6.6	0	0	26	6.6
101,000 – 250,000	104	26.4	42	10.7	146	37.1
>250,000	46	11.7	153	38.8	199	50.5
No idea	6	1.5	3	0.8	9	2.3

Most of respondents in both districts (42.2%) were in the age range of 40-49 years and majority of HH heads (93.9%) were males. Over 94% of the respondents fall between 20 to 60 years of age, conforming to the active workforce of the population of the Federal Capital Territory.

Majority of respondents (60.9%) were Civil Servants, in terms of occupation

Majority (93.7%) of the respondents had formal education above secondary level, with 66.3% having at least a first degree or a Higher National Diploma.

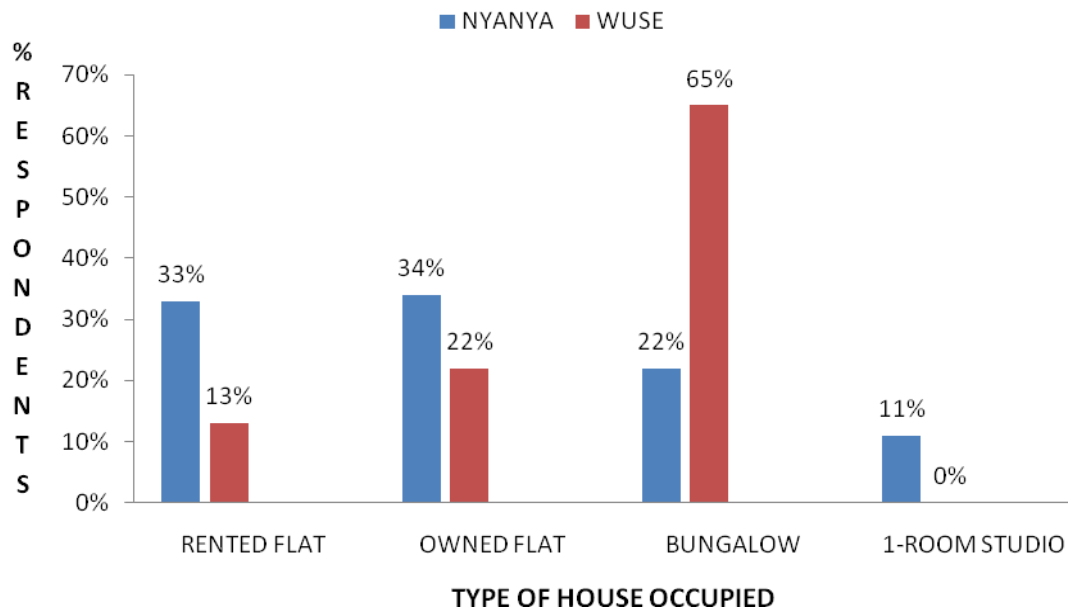


Figure 1: Bar Chart showing types of houses occupied by respondents

Bungalow types of houses are the commonest residences among respondents, particularly in Wuse district, while flats are commoner in Nyanya district.

Table 4.2: Knowledge on solid waste management amongst respondents

KNOWLEDGE ON SOLID WASTE	NYANYA DISTRICT_n = 196		WUSE DISTRICT_n = 198		TOTAL_n = 394	
	FREQ.	%	FREQ.	%	FREQ.	%
Define Solid Waste correctly	84	21.32	148	37.56	232	58.88
Mention 3 correct Solid Waste storage methods	180	45.69	198	50.25	378	95.94
Mention at least 3 correct means of waste collection	140	35.53	198	50.25	338	85.79
HANDLING METHODS – Methods used in handling stored waste						
Use of Refuse Bins	178	45.18	198	50.25	376	95.43
Dumpsite around the House	46	11.68	0	0	46	11.68
Moving to Distant Dumpsites	88	22.34	6	1.52	94	23.86
Burial Around the House	24	6.91	0	0	24	6.91
FINAL DISPOSAL METHODS – Opinion on final disposal method of waste disposal						
Allow to Decay into Manure	36	9.14	0	0	36	9.14
Burning Around the House	104	26.40	0	0	104	26.40
AEPB to Collect and Dispose	189	47.97	198	50.25	387	98.22
To be Cleared by those Nearby	60	15.23	0	0	60	15.23

Knowledge about solid waste management appears generally good amongst respondents, with as many as 86% to 96% being aware of proper storage and disposal methods. However, knowledge about what constitutes solid waste was relatively low (58.88%).

Opinion about handling and final disposal methods seem to be guided by prevailing practices in each of the two study districts, with all respondents in Wuse district more disposed to proper methods.

Table 4.3: Respondents’ perceived health hazards of improper solid waste management.

HEALTH HAZARD	NYANYA	WUSE	TOTAL
	n = 196	n = 198	n = 394
	%	%	%
Accident/Injuries	23	38	61
Malaria	43	48	91
Typhoid Fever	40	49	89
Cholera	46	50	96
Respiratory Diseases	32	49	81
Worm Infestation	32	50	82
Water Pollution	47	50	97
Rodents/Flies Menace	45	49	94
Skin Diseases	26	38	64
Cancers	18	28	46
Eye Diseases	12	23	35
Reproductive Diseases	8	27	35
Musculoskeletal Problems	6	21	27

All the 394 (100%) believe that improper solid waste management constitutes one form of health hazard or the other. However, majority (over 75%) believed that it can result in either Malaria, and/or Typhoid, Cholera, Respiratory diseases, Diarroedal diseases, Water pollution, menace of rodents/flies.

Table 4.4: Frequency distribution on types and sources of wastes generated in Households

TYPE OF REFUSE	NYANYA DISTRICT		WUSE DISTRICT		TOTAL	
	n = 196		n = 198		n = 394	
	FREQ.	%	FREQ.	%	FREQ.	%
Garbage	174	44.2	182	46.2	356	90.4
Combustible Rubbish	96	24.4	122	31.0	218	55.3
Non-Combustible Rubbish	104	26.4	126	32.0	230	58.4
Ashes And Dust	84	21.3	18	9.6	102	25.9
SOURCE OF REFUSE						
Vegetation	42	10.7	86	21.8	128	32.5
Building Debris	28	7.1	64	16.2	92	23.4
Various Combinations	189	48.0	194	49.2	383	97.2

Garbage is the single largest (90.4%) form of refuse generated by most of the households.

Almost all the households (97.2%) generate various combinations of types of refuse from different sources.

Table 4.5: Means of storage of solid waste at point of generation

STORAGE RECEPTACLES		NYANYA DISTRICT		WUSE DISTRICT		TOTAL	
		n = 196		n = 198		n = 394	
		FREQ.	%	FREQ.	%	FREQ.	%
AVAILABILITY OF REFUSE BIN							
Refuse Bin Available	YES	112	28.4	198	50.3	310	78.7
	NO	84	21.3	0	0	84	21.3
BIN WITH COVER							
Refuse Bin With Cover	YES	78	69.6	192	97.0	270	87.1
	NO	34	30.4	6	3.0	40	12.9
TYPES OF REFUSE BINS							
Plastic 120litres		58	18.7	145	46.8	203	65.5
Plastic 240litres		28	9.0	43	13.9	71	22.9
Metal Communal Bin 1.1m ³		12	3.9	6	1.9	18	5.8
Waste Depots 1.3m ³		4	1.3	0	0	4	1.3
Dust Bins 0.4m ³		8	2.6	4	1.3	12	3.9
Large Bins > 1m ³		2	0.7	0	0	2	0.7

Majority (78.7%) of the households had refuse bins for storage of generated refuse and most (87.1%) of the refuse bins in the 2 districts had covers.

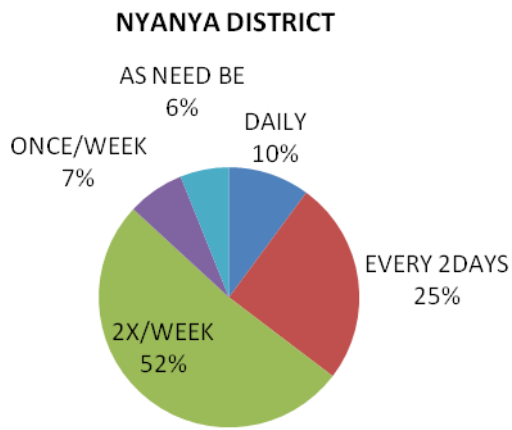


FIG. 2A

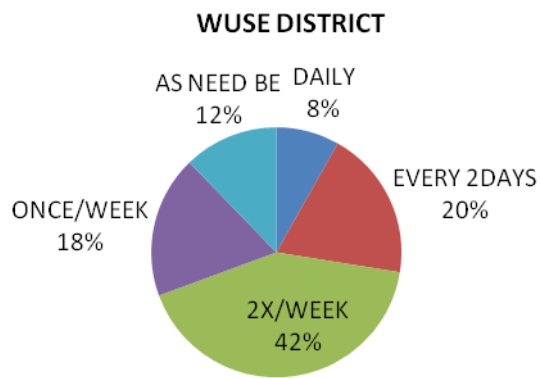


FIG. 2B

Figure 2A and 2B: Frequency of refuse collection among households by Study Districts

Most households (42-52%) have stored refuse collected at least twice a week in both study districts

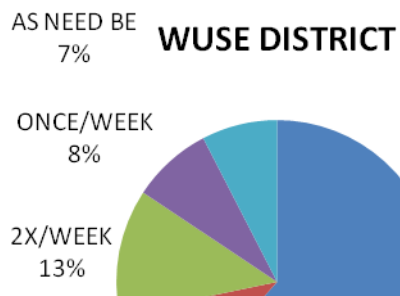
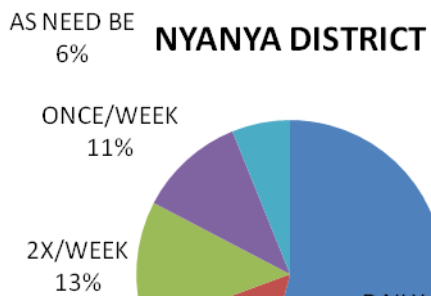


FIG. 3A

FIG. 3B

Figure 3A and 3B: Frequency of cleaning surroundings by Households in the two Study

Districts As many as at least 54.1% of respondents clean their surroundings daily in each of the study districts.

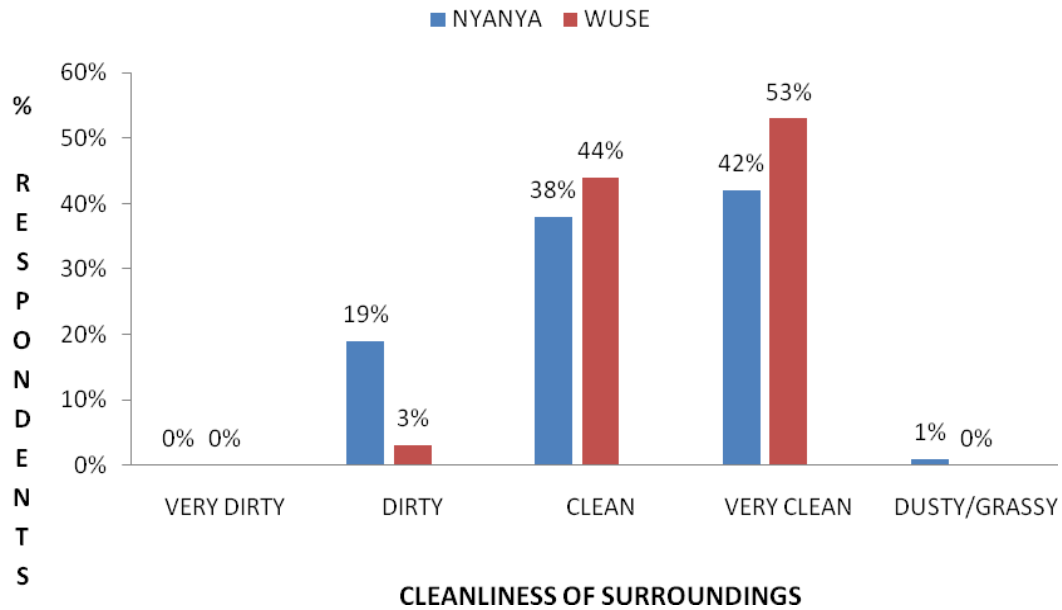


Figure 4: Opinion of respondents on level of cleanliness of their surroundings

Majority of respondents (42 - 53%) in both Study Areas believed that their surrounding is very clean.

19% of respondents who live in Nyanya Study Area are of the opinion that their surrounding is dirty.

Table 4.6: Persons responsible for cleaning of surroundings of Households

PERSONS RESPONSIBLE FOR CLEANING SURROUNDINGS	NYANYA DISTRICT		WUSE DISTRICT		TOTAL	
	n = 196		n = 198		n = 394	
	FREQ.	%	FREQ.	%	FREQ.	%
Group Of Women	16	4.1	6	1.5	22	5.6
Children Or Servants	76	19.3	122	31.0	198	50.3
Rotation Among Households	30	7.6	12	3.0	42	10.6
Group Of Men	5	1.3	0	0.0	5	1.3
Paid Cleaners	34	8.6	36	9.1	70	17.7
Cleaning By Self	15	3.8	4	1.0	19	4.8
No Formal Arrangement	20	5.1	18	4.6	38	9.7
TOTAL	196	49.8	198	50.2	394	100.0

Most of the respondents (50.3%) engage children or househelps to clean the surroundings of the house.

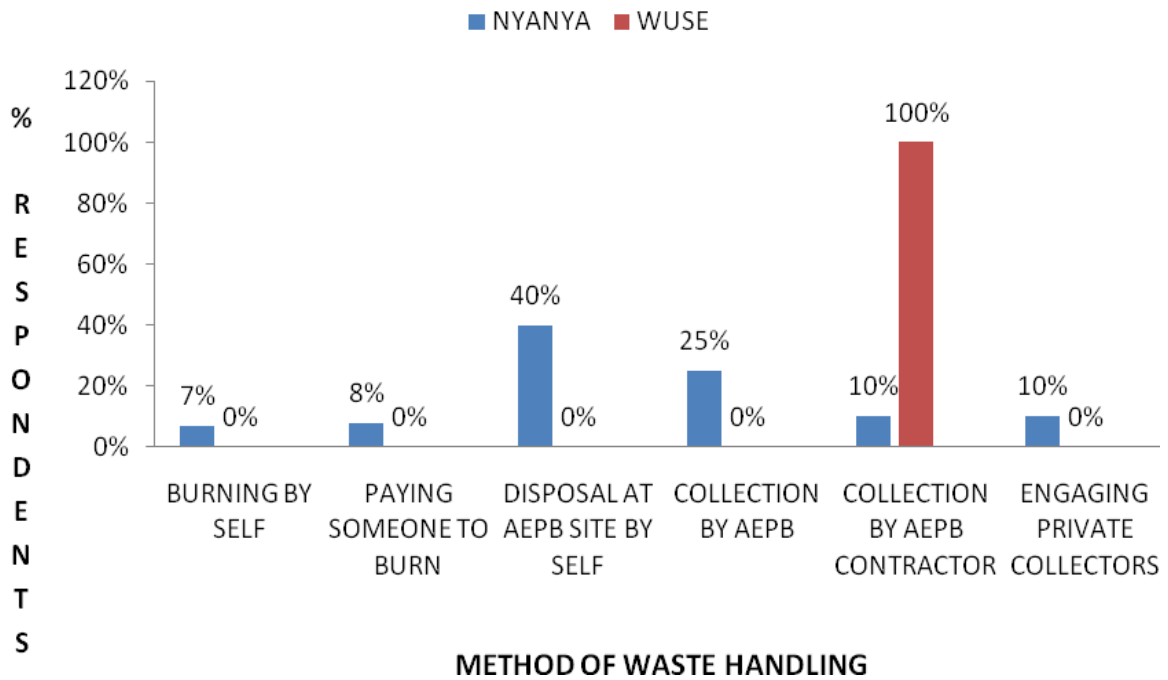


Figure 5: Methods of handling wastes from point of storage

All (100%) of the respondents in Wuse Study Area have their refuse collected by appointed AEPB contractors.

As many as 15.0% of respondents in Nyanya Study Area burn their refuse, either by self or by paid agents.

Table 4.7: RESULTS OF IN-DEPTH INTERVIEW (IDI) WITH MANAGEMENT STAFF OF THE AEPB AND WASTE COLLECTION CONTRACTORS

1. Strategies adopted for carrying out responsibilities

Most of the respondents enumerated proper schedules of duties, the P-P-P initiative, regular Monitoring and Evaluation and Supportive Supervision as the main strategies for carrying out the Board’s responsibilities.

2. Designated spots/locations for collection of refuse heaps and Dumpsites in AMAC

All the respondents who are staff of the Solid Waste Management Department of the AEPB, are aware of the specific sites/locations for waste dumps in AMAC. They listed four temporary dumpsites in Nyanya, one each in Jabi, Garki and Lugbe, and the two functional permanent dumpsites in Goza and Ajata, and the Mpape Transfer Station

3. Frequency of evacuating designated refuse dumps

Over half (60%) of the respondents confess that evacuation of designated refuse dumps is irregularly carried out. However, the contractors say they collect refuse from residences at two days intervals to avoid overflow and spillage

4. Final solid waste disposal methods

Majority of the respondents say that Landfill is the final waste disposal method, while few others say open dumping is common

5. Staff Strength and Disposition of the AEPB and contractors

A comprehensive manpower disposition of the AEPB was provided. The AEPB defines the minimum number and cadre of staff to be engaged by each contractor

6. List of equipment and other material resources

The list of available equipment and other working tools, with their states of functionality provided is presented below. The AEPB determines the minimum types and number of equipment to be acquired by its contractors for their operations..

IDI Guide Equipment and gadgets owned by the AEPB and their states of functionality

S/NO,	EQUIPMENT/MATERIALS	QUANTITY	FUNCTIONAL	UNDER REPAIR
1.	Compacting Truck	3	1	2
2.	Side loader	2	0	2
3.	Tipper	4	3	1
4.	Pail loader	2	1	1
5.	Bull dozer	2	1	1
6.	Roll-on Roll-off	2	1	1

The list shows that most of the equipment are not in proper working condition and hence not in use. This obviously will hamper the activities of the Board. Respondents say that more modern solid waste management equipment and vehicles are needed

7. Approved Annual Budget for the AEPB in 2010, 2011 and 2012

The Board had the annual budgetary appropriations for its operations for the last three years as follows: 2010 – N2.7 Billion; 2011 – N1.935Billion; 2012 – N1.365Billion. This shows a dwindling trend. The bulk (over 70%) of the money appropriated each year for the AEPB is spent by the Solid Waste Management Department. Indeed, the budget is articulated by SWM Department for the Board and marked up to provide for other Departments.

Percentage of the appropriated sums for the three years released and actually cash-backed ranged from 100% in 2010, 71.66% in 2011 and 50.55% in 2012.

All the respondents insisted that the amount provided for SWM has never been adequate

8. Estimates considered enough for proper SWM yearly in the FCT

The respondents believe that the annual budgetary provision for SWM needs to be increased by 75% - 100% for proper SWM. The dwindling trend in budgetary appropriation is said to be inimical to proper SWM.

9. Payment of fees-for-services rendered by the AEPB, efficiency and effectiveness in its collection

All the respondents are aware of fee-for-service scheme being operated in the whole of the Central Business District, including Wuse district, and on pilot basis in some parts of Nyanya district. Fees charged depend on the type of facility in use and its location.

About three quarters of the respondents feel that the fees collection system is ineffective and grossly inefficient, with leakages and corrupt practices. Contractors do not charge fees directly.

None of the respondents is able to say what percentage of the SWM services is covered by the Fee-for-Service

10. Creation of regular environmental education and awareness on SWM to residents by the AEPB

All the respondents, including contractors, admit that the Board does not create any environmental education and awareness on SWM for residents No education materials are therefore available.

11. Respect for rules and regulations of SWM by residents of the FCT

Less than half of respondents think that residents obey SWM rules and regulations. They believe that 'I don't care' attitude; poor knowledge and awareness on environment; lack of sensitization and education by the AEPB are responsible for this situation. The contractors say they have very cordial relationship with residents within their areas of operations and that the compliance of residents to sanitary regulations is good, while few others say it is only fair.

12. Enforcement of government environmental and sanitation laws for defaulters

All the respondents are aware of the mobile courts operations for defaulters of sanitation laws. Fines are said to be charged depending on degree of offence. However, the courts do not operate regularly

13. Problems and challenges faced by AEPB in managing solid waste

Respondents listed the following as challenges faced by the Board in SWM:

- i) Inadequate funding;

- ii) Lack of modern equipment and gadgets;
- iii) Lack of good road network in some parts of the city;
- iv) Poor town and environmental planning;
- v) Inadequate private sector involvement

Respondents say most of the factors are beyond the control of the Board. However, efforts are being made at advocacy at highest level of government.

14. Factors militating against proper SWM in the FCT

The factors militating against proper SWM in the FCT are said to include:

- a) Poor governance;
- b) Phenomenal population growth;
- c) Absence of adequate environmental laws and legislations;
- d) Corruption;
- e) Poor remuneration and motivation for AEPB personnel;

15. Any additional comments

Over 60% of the respondents believe that involvement of LGAs, adopting modern SWM system, more private sector involvement and instituting the waste-to-wealth programme could help improve SWM.

CHAPTER FIVE

DISCUSSION

The study looked at the patterns of Solid waste management in the two selected districts of Abuja Municipal Area Councils (AMAC). Against the background of the population figures of AMAC from the 2006 population census, the demographic distribution of respondents depicted that 93.9% are males, with about the same proportion being in the age range of 20 to 60 years. This reflects the national demographic characteristics and is consistent with the report of National Demographic and Health Survey (NDHS) that most households in Nigeria are headed by males⁵⁹. The household sizes averagely range between 5 and 7 persons. Most of them are also of the extended family type. These family size and type are common in both districts of study. The family size appears to have a significant positive relationship with the amount of wastes generated, as larger families tend to generate more waste. This conforms to the findings of a study in Samaru-Zaria, Nigeria.¹³ Analysis also showed that 93.7% of the respondents have formal education above secondary level, with 66.3% having at least a first university degree or Higher National Diploma. This trend particularly appears to reflect in the level of knowledge and awareness of respondents on methods and practices of solid waste management. The relationships between level of income, city structure and waste management appears mixed up. A report from Zaria¹³ did not find any relationship between household income and the choice of disposal method, while this contrasts with that from Ibadan, Nigeria,⁶⁰ where increased household income was found to encourage the use of adequate waste disposal methods.

On the whole, socio-demographic variables do not seem to have any significant impact on the type or amount of solid waste being generated or disposal practices adopted. A study carried out in Makelle city in northern Ethiopia similarly showed that socio-demographic variables such as age, sex and educational level have insignificant impact on the choice of waste disposal practices.⁶¹ Knowledge, awareness and behavioural change, rather than socio-demographic characteristics are important factors that influence waste disposal practices. This is consistent with reports of earlier studies.^{47, 48, 51}

Environmental knowledge and awareness appear to be generally high amongst respondents, with as many as 86-96% being aware of proper storage and disposal methods. These attributes appear to enhance proper and adequate solid waste disposal and handling practices. Many of them also store generated waste in proper refuse bins with cover. They are generally aware of the health and environmental hazards associated with improper waste handling and disposal practices. These might all be related to existing compelling laws guiding the choice of waste disposal methods being adopted, depending on areas of residence.

Opinion about handling and final disposal methods also seem to be guided by prevailing practices in each of the two study districts, with all respondents in Wuse district more disposed to proper methods. On the contrary, all the 35.5% who believe in either burying refuse to decay into manure or burning these refuse around their houses, reside in Nyanya district. Some of them actually put these beliefs into practice.

All the houses surveyed in the Wuse district have refuse bins for storage of solid waste, in conformity with best practices and as defined by proper and adequate solid waste management. Over 87.1% of the refuse bins are provided with cover, but fewer of the refuse bins in Nyanya

district have cover. The commonest type of refuse bins in use is the 120-litre plastic bin, followed by the 240-litre type, particularly in Wuse district. A previous published study on solid waste management in Abuja⁶² corroborates the fact that majority of residents in Nyanya district use municipal dustbins, which are covered. In contrast, a study in Lagos in 2001 showed that residents preferred to store generated waste in small uncovered plastic buckets.⁶³

In the two study districts garbage constitutes the major type of the waste, accounting for 90.6% of the number of respondents who generate it. This conforms to the findings in previous studies in several cities in Nigeria and Asia where garbage constituted 67%, 43.2%, 52.0% and 75% respectively of solid waste generated from households.⁶⁴⁻⁶⁷

Generally, the frequency of refuse collection is determined by the quantity of waste generated. In areas where there is P-P-P in managing the waste such as in Wuse district, it is easy to monitor and regulate frequency of emptying waste bins. In this survey, most households empty their refuse storage facilities twice a week, some empty daily, suggesting large amount of waste being generated. It is common to see overflow of refuse bins in both districts. Reasons adduced for overflow included among others, delay in collection by AEPB, inadequate manpower, equipment and vehicles by AEPB and private contractors. In previous studies it was reported that poor funding is one of the main reasons for poor collection and disposal of refuse. Environmental Protection Agencies are understaffed, with poorly trained workforce.²⁹The collection vehicles are in a state of disrepair in most cities of Nigeria. There is also inadequate service coverage in most urban areas and in rural areas there is no collection service at all. Refuse are dumped on any vacant plot of land and by the road side. Less than 60% of municipal solid waste generated is collected in developing countries⁶⁸

Municipal Solid waste collection and disposal is regarded as social service. In many cases, no fee is paid by solid waste generators and waste management agencies rely on government budgetary allocations. This is often grossly inadequate. In this study wastes generated in the two districts are either collected by the Abuja Environmental Protection Board, its agents (contractors), or are burnt by the households. Household waste burning is widely practiced in Nigeria especially in dry season as a form of reducing the volume of combustibles in the wastes. All the respondents (100%) believed that improper solid waste management could constitute a form of health hazard; they viewed Malaria, Typhoid Fever, Cholera and Diarrhoeal Diseases etc. as commonest health hazards of improper solid waste management. This agrees with report of a study in South west Nigeria that revealed a generally poor environmental hygiene, as the waste is disposed in open dumps, into streams or by open burning.²⁰

In the last three years, budgetary appropriation for the AEPB ranged from 2.7 Billion Naira in the year 2010, falling to 1.935 Billion Naira in the year 2011 and again dropping further to 1.365 Billion Naira in 2012. Even then, not the total sum appropriated is released and cash-backed. From these budgetary allocations and the dwindling trend, it is obvious that the major challenge faced by waste management authorities is lack of necessary logistics and financial backing to collect and dispose wastes generated from different parts of the city. Also there is no resource recovery effort by the government to offset the cost of solid waste management.

Most of the respondents in Nyanya district believe that solid waste management as it affects their area is extremely poor and that a lot can be done to improve on present method, or the method changed outright. Up to 85.7% of respondents in this area want the method changed. Alternative methods suggested include recycling, composting or waste segregation, as means of final

disposal. The remaining 14.3% want the current method retained, but radically improved upon. This latter stance conforms to findings among most respondents (97.0%) in Wuse district. The respondents identified the shortcomings of the present method and also factors militating against proper solid waste management in AMAC to include poor governance, lack of proper and adequate supervision, poor town/environmental planning and lack of good roads, inadequate private sector involvement, inadequate funding, phenomenal population growth, corruption, absence of adequate environmental laws and poor remunerations for AEPB personnel.

Ways of improving the method as suggested include involvement of Local Government authorities, enactment and enforcement of strict and effective environmental laws, more private sector involvement, modernization of present and establishment of more dumpsites, and Waste-to-Wealth programme. Others include adopting methods used in developed countries, adequate funding, acquiring modern waste management equipment, appointing more and skilled personnel and closer supervision of all those involved in waste management.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 CONCLUSION

This study has shown that in spite of the planned nature of the new Federal capital city, Abuja-Nigeria, it is still facing challenges with municipal solid waste management. Results of the study highlights varying levels of knowledge and attitudes among residents, with higher knowledge, attitude and practices observed among residents with higher educational levels. Socio-economic variables appear to have minimal bearing on solid waste handling practices by the respondents. The proportion of residents served with proper and adequate solid waste management facilities are relatively small, and reside mostly in the urban district of Wuse. Garbage is the commonest type of waste generated in the two districts. The solid waste disposal and management practices in Nyanya district is still rudimentary, with open waste disposal commonly practiced. The existing solid waste management system is affected by unfavourable economic, institutional, legislative, technical and operational constraints and thus it is still poor and not fully effective. Because uniform patterns are not being applied in all parts of the Territory, the satellite towns are particularly affected by this improper solid waste management. Major factors militating against proper solid waste management in the study districts include lack of uniform institutional arrangement covering all areas, insufficient human, financial and material resources, absence of bylaws and standards, inappropriate technology and lack of uniform city design and layout.

Promotion of community and private sector participation is still only being developed, while skilled labour is grossly inadequate. On the whole, solid waste management practices are inadequate, inefficient and ineffective, coupled with differential solid waste management practices in all parts of the city.

6.2 RECOMMENDATIONS

Based on the findings of this study, there is strong need to improve solid waste management in line with international best practices in the FCT in general and AMAC in particular. As such, the following recommendations are hereby made for the various stakeholders:

- i) Improved and strong political will and commitment at the highest government level, with more effective and efficient governance mechanisms by the AEPB, through provision of proper regulatory laws and policy framework for the Board to operate;
- ii) Expansion and improved partnership with the private sector, which should be extended to the Local Government authorities; proper planning, which should be at par with pace of expansion and development,
- iii) Radical improvement in funding, while reforming its fees-for-services scheme to be more efficiently and effectively run as alternative source of funding;
- iv) The AEPB to regularly create more awareness to general public on environmental compliance through mass media, as well as supportive supervision;
- v) Improved involvement of the private sector and the LGAs in solid waste management, as well as communities as pressure groups and change agents to effect positive solid waste reforms;

- vi) Enforcing laws on environmental sanitation, including ones on prohibition of indiscriminate waste disposal.

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APPENDICES

APPENDIX 1

Dear Respondent,

I am a post graduate student of Community Medicine Department of the Ahmadu Bello University, Zaria. I am currently carrying out a research work on “Patterns of Solid Waste Management in selected districts of Abuja Municipal Area Council of the Federal Capital Territory.

2. I would very much appreciate if you would kindly answer the questions contained in the attached questionnaire as correctly as possible.

3. This research is purely an academic exercise and I therefore wish to assure you that all information you will provide will be treated with absolute confidentiality and for the purpose it is meant.

4. Thank you for your anticipated cooperation.

Dr. Abdurrazaq L. Gbadamosi

QUESTIONNAIRE

SECTION A: PERSONAL DATA

1. Location of Residence: _____

2. Sex of Respondent: Male () Female ()

3. Age _____ years

4. Is Respondent a Head of Household? Yes () No ()

5. If No, what is the relationship with Head of Household?

- | | | | |
|------------------------------|-----|-----------------------------|-----|
| a) Husband | () | e) Father | () |
| b) Wife | () | f) Mother | () |
| c) Son | () | g) Extended family relation | () |
| d) Daughter | () | | |
| h) Any other (specify) _____ | | | |

6. Number of people in the household: _____

7. Please indicate the highest level of education attained;

- | | |
|--------------------------------------------|-----|
| a) No formal education | () |
| b) Quranic School | () |
| c) Primary Education | () |
| d) Secondary, Commercial, Teacher Grade II | () |

- e) Diploma, GCE (A Level), or NCE ()
- f) University Degree ()
- g) Any other (specify)_____ ()

8. What is your occupation?_____

9. Could you please state or estimate your monthly income:

- a) Less than N18,000.00 ()
- b) Between N18,000.00 – N50,000.00 ()
- c) Between N50,000.00 – N100,000.00 ()
- d) Between N100,000.00 – N250,000.00 ()
- e) More than N250,000.00 ()
- f) No idea ()

SECTION B: RESIDENTIAL DATA

10. Type of house (Please tick as appropriate)

- a) Flat rental ()
- b) Flat owned ()
- c) Bungalow/Duplex rental ()
- d) Bungalow/Duplex owned ()
- e) Studio/One Room Apartment ()
- f) One storey/Two storey rental ()
- g) One storey/Two storey owner ()
- h) Multi-purpose apartment rental ()

11. Number of rooms in the household_____

12. How long have you lived in this neighbourhood/ward _____years

13. Who are your neighbours? (Please tick as appropriate)

- a) Other residents ()

- b) Shopping Mall ()
- c) Hospital/Clinic ()
- d) Market ()
- e) Entertainment Centre ()
- f) Others (Specify) _____

SECTION C: ENVIRONMENTAL KNOWLEDGE AND AWARENESS OF RESPONDENTS

14. What do you understand by solid waste? _____

15. Mention the various ways in which refuse is stored before collection?

- i) _____
- ii) _____
- iii) _____
- iv) _____

16. Mention the different ways you know that refuse is collected?

- i) _____
- ii) _____
- iii) _____
- iv) _____

17. How should collected solid waste be handled?

- a) Should be dumped around the house Yes () No ()
- b) Should be stored in refuse bins Yes () No ()
- c) Should be dumped in refuse dumpsites around Yes () No ()
- d) Should be transported to distant dumpsites by residents Yes () No ()

e) Should be buried around h house Yes () No ()

18. How should collected refuse be finally disposed of?

a) Should be left to decay into manure Yes () No ()

b) Should be burnt Yes () No ()

c) Should be left for AEPB to collect Yes () No ()

d) Should be cleared by those living nearby Yes () No ()

e) It is not my business Yes () No ()

f) Others (Specify) _____

19. Do you think improper disposal of refuse is a health hazard? Yes () No ()

20. If yes, what are the health hazards? Tick any of these options that you think apply:

i) Accidents & Injuries ()

xii) Musculoskeletal Problems ()

ii) Malaria ()

xiii) Birth Defects ()

iii) Typhoid ()

xiv) Cancers ()

iv) Cholera ()

v) Respiratory Infections ()

vi) Diarrhoeal Diseases ()

vii) Worm Infestations ()

viii) Water Pollution ()

ix) Rodents & Flies Breeding ()

x) Reproductive Disorders ()

xi) Skin infections ()

- ii) Every two days ()
- iii) Twice a week ()
- iv) Once a week ()
- v) Others (specify)_____

27. Where do you dispose your refuse after storage?

- a) At the refuse heap/dump nearby ()
- b) Behind the house ()
- c) The Abuja Environmental Protection Board (AEPB) carries it from the house to designated dump site ()
- d) Solid Waste Management Contractors are responsible for collecting the refuse ()
- e) Any other (specify)_____

28. What type of vehicle(s) is/are used in refuse collection from your house?

- a) Compactor truck ()
- b) Side loader ()
- c) Rear loader ()
- d) Mini truck ()
- e) Tipper ()
- f) Skip truck ()
- g) Open back truck ()
- g) Others (Specify) _____

29. Is the refuse bin often allowed to overflow before collection? Yes () No ()

30. If yes, why? Give reason(s)

- i) _____
- ii) _____

iii) _____

31. Is the waste bin adequate for the quantity of refuse being generated in your residence?
Yes () No ()

32. If no, why? Give reason(s)

i) _____

ii) _____

iii) _____

33. Do waste pickers and scavengers have access to the waste bin? Yes () No ()

SECTION E: TYPES OF SOLID WASTE GENERATED

34. What types of wastes do you dump in the Refuse Bin?

a) Garbage ()

b) Combustible rubbish ()

c) Non-Combustible rubbish ()

d) Ashes and Dust ()

e) Vegetation ()

f) Building debris ()

g) Others (Specify) _____

35. Are wastes segregated at storage before collection? Yes () No ()

SECTION F: TYPES OF SOLID WASTE DISPOSAL AND MANAGEMENT PRACTICES

36. How often do you sweep your surrounding?

a) Daily ()

b) Every other day ()

c) Twice a week ()

d) Once a week ()

e) Others (specify) _____

37. How do you organize yourself to keep your surrounding clean? (Pls. tick as appropriate)

- a) By organizing groups of women in the house ()
- b) By organizing the children/servants in the house ()
- c) By organizing men in the house ()
- d) By rotating the cleaning among households in the house ()
- e) By contributing money to employ people to clean ()
- f) There is no formal organization ()
- g) Any other (specify) _____

38. Are there refuse heaps near of your house? Yes () No ()

39. Are there refuse heaps on the sides of the roads/streets and behind some houses?
Yes () No ()

40. How have you been disposing your refuse?

- a) Burning the refuse ourselves ()
- b) Paying someone to burn the refuse ()
- c) Being cleared by AEPB ()
- d) Disposing it at AEPB designated dump sites by us ()
- e) Being cleared by AEPB Refuse contractors ()
- f) Being cleared by private refuse collectors ()
- g) Others (specify) _____

41. How would you classify your surrounding environment?

- a) Very dirty ()
- b) Dirty ()
- c) Clean ()
- d) Very clean ()

e) Others (specify) _____

SECTION G: METHODS OF SOLID WASTE MANAGEMENT

42. Would you prefer a different method of solid waste management to the present system?

Yes () No ()

43. If yes, suggest three other methods in order of preference:

a) _____

b) _____

c) _____

44. If no, suggest various ways that you think the present method can be improved upon in the FCT:

i) _____

ii) _____

iii) _____

iv) _____

v) _____

SECTION H: FACTORS MILITATING AGAINST PROPER SOLID WASTE MANAGEMENT

45. What do you think are the shortcomings of the present system of waste management in your area?

i) _____

ii) _____

iii) _____

iv) _____

v) _____

46. What factors do you think are militating against proper solid waste management in the FCT?

i) _____

ii) _____

iii) _____

iv) _____

v) _____

47. Do you have any additional comments or suggestions regarding solid waste management?

i) _____

ii) _____

iii) _____

iv) _____

v) _____

Thank you for your cooperation

APPENDIX 2

IN-DEPTH INTERVIEW (IDI) GUIDE FOR A.E.P.B

1. What are the legal instruments that enable the Board to carry out its activities?
2. What are the strategies for carrying out these responsibilities?
3. How is the organization of solid waste management done in terms of storage, collection, transportation and final disposal?
4. Are there specific/designated spots or locations for the collection of the refuse heaps in Abuja Municipal Area Council? Yes () No ()
5. If yes, please mention these designated spots or locations:
 - i) _____
 - ii) _____
 - iii) _____
 - iv) _____
6. How often are these refuse heaps or dumps at designated sites evacuated by the Board?
7. How are solid wastes disposed of finally?
8. What is the total manpower strength of the Board involved in solid waste management? Give a breakdown.

S/NO,	STAFF CADRE	NUMBER
1.		
2.		
3.		
4.		
5.		

9. What other resources in terms of equipment and vehicles does the Board have? Give the current list of the various equipment/materials, their quantities and present state, used for solid waste management in Abuja municipality

S/NO,	EQUIPMENT/MATERIALS	QUANTITY	FUNCTIONAL STATE	REMARKS
1.				
2.				
3.				
4.				
5.				
6.				
7.				

10. Do you think these resources are adequate for managing solid waste?

11. If no, where are the areas of deficiencies?:

12. What was the approved annual budgetary allocation of the Board in the last 3 years?

2010_____2011_____2012_____

13. What percentages of these allocations were dedicated to solid waste management?

2010_____2011_____2012_____

14. Were these allocations adequate?

Yes ()

No ()

15. If No, in your informed opinion, what estimate do you consider enough for solid waste management in FCT yearly?

16. Do people pay for the services rendered by the Board? Yes ()

No ()

17. If Yes, how much is paid per month?

18. How effective is the collection system for this fee?

19. What percentage of the cost of solid waste management services does this fee cover?

20. Does the Board create regular environmental education awareness to the public?

Yes ()

No ()

21. If Yes, what are the scope/content/highlights of the message?

IN-DEPTH INTERVIEW (IDI) GUIDE FOR CONTRACTORS

1. Is your company solely engaged in solid waste management? Yes () No()
2. If no, in what other areas is your company engaged?
3. How long has your company been involved in solid waste management?
4. What Districts/Areas of the FCT does your company cover?
5. What are your defined functions as a solid waste management company?
6. What is the duration of your contract?
7. What aspects of solid waste management is your company involved in?
8. What type of solid waste handling and disposal are you carrying out?
9. What is your manpower strength and breakdown of the various cadres?

S/NO,	STAFF CADRE	NUMBER
1.		
2.		
3.		
4.		
5.		

10. What specialized equipment and vehicles do you own for solid waste management? List them and quantity.

S/NO,	EQUIPMENT/MATERIALS	QUANTITY	FUNCTIONAL STATE	REMARKS
1.				
2.				
3.				
4.				
5.				
6.				
7.				

11. Do these resources meet the A.E.P.B. minimum/maximum requirement for solid waste management contractors?

12. How would you describe the attitude and cooperation of residents of households under your jurisdiction for solid waste management?
13. How frequently do you collect refuse for disposal from households in your coverage area?
14. How compliant are residents to regulations guiding solid waste generation and storage?
15. Do you charge residents any fees?
16. If yes, how much and to whom are these fees remitted?
17. Are you involved in residents' education and awareness on solid waste management?
18. What problems and challenges are being encountered by your organization in managing solid waste?
19. How are these challenges being overcome?
20. What do you think are factors militating against proper solid waste management in FCT?
21. How would you classify the area being managed by you in terms of cleanliness?
 - a) Very clean ()
 - b) Clean ()
 - c) Dirty ()
 - d) Very dirty ()
 - e) Others (specify)_____
22. Do you have any additional comments or suggestions regarding solid waste management?

Thank you for your cooperation



APPENDIX 4
DEPARTMENT OF COMMUNITY MEDICINE
Ahmadu Bello University,
Zaria - Nigeria





APPENDIX 5
DEPARTMENT OF COMMUNITY MEDICINE
Ahmadu Bello University,
Zaria - Nigeria



APPENDIX 6

APPENDIX 7

DISTRICTS AND THEIR WARDS IN AMAC⁵⁸

S/N	DISTRICT	WARDS	REMARKS	
1.	WUSE	Wuse Zones 1-7 Central Business District Maitama Village Yakubu Gowon Barracks GadoNasko Barracks Central Bank of Nigeria	Wuse II Maitama Aso Drive Minister's Hill Van Lambu Village	Wuse is one of the selected Districts for this study
2.	NYANYA	Nyanya Village/Gwari Nyanya Site Areas A to F Nyanya Village/Gwandara	AnguwanBawa Gbagarape Kugbo	Nyanya is one of the selected Districts for this study
3.	CITY CENTRE	Garki Areas 1-11 Central Area Camp Bassey Barracks GindinDutse/OVA Camp	Old Secretariat (Mile 2) Fort 1 Babangida Barracks Presidential Villa	

-
4. GWARINPA Gwarinpa Village Katampe
 Gwarinpa Life Camp Kuchigoro
 UtakoKado Village
 Kado Federal Housing Mabushi
5. GARKI Garki village Garki II
 DantataKobi
 KurumdumaDurumi I
 Durumi II Durumi III
 NEPA Village Apo
 DamagazaGudu
 WumbaAsokoro
 DutseGuzape
 Abacha Barracks
6. GUI GuiDandi
 NuwalogyeGora
 MakanimaGbessa
 GwakoDodo
 ZamaniIddoGosa
 BarowaTudunwada
-

IddoPadaDayisa

TungaKwasoIddoSarki

GuiPasaliIddo Sabo

IddoMa'ajiAirport

DamakubaSauka

TogeTakilogo

Tungan Jika Makana

Kokole Gbenduniya

7. GWAGWA GwagwaZaudinaKarsana I Saburi I Karsana II Saburi II
KaginiFilinDabo I Karsana III FilinDabo II KabaBagusaFilinDabo III Dei
DeiTasha

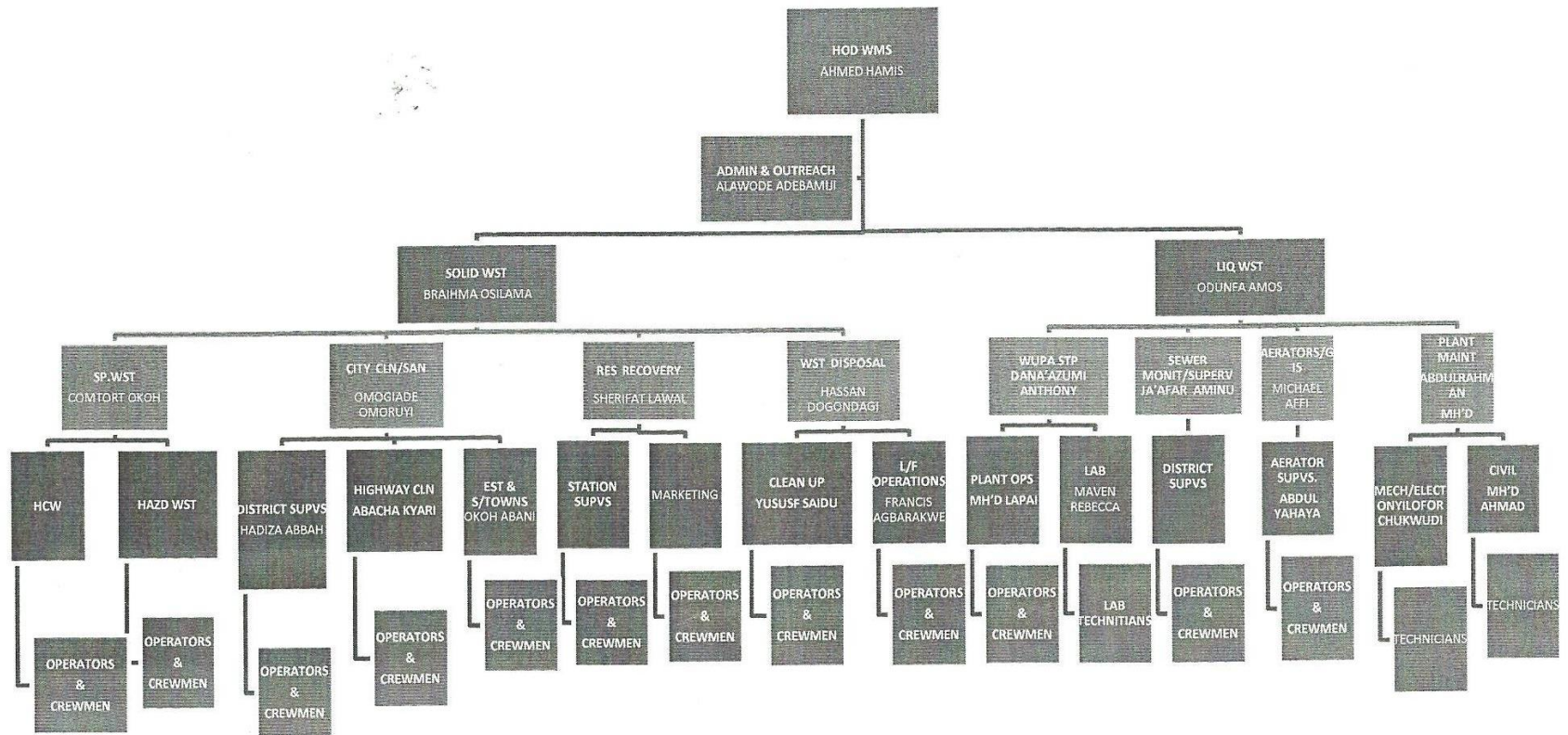
8. KARU Karu Village Karu Site (FHA)
Jikoyi

9. KARSHI KarshiGidanBoyi
TungaGidanKwano
AlekuKusaki
Gidan Kaka Odu
KupayiUgamada
KutasaUnguwanTiv

-
10. KABUSA KamakusaDamasasa
KabusaLugbe
KettiSabonLugbe
ZidnaGaladimawa
ZhiduLekogoma
WaniDogoriGada
BurumAleyita
TakusharaPiwoyi
SherettiPykasa
11. ORAZO Orazo I GidanAjiyaOrazo II
MunapeyiKasaMadallaMunapeyiSarnaIdanMangoraBadnaGuguguChoriBisaKpepegyiW
owoKuruduSabonGariKwoiAnkaAjataKuruduGwandaraAngwanSako
12. JIWA JiwaGyeda
KarmoTsohoPaipe
Karmo Sabo Zhidu
TunganMadakiIduGwari
HulumiTunganDallatu
BasanJiwa
-

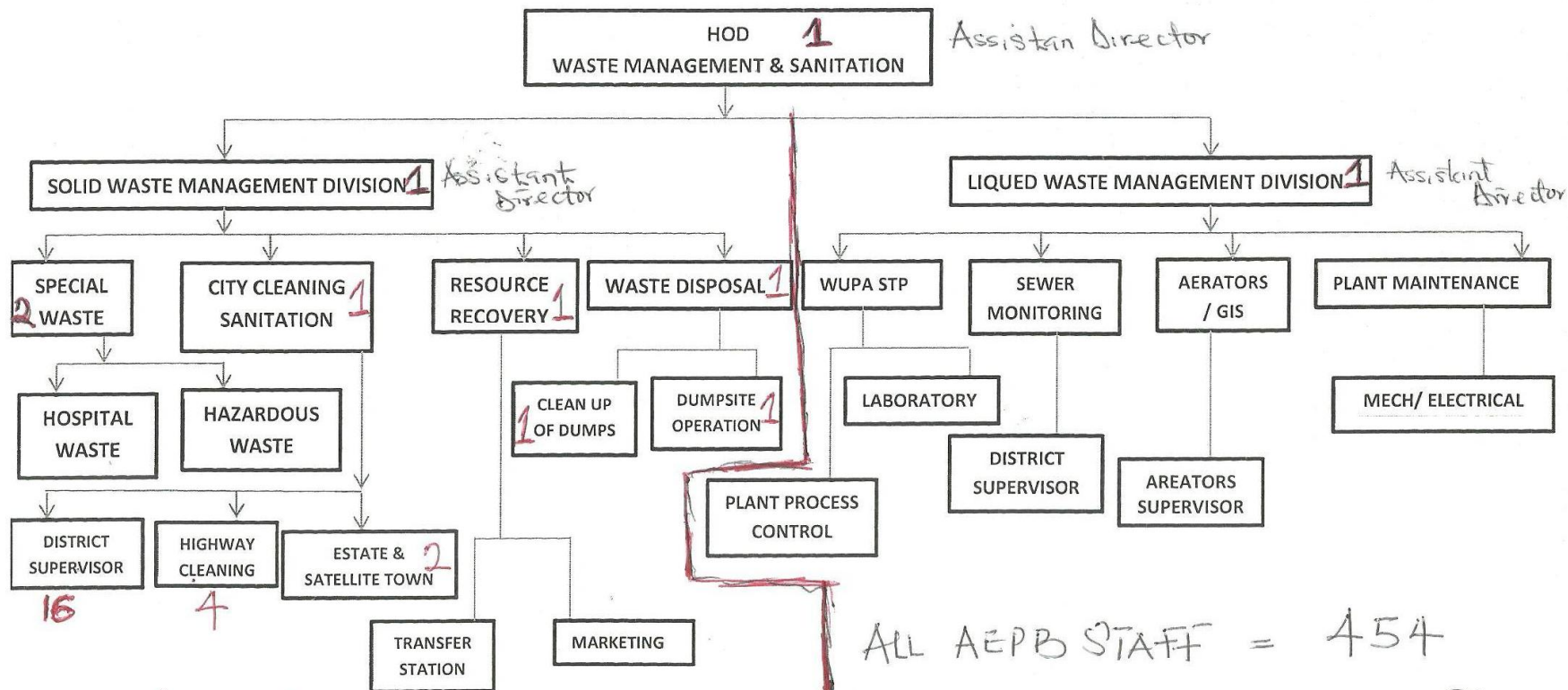
Question 2

APPENDIX 8



All in All we have 150 Solid Waste Management Staff running Waste Management activities.

APPENDIX 9 WASTE MANAGEMENT & SANITATION DEPARTMENT ORGANOGRAM



Crewmen (casuals) and Driver's
No: = 25
Litter Casual Staff = 42

ALL AEPB STAFF = 454
Waste Management Sanitation Department = 96
Solid Waste Management = 54

APPENDIX 10

MONTHLY TOTAL WASTE COLLECTED IN 2010, 2011, 2012 AND 2013						
S/NO	MONTHS	2010	2011	2012	2013	TOTAL
1	JANUARY	15,371.62	20628.719	17031.69	53,032.03	106,064.06
2	FEBRURY	32,671.69	18916.55	18000.918	21,244.86	90,834.01
3	MARCH	15,832.44	22399.822	22000.914	60,233.18	120,466.35
4	APRIL	13,746.10	17002.71	19516.068	50,264.87	100,529.75
5	MAY	16,509.17	19933.776	21681.036	58,123.98	116,247.96
6	JUNE	15,941.95	18795.078	20444.112	55,181.14	110,362.28
7	JULY	11,235.74	20496.078	20943.468	52,675.29	105,350.58
8	AUGUST	7,014.38	20677.356	18168.696	45,860.44	91,720.87
9	SEPTEMBER	16,752.00	21501.126	0	38,253.13	76,506.25
10	OCTOBER	15,864.00	21601.728	3644.55	41,110.28	82,220.56
11	NOVEMBER	14,902.00	21674.871	0	36,576.87	73,153.74
12	DECEMBER	14,753.23	22151.151	7975.188	44,879.57	89,759.14
	TOTAL	190,594.32	245778.965	169406.64	605,779.93	1,163,215.56
BUDGETRY APPROPRIATION						
S/NO	YEARS	AMOUNTS	PECENTAGE	RELEASED AND CASH		
1	2010	2,700,000,000	100%	RELEASED		
2	2011	1,935,000,000	71.66%	RELEASED		
3	2012	1,365,000,000	50.55%	RELEASED		

APPENDIX 10B Volume

S/NO	CONTRACTOR	DISTRICT	TOTAL WASTE COLLECTED IN 2010												TOTAL
			JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	
1	E.S.I	GARKI I	1024	932	1327	1213	1593	1557	1070	658	1498	1472	1342	13686	27372
2	GLOBAL GREEN	GARKI II	998	780	1028	598	562	490	384	384	688	648	672	7232	14464
3	LAURMAN	C.B.D	970	988	1155	1313	1221	1452	1393.2	900	1092	1192	1058	12734.2	25468.4
4	WHITECLEAN	GWARINPA	1140	924	1060	772	570	684	1092	804	1020	972	708	9746	19492
5	INTERPROJECT	WUSE II	1512	1356	1565	1481	1517	1608	1440	1140	1044	1128	984	14775	29550
6	SOIL SCISSORS	ASOKORO	4416	3588	1878	1986	1714	660	1728	1416	1818	1578	2028	22810	45620
7	ANETOR	WUSE I	900	924	895	751	751	744	696	586	838	838	496	8419	16838
8	ADVANTAGE	JABI	1041	1320	1882	2530	2578	4284	588	1104	1184	1248	720	18479	36958
9	COSMOPOLITAN	MAITAMA	1428	1582.75	1424	1738	1938	2832	1574	1142	2226	2226	1776	19886.75	39773.5
10	ENVIRONMENTAL EXPRESSION	GARKI II	13429	12394.75	12214	12382	12444	14311	9965.2	8134	11408	11302	9784	936	128703.95
11	WASTE POINT	APO	1128	624	710	964	904	516	1420	338	1420	1152	1218	10394	20788
12	BLACKMOORE	GWARINPA	792	912	776	672	636	588	456	206	996	1032	636	7702	15404
13	ALBA	WUSE I	588	972	1102	1214	2426	1512	432	240	1416	1380	756	12038	24076
14	INEX		0	0	0	0	564	1084	804	720	1224	1020	876	6292	12584
15	LAAB		0	0	0	0	0	0	334	0	0	0	0	334	668
16	NATURE	WUSE	0	0	0	0	0	0	288	0	0	0	0	288	576
17	PRIMEROSE		576	828	1125	577	721	348	420	558	882	940	744	7719	15438
18	HEALTH INFORMATION		360	324	402	382	286	336	276	192	324	324	384	3590	7180
19	POLYGLOBAL		288	300	343	335	311	192	312	276	300	312	228	3197	6394
20			4334	3980	3355	2901	3213	2836	2862	2292	2205	2784	1906	32668	65336
21	EFAB	EFAB ESTATE	54	48	65	69	2409	48	42	100	56	62	44	2997	5994
22	ODOSCO	LUGBE	288	384.5	316	330	320	270	432	204	396	276	216	3432.5	6865
23	CLEANRITE	LIFECAMP	288	462	688	427	811	756	624	666	1010	984	852	7568	15136
24	MAISHARA	LUGBE	68	80.5	133	103	127	14	216	58	56	22	0	877.5	1755
25	PANACEA	GAMES VILLAGE	0	0	0	60	312	180	216	108	540	600	288	2304	4608
26	PALISCO	SUNCITY	0	0	0	0	0	0	132	204	0	0	0	336	672
27	SHAFAT	GADUWA	0	0	0	0	0	0	432	168	348	300	48	1296	2592
28	DANATATA	D. YARD	100.5	23.25	29	28.25	28.25	19.5	27.75	18.6	19.5	12.75	27	334.35	668.7
29	JULIUS BERGER	B. YARD	517.5	478.5	588	473.75	515	551.25	467.6	539.9	513	331.5	468.75	5444.75	10889.5
30	COCA COLA		0	0	0	0	0	0	0	0	7.5	0	0	7.5	15
31	OTHER COMPANY		808	964	713.75	872.5	654.25	982.5	739.47	831.5	1158.25	1091	1172	9987.22	19974.44
TOTAL			37048	35170.25	34773.75	34172.5	39125.5	38855.25	30863.22	23988	35687.25	35227.25	29431.75	247510.77	

Tons

WASTE DISPOSAL UNIT																
REPORT OF CONTRACTORS MONTHLY ACTIVITIES FOR THE YEAR 2011																
S/NO	NAME OF COMPANY	MONTHLY REPORT												TOTAL		
		JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER			
1	E.S.I	GARKI I	1225.664	1131.408	1544.888	1415.232	1664.064	1527.984	1527.984	1553.256	1572.696	1559.088	1518.264	1512.432	17752.96	
2	ANETOR	WUSE ONE	797.04	686.232	691.88	583.2	664.848	608.472	655.128	688.176	729	670.68	616.248	645.408	8036.312	
3	ALBA	WUSE ONE	979.776	897.128	979.896	804.816	944.784	956.448	898.128	909.792	944.784	921.456	1024.768	1166.4	11417.776	
4	ENVIRONMENTAL EXPRESSION	WUSE ONE	816.48	694.008	1000.936	822.312	822.312	559.872	373.248	443.232	530.712	682.344	688.176	678.456	8112.088	
5	SOLE SCISSORS	ASOKORD	913.68	1205.28	1625.376	1506.6	1096.416	1152.792	1677.672	1440.504	1395.792	1345.248	1561.032	1395.792	16316.184	
6	LAURMAN	C.B.D	1026.432	929.232	1030.488	682.344	896.184	927.288	1121.688	1597.968	1562.976	1411.344	1236.384	1353.024	13775.352	
7	WHITE CLEAN	GWARINPA	882.576	633.744	748.824	886.464	886.464	902.016	1069.2	863.136	874.8	888.408	723.168	709.56	10068.36	
8	CLEANTITE	LIFECAMP	1038.096	921.456	1096.816	1143.072	874.8	583.2	653.184	653.184	653.184	773.712	804.816	771.768	9967.288	
9	WASTE POINT	ARO	1051.704	835.92	1047.872	826.2	789.264	1069.2	1041.984	1119.744	1111.968	1069.2	952.56	853.416	11769.032	
10	COSMOPOLITAN	MAITAMA	3209.544	2812.968	2830.056	2783.808	3505.032	2482.488	2468.88	2128.68	2058.696	2212.272	2851.848	3293.136	32637.408	
11	ADVANTAGE	JABI/UTAKU	1971.216	1971.216	2682.872	1621.296	1644.624	1481.328	1504.656	1609.632	2181.168	2064.528	1807.92	1726.272	22266.728	
12	INTERPROJECT	WUSE TWO	1290.812	1150.848	1244.12	913.68	1259.712	1271.376	1353.024	1131.408	1306.368	1213.056	1294.704	1318.032	14747.14	
13	INEX CLEANERS	WUSE TWO	746.496	571.536	618.56	285.768	517.104	686.232	779.544	725.112	855.36	919.512	973.944	1032.264	8711.432	
14	BLACKMOORE	GWARINPA	804.816	501.552	687.88	734.832	979.776	758.16	1073.088	991.44	933.12	898.128	1014.768	863.136	10240.696	
15	GLOBAL GREEN	GARKI II	968.112	839.808	921.84	594.864	804.816	839.808	1038.096	1562.976	1562.976	1411.344	1236.384	1353.024	13134.048	
16	JULIUS BERGER	J. YARD	509.571	524.151	535.53	417.717	505.197	572.265	521.964	518.319	535.815	532.17	596.322	543.834	6312.855	
17	DANTATA	D. YARD	29.889	25.515	34.244	29.889	25.515	29.889	42.282	38.637	22.599	24.786	28.431	29.889	361.565	
18	PRIMEROSE	GARKI II	31.104	60.264	10	0	3.888	3.888	1.944	7.776	3.888	0	7.776	0	130.528	
19	HEALTH INFO	KADO ESTATE	361.584	338.256	547.904	139.968	489.888	408.24	244.944	268.272	338.256	384.912	373.248	408.24	4548.656	
20	POLY GLOBAL	WUYE	279.936	303.264	489.912	186.624	244.944	268.272	338.256	384.912	373.248	408.24	361.584	361.584	4000.776	
21	EFAB CLEANERS	EFAB ESTATE	3.888	0	0	0	1.944	0	0	0	0	7.776	0	0	13.608	
22	ODOSCO	LUGBE	46.651	0	0	0	0	0	0	0	0	0	0	0	46.651	
23	A.E.P.B	WUSE/GARKI	1626.156	1882.764	2030.328	624.024	1312.2	1694.196	2111.184	2041.2	1819.584	1878.876	1780.704	1804.032	20605.248	
24	MAHAJ	JABI/LUGBE	17.496	0	0	0	0	11.664	0	0	0	2.916	0	0	32.076	
25	VALE	SUNNY VALE	0	0	0	0	0	0	0	0	139.968	244.944	81.648	58.32	524.88	
26	IMMACULATE		0	0	0	0	0	0	0	0	29.16	36.936	19.44	31.104	116.64	
27	ctec		20628.719	18916.55	22399.822	17002.71	19933.776	18795.078	20496.078	20677.356	21501.126	21601.728	21674.871	22151.151	245778.965	

TONS

TATOL WASTE COLLECTED IN 2012

S/NO	CONTRACTOR	DISTRICT	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	TOTAL
1	JULIUS BERGER	BERGER YARD	319.41	511.056	619.164	541.944	577.044	593.892	606.528	525.798	0	73.008	0	147.42	4515.264
2	DANTATA	DANTATA YARD	14.04	20.358	20.358	23.868	19.656	18.252	18.252	16.146	0	3.51	0	8.424	162.864
3	E.S.I	GARKI 1	1184.976	1177.488	1400.256	1211.184	1450.8	1299.168	1342.224	1233.648	0	280.8	0	584.064	11164.61
4	ADVANTAGE	JABI/UTAKU	1452.672	1381.536	1961.856	1765.296	2012.4	2201.472	2384.928	1920.672	0	370.656	0	977.184	16428.67
5	WASTE POINT	APO	688.896	718.848	786.24	921.024	997.776	844.272	803.088	703.872	0	142.272	0	394.992	7001.28
6	WHITE CLEAN	GWARINPA	438.048	580.32	550.368	391.248	655.2	731.952	554.112	531.648	0	134.784	0	400.608	4968.288
7	COSMOPOLITA	MAITAMA	2177.136	2349.36	2916.576	2553.408	2266.992	2398.032	2779.92	2332.512	0	277.056	0	726.336	20777.33
8	SOLE SCISSORS	ASOKORO	1383.408	1237.392	1512.576	900.432	1190.592	1338.48	1074.528	1074.528	0	263.952	0	280.8	10256.69
9	INTERPROJECT	WUSE TWO	1156.896	1055.808	1280.448	1235.52	1359.072	1179.36	1224.288	1078.272	0	247.104	0	494.208	10310.98
10	INEX CLEANERS	WUSE TWO	666.432	853.632	1014.624	936	902.304	840.528	842.4	821.808	0	187.2	0	424.944	7489.872
11	CLEANRITE	LIFE - CAMP	718.848	651.456	898.56	720.72	842.4	623.376	1091.376	707.616	0	136.656	0	292.032	6683.04
12	BLACKMOORE	GWARINPA	628.992	718.848	921.024	831.168	877.968	546.624	415.584	1291.68	0	112.32	0	170.352	6514.56
13	GLOBAL GREEN		707.616	606.528	696.384	617.76	651.456	673.92	662.688	550.368	0	112.32	0	293.904	5572.944
14	LAURMAN	C.B.D	1055.808	1149.408	1697.904	1497.6	1493.856	1415.232	1460.16	1291.68	0	299.52	0	499.824	11860.99
15	ANETOR	WUSE ONE	428.688	471.744	359.424	381.888	651.456	675.792	628.992	561.6	0	114.192	0	292.032	4565.808
16	ALBA	WUSE ONE	969.696	1022.112	1278.576	1170	1235.52	1181.232	1220.544	1063.296	0	196.56	0	404.352	9741.888
17	ENVIRONMENTAL EXPRESSION	WUSE ONE	584.064	619.632	842.4	666.432	730.08	711.36	700.128	634.608	0	97.344	0	284.544	5870.592
18	HEALTH INFO	KADO ESTATE	475.488	438.048	374.4	381.888	378.144	370.656	387.504	329.472	0	58.032	0	136.656	3330.288
19	POLY GLOBAL	WUYE	335.088	396.864	394.992	310.752	353.808	340.704	368.784	297.648	0	61.776	0	125.424	2985.84
20	PRIME ROSE	GARKI 2	400.608	741.312	780.624	853.632	679.536	615.888	642.096	518.544	0	134.784	0	350.064	5717.088
21	A.E.P.B	WUSE/GARKI	1110.096	992.16	1392.768	1383.408	1886.976	1314.144	1329.12	1138.176	0	267.696	0	482.976	11297.52
22	VALE	SUNNY VALE	33.696	0		0	22.464	123.552	11.232	22.464	0	0	0	0	213.408
23	JIMMACULATE		11.232	16.848	24.336	1.872	20.592	69.264	78.624	89.856	0	11.232	0	78.624	402.48
24	citec		89.856	213.408	202.176	168.48	303.264	292.032	292.032	247.104	0	56.16	0	101.088	1965.6
25	JADES	GUDU		44.928	44.928	46.8	56.16	13.104	24.336	11.232	0	5.616	0	13.104	260.208
26	BNL YARD			29.952	26.208	0	65.52	9.36	0	0	0	0	0	11.232	142.272
27	Other Company			3.744	3.744	3.744	0	204.048	136.656	190.944	0	0	0	0	542.88
TOTAL			17031.69	18002.79	22000.91	19516.07	21681.04	20625.7	21080.12	19185.19	0	3644.55	0	7975.188	170743.2

TOTAL WASTE GENERATED IN FCT FOR THE YEAR 2013 IN (TONS)

S/NO	COMPANY	DISTRICTS	JANUARY	FEBUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	TOTAL WASTE PER COMPANY
1	SOLE SCISSORS	ASOKORO	1037.088	1152.684	1038.96	1426.464	1996.488	2045.628	1656.72	1181.232	1579.5	1333.8	1486.836	1812.564	17747.964
2	LAURMANN	C.B.D	1207.44	2091.024	2568.384	2091.024	2008.656	1898.208	1404	1280.448	1493.856	853.632	943.488	1381.536	19221.696
3	E.S.I	GARKI 1	1447.056	1499.472	1327.248	1499.472	1596.816	1448.928	1280.448	1302.912	1156.896	787.644	1145.664	1538.784	16031.34
4	GLOBAL GREEN	GARKI 2	628.992	662.688	606.528	662.688	1055.808	640.224	460.512	325.728	123.552	224.64	292.032	303.264	5986.656
5	PRIME ROSE	GARKI 2	733.824	213.408	527.904	404.352	595.296	685.152	563.472	661.284	689.364	591.084	607.932	671.112	6944.184
6	WASTE POINT	APO	932.256	1939.392	1170	1725.984	1755.936	1330.992	1132.56	874.224	771.264	633.204	954.72	1415.232	14635.764
7	CLEANRITE	LIFE - CAMP	550.368	606.528	427.518	606.528	718.848	617.76	415.584	292.032	381.888	4.68	303.264	471.744	5396.742
8	LAURMAN	GWARINPA	280.8	0	0	0	0	0	0	0	0	0	0	0	280.8
9	WHITE CLEAN	GWARINPA	808.704	904.176	771.264	904.176	814.32	795.6	909.792	527.904	673.92	662.688	943.488	1235.52	9951.552
10	ADVANTAGE	JABI/UTAKU	2066.688	2369.952	2347.488	2369.952	2553.408	2270.736	1909.44	1186.848	1065.168	533.52	1381.536	1896.804	21951.54
11	HEALTH INFO	KADO ESTATE	297.648	333.216	355.68	333.216	363.168	335.088	387.504	335.088	323.856	168.48	146.016	280.8	3659.76
12	COSMOPOLITAN	MAITAMA	1855.152	2047.968	2149.056	2047.968	2238.912	2152.8	1506.96	1093.248	1432.08	1134.432	1538.784	2740.608	21937.968
13	ANETOR	WUSE ONE	640.224	640.224	617.76	640.224	651.456	539.136	597.168	134.784	408.096	280.8	224.64	449.28	5823.792
14	ALBA	WUSE ONE	979.056	808.704	752.544	808.704	943.488	887.328	808.704	606.528	776.88	370.656	539.136	685.152	8966.88
15	ENVIRONMENTAL EXPRESSION	WUSE ONE	512.928	0	368.784	673.92	898.56	668.304	705.744	318.708	723.06	249.912	359.424	760.968	6240.312
16	INEX CLEANERS	WUSE TWO	864.864	801.216	486.72	801.216	947.232	879.84	909.792	707.616	844.272	505.44	577.044	850.824	9176.076
17	INTERPROJECT	WUSE TWO	1213.056	1213.056	1179.36	1213.056	1257.984	1179.36	1044.576	932.256	853.632	640.224	673.92	999.648	12400.128
18	POLY GLOBAL	WUYE	320.112	361.296	335.088	361.296	443.664	468	350.064	314.496	449.28	89.856	168.48	269.568	3931.2
SUB TOTAL			16376.256	17645.004	17030.286	18570.24	20840.04	18843.084	16043.04	12075.336	13746.564	9064.692	12286.404	17763.408	190284.354
OTHER COMPANIES AREAS															
19	JULIUS BERGER	BERGER YARD #	379.08	650.754	626.184	650.754	480.168	412.074	520.884	316.602	371.358	35.802	10.53	84.24	4538.43
20	DANTATA	DANTATA YARD	18.954	18.954	24.57	18.954	18.954	17.55	18.954	18.252	18.252	10.53	12.636	20.358	216.918
21	A.E.P.B	WUSE/GARKI	2228.616	2062.944	2006.784	2169.648	2400.84	2705.976	2894.112	2442.96	2504.736	887.328	1291.68	2706.912	26302.536
22	STDA/AMAC/OTHERS		280.8	318.708	341.172	369.252	619.164	675.324	637.416	1632.852	2339.064	1439.802	1438.398	2150.226	12242.178
23	IMMACULATE		134.784	269.568	202.176	269.568	303.264	280.8	303.264	224.64	292.032	157.248	134.784	269.568	2841.696
24	ctec		168.48	258.336	269.568	258.336	292.032	280.8	0	11.232	0	0	15.769728	0	1554.553728
25	JADES	GUDU	18.72	5.616	0	5.616	134.784	0	0	0	0	0	0	0	164.736
26	BNL YARD		0	0	146.016	0	0	33.696	0	0	0	0	0	0	179.712
27	PAMACEA		11.232	11.232	11.232	11.232	11.232	11.232	0	0	56.16	0	0	0	123.552
28	B.L HARBERT CONSTROTION LTD	CENTRAL AREA	125.424	0	0	0	0	0	0	0	0	0	0	0	125.424
29	E.C.L	MABUSHI	0	0	0	0	0	0	0	0	0	0	0	0	0
30	C.C.E.C.C.	YARD	1.872	3.744	7.488	3.744	3.744	1.872	0	0	0	0	0	0	22.464
31	EFAB	YARD	0	0	0	0	37.44	46.8	0	213.408	336.96	0	2.628288	0	637.236288
32	MAHAJ	KARU I	0	0	0	0	0	0	0	0	0	0	0	0	0
33	G. CARPPAS		0	0	0	0	11.232	0	0	0	0	0	0	0	11.232
34	S.T.K		0	0	0	0	0	0	0	0	0	0	0	0	0
SUB TOTAL			3367.962	3599.856	3635.19	3757.104	4312.854	4466.124	4374.63	4859.946	6042.114	2530.71	2906.426016	5231.304	49084.22002
GRAND TOTAL			19744.218	21244.86	20665.476	22327.344	25152.894	23309.208	20417.67	16935.282	19788.678	11595.402	15192.83002	22994.712	239368.574

APPENDIX 11

DISTRIBUTION OF SOLID WASTE BINS IN AMAC CITY CENTRE 2012

S/NO.	DISTRICTS	240L WASTE BINS	1.1M ³ GALVANIZED BINS
1.	Asokoro	1,800	150
2.	Asokoro Extension	500	50
3.	Central Business District	1,200	500
4.	Garki I	2,000	200
5.	Garki 2A	900	100
6.	Garki 2B	1,000	150
7.	Gudu/Durumi/Apo	1,500	100
8.	Life Camp	1,000	35
9.	Gwarinpa 2A	500	50
10.	Gwarinpa 2B	500	15
11.	Jabi/Utako/Mabushi	2,000	200
12.	Kado	500	10
13.	Maitama (A & B)	2,000	400
14.	Wuse 1A, B & C	2,500	500
15.	Wuse 2A & 2B	3,000	500
16.	Wuye	400	15
	TOTAL	21,300	2,975

Source: AEPB

APPENDIX 12

AEPB Waste Management Department Refuse Bins Census Programme: Gross Summary Sheet

FCT DISTRICT/AREA	NUMBER OF REFUSE BINS AND TYPES			
	120LTS.	240LTS.	1.1M ³	TOTAL
Apo/Garki II	424	240	7	671
Garki Operational Zone	1,113	835	74	2,022
Life Camp/Gwarimpa	590	110	23	723
Maitama/Asokoro	635	763	90	1,488
Wuse	1,039	985	55	2,079
Karu/Karshi	409	250	19	678
Kubwa/Bwari	1,117	134	8	1,259
Gwagwalada/Kwali#	590	110	23	723
TOTAL BINS IN CIRCULATION	5,917	3,427	299	9,643

Source: AEPB Inventory List, June 1997

The above is the census conducted by the AEPB on the distribution of refuse bins in the various districts. The bins ranged from the large metal bins placed within the neighbourhood collection centres to the plastic bins placed by the various households.