

TITLE PAGE

DOMESTIC WASTE MANAGEMENT IN AKWANGA
TOWN, AKWANGA LGC NASARAWA STATE, NIGERIA

SUBMITTED BY

MAIYAKI KOTO AHMED

PGD/PGS/GEO/05/06/318

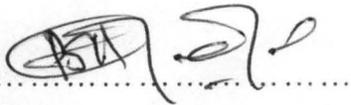
PGD ENVIRONMENTAL MANAGEMENT, GEOGRAPHY
DEPARTMENT, SCHOOL OF SCIENCE AND SCIENCE
EDUCATION FEDERAL UNIVERSITY OF TECHNOLOGY
MINNA

IN PARTIAL FULFILLMENT OF THE REQUIREMENT
FOR THE AWARD OF POST-GRADUATE DIPLOMA IN
ENVIRONMENTAL MANAGEMENT, FEDERAL
UNIVERSITY OF TECHNOLOGY MINNA, NIGER STATE.

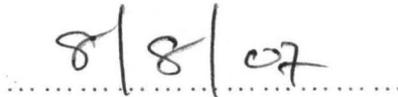
MARCH, 2007

CERTIFICATION

I certify that this research project is an independent work carried out by MAIYAKI KOTO AHMED, PGD/PGS/GEO/05/06/318, Supervised and approved by the department of Geography, Federal University of Technology, Minna. This project meets with part of the requirement for the award of post-graduate diploma in Environmental Management.



§ Dr. A. S. Abubakar
(Supervisor)



Date



Dr. P. S Akinyeye
(Head of Department)



Date

.....
External Examiner

.....
Date

DEDICATION

This project report is dedicated to my beloved children Alpha, Divine, Greatness (Sons), Rejoice, Destiny Torzen (Daughters), their mother and good people of Nasarawa State whom Domestic waste management is their major concern.

ACKNOWLEDGEMENT

To every thing on the earth there is a season, reason, and purpose, a time to be born and a time to struggle. Also there is a time to plant and time to reap the fruit of your labour. Anything that has the beginning must have an end. Praise God for the race is not unto He that runneth but God that showed me mercy to be able to accomplish the task of this research.

My profound gratitude goes to my project supervisor Dr. A.S Abubakar for his intellectual and moral support throughout the programme. I must also tender my gratitude to the head of department, Department of Geography, federal university of Technology Minna in person of Dr. P.S Akinyeye and all other lecturers in the department of geography FUT MX whom I cannot afford to mention their names. May the almighty God reward you a hundred fold.

I must appreciate the kind gesture of the Nasarawa State civil services commission for allowing staff" training and especially the Akwanga Local government for releasing me to go on with the programme.

I will not forget to mention my Director, works Department Akwanga LGC Mr. Silas Boyi, and Dr. Orji Ikechukwu a medical Doctor with Nasarawa state Hospital Board, Ministry of Health Lafia, for their moral advices, encouragements and otherwise. May the good Lord reward you abundantly.

Worthy of thanks also are my colleagues in PGD environmental Management for their co-operation, tolerance and criticism.

Finally my sincere appreciation goes to my lovely wife Mrs Barkisu Ahmed Koto, my son Alpha Ahmed Koto in police secondary school Minna, Divine and greatness, also my beautiful Daughter Rejoice and Destiny.

ABSTRACT

Domestic waste disposal in the urban areas of Nigeria is a serious problem. Due to rapid increase in urban population, the amount of Domestic waste from school environment, Hotels, Restaurants, churches and recreational centers where receptions take place, and many household waste that must be regularly collected, transported and ultimately disposed off has increased tremendously in recent years. As a result, in large part of our cities subhuman conditions prevail as the garbage removal machinery is inadequate to cope with the tasks of sanitation and cleanliness.

Although bold steps have been taken by the government at various levels to combat the waste disposal problem these efforts have not as yet yielded much satisfaction.

The ineffectiveness of these attempts to clean up Nigeria's environment stems partly from the fact that the nation has not been able to fully appreciate the Domestic waste characteristics. It is pertinent to understand both the characteristics of the population and the type of Domestic waste (i.e. Biotic) generated in order to effect a more satisfactory situation.

This project work has attempted to assess the composition rate of generation and problems of refuse disposal and suggest an effective method of waste disposal in Akwanga town.

To accomplish this, strategic points of Education, commercial, Residential (or Household) were studied based on the structural pattern of the town. The methodology comprised the use of questionnaires; other methods used included oral interview collection of primary and secondary information from offices and textbooks. The findings in the study research showed:

- Inadequacy in refuse storage facilities

- Inaccessibility to most of the residential areas
- Inadequacy in sanitation personnel by the LGC
- Rate of Domestic waste generation per day was as high as 0.46 kg/cap.

From the results revealed by the study in terms of refuse composition, rate of generation, problems facing refuse management etc and effective refuse collection is suggested for Akwanga town, which includes: enforcement of order to each household, schools, Hotels and restaurants to have at least a standard refuse dust bin in their house. Also the used of transfer station is recommended in the proposal.

Advice is also given to the Local government as to intensify enlightenment campaign to public on the use of refuse disposal and the need to live in a clean environment.

TABLE OF CONTENTS

Title page - - - - -	i
Certification - - - - -	ii
Dedication - - - - -	iii
Acknowledge - - - - -	iv-v
Abstract - - - - -	vi-vii
Table of contents - - - - -	viii
List of tables - - - - -	
List of figures - - - - -	
List of plates - - - - -	

CHAPTER ONE

1.0 Introduction- - - - -	1-3
1.1.0 Basic concept and classification of domestic waste -	4
1.1.1 The concept of domestic waste - - - - -	4
1.1.2 Degradable and non-degradable waste concept - -	4-5
1.1.3 Composition and quality of waste generation - -	5-6
1.2.0 Statement of the research problems - - - - -	7-8
1.3.0 Justification of the study - - - - -	8
1.4.0 Aim and objective of the study - - - - -	8
1.4.1 Aim of the study- - - - -	8
1.4.2 Objectives of the study- - - - -	9
1.5.0 Scope and limitation of the study- - - - -	9
1.5.1 Scope of the study-- - - - -	9
1.5.2 Limitation of the study- - - - -	9-10
1.6.0 Description of the study area- - - - -	10-13
1.6.1 Population distribution and density- - - - -	14

1.6.2	Urban growth of Akwanga town (the study area)-	-	-	-	-	-	-	14-15
1.6.3	Temperature-	-	-	-	-	-	-	15-16
1.6.4	Rainfall-	-	-	-	-	-	-	16
1.6.5	Wind--	-	-	-	-	-	-	16-17
1.6.6	Geology-	-	-	-	-	-	-	17
1.6.7	Soil and vegetation of the area-	-	-	-	-	-	-	17

CHAPTER TWO

2.0	Literature review	-	-	-	-	-	-	18
2.1	Solid waste management in developed countries-	-	-	-	-	-	-	18-19
2.2.0	Classes of domestic waste generation-	-	-	-	-	-	-	19-20
2.2.1	Domestic waste generation-	-	-	-	-	-	-	20
2.2.2	Commercial wastes generation	-	-	-	-	-	-	20-21
2.2.3	Institutional waste generation	-	-	-	-	-	-	21
2.2.4	Recreational and social waste generation-	-	-	-	-	-	-	21
2.3.0	Domestic waste management strategies in Nigeria as a developing countries-	-	-	-	-	-	-	22-26
2.4.0	Domestic waste management procedure-	-	-	-	-	-	-	26
2.4.1	Refuse collection-	-	-	-	-	-	-	26
2.4.2	Open dump and sanitary land fill-	-	-	-	-	-	-	26-27
2.4.3	Sources reduction and refuse-	-	-	-	-	-	-	27
2.4.4	Incineration	-	-	-	-	-	-	27-28
2.4.5	Recycling of domestic waste-	-	-	-	-	-	-	28-29
2.5.0	environmental and public health impact of domestic waste-	-	-	-	-	-	-	29-30

CHAPTER THREE

3.0	Research methodology - - - - -	30	3.1.0
	Data and computational techniques- - -	30	
3.1.1	Pre-field work- - - - -	30	
3.1.2	Composition of the domestic waste- -- -	30	
3.1.3	Main fieldwork- - - - -	31	
3.2.0	A questionnaire administration and sampling representation.-32		
3.3.0	Data analysis and presentation- - - -	38	
3.3.1	Schematic representation of the research methodology-	38-39	

CHAPTER FOUR

4.0	research finding and analysis- - - -	39	
4.1.0	socio-economic status- - - - -	39	
4.2.0	types of refuse generation- - - - -	40	
4.3.0	Availability of refuse storage facilities-	42	
4.4.0	method of refuses storage- - - - -	43	
4.5.0	method of refuse disposal- - - - -	44	
4.6.0	mode of accessibility from house to the refuse dumping side facilities - -		
	- - - - -	46	
4.7.0	body responsible for final disposal- - -	48	
4.8.0	frequency of refuse disposal- - - - -	49	
4.9.0	locations of refuse dumping side - - - -	51	
4.10	Distances of the dumping side from responding homes-	53	
4.11	amount willing to pay monthly for refuse collection -	54	
4.12	waste generation rates - - - - -	56	
4.13	quality of refuse generation- - - - -	57	

4.14	Effect of refuse dump on the people and their surrounding environment -	57
4.15	bodies/agencies responsible for domestic waste management in Nasarawa State -	58

CHAPTER FIVE

5.0	Summaries of research findings, conclusion and recommendation-	59
5.1	Summaries of findings-	59
5.2.0	Recommendations and conclusion-	60
5.2.1	Proposal on refuses storage-	63
5.2.2	Conclusion-	64
5.3	Reference -	66
5.4.0	Appendix-	68

LIST OF TABLE'S

1.1.3	Classification of domestic waste materials composition-----	5-6
2.2	Type of solid waste in U.S.A -----	19
2.3	Domestic waste generation rates (in kg per household and per capital per day)-----	24-25
3.4	Sampling in representation table in Akwanga Nasarawa state-----	32-33
4.1	Monthly income earners -----	40
4.2	Type of refuse generated -----	41
4.3	Availability of refuses storage facilities -----	43
4.4	Method of refuses storage-----	44
4.5	Method of refuse disposal-----	44-45
4.6	Mode of accessibility from house to the refuse dumping side Facilities-----	47
4.7	Body responsible for final disposal -----	49
4.8	Frequency of refuse disposal-----	50
4.9	Location of refuse dumping side -----	52
4.10	Distances of the dumping side from responded home-----	53-54
4.11	Amount willing to pay monthly -----	55
4.12	Studies on refuse generation rate-----	56-57

LIST OF FIGURES

Figure 1:	Map of Nigeria showing Nasarawa state-----	11
Figure 2:	Map of Nasarawa state showing Akwanga local Government Area-----	11
Figure 3:	Map of Akwanga showing Mada-south District -----	12
Figure 4:	Map of Mada south district showing Akwanga town (study Area)-----	12
Figure 5:	Base map of Akwanga town with structural development-----	13
Figure 6:	Pie chart showing type of refuse generation or origin-----	42
Figure 7:	Pie chart showing method of refuse storage-----	46
Figure 8:	Pie chart showing mode of accessibility to depot-----	48
Figure 9:	Bar chart showing body responsible for final disposal-----	49
Figure 10:	Bar chart showing frequency of refuse disposal-----	51
Figure 11:	Bar chart showing location of refuse dumping site-----	52
Figure 12:	Bar chart showing distance of refuse depot from respondent's residence-----	54
Figure 13:	Bar chart showing amount willing to pay monthly-----	55

LIST OF PLATES

(Terrestrial photographs of waste dumping sites)

Plate I:	Unauthorized dumping site, central primary school ground Akwanga	33
Plate ii:	Authorized dumping site of primary school ground	34
Plate iii:	Refuse dumping blocking drainage/culvert	34
Plate iv:	Opening dumping site at Angwan Salihu Akwanga town	35
Plate v:	Household discharge along the road at Angwan Affi	35
Plate vi:	Dumping refuse along the roadside	36
Plate vii:	Manual dumping site along Andaha/Jos road Akwanga town	36
Plate viii:	Open dump and sanitary landfill	37
Plate ix:	Indiscriminate domestic waste disposal at commercial area	37
Plate x:	Indiscriminate domestic waste disposal at residential area	37

CHAPTER ONE

1.0 INTRODUCTION

Domestic waste refers to household and commercial solid wastes. These are disposed of by or on behalf of the local authority. Waste generation is much lower in developing countries, whereas the USA has more than double the waste generation per person than many European countries, including the UK. (EPA Act UK, 1990)

Domestic waste is the useless, unwanted or discarded material with insufficient liquid content to be free flowing (united state environmental protection agency, 1992). Solid waste from household are substances, materials or objects discarded as worthless or unwanted, defective or of no further value for human economic production activities or process (Adegoke, 1990). The largest increase in domestic waste contribution have been papers, rather than pure water, plastics, beads, glass and metals (tins) reflecting the increasing importance of consumables in society.

Domestic waste are man's unwanted materials which are non liquid and non gaseous and consist of organic matter (easily biodegradable) and inorganic (non biodegradable, which consist of materials such as metals, plastics tins, bottles and broken glasses). Okafor, in 1985 tried to classify municipal waste as those waste generated in urban center and consist of household, garbage's agricultural and industrial garbage's as well as those from recreational activities of man. From

these identification of municipal waste, all domestic waste generated by man, falls in this category. The composition of domestic solid waste in the cities includes food waste paper, plastic and metals, broken bottles, textile, bones, glass, wood and leaves leather, rubber, ceramic, faces, and other remnants.

According to Ogunjobi, (1989), virtually all the states of Nigeria are highly polluted, largely from domestic solid waste, with as many as 25% of the people living in these towns of population ranging from 20,000 to more than 4million. The sanitation and health problems that are engendered by this pattern of urbanization are significant. Estimates put the daily growth of domestic waste in Nigeria at 260,000 cubic meters per year. Informal practices in dealing with this waste-use of a shallow open hole dug in street next to the home, schools or Hotel-lead to stagnant pools, where generated waste and domestic garbage mix and become foul-smelling breeding grounds for insect larva. Piles of garbage often hinder circulation of vehicles and pedestrians. These conditions are considered a major factor linked to the propagation of typhoid fever, dysentery, malaria, hepatitis, bilharzias and guinea worm. Faced with these burgeoning problems, the government is not objecting to those seeking to develop Local private solution to resolve their sanitation and health problems. Such initiative must overcome the popular expectation that it is the government's duty to provide these facilities.

These wastes could be disposed off in several ways to meet sanitary ends, reducing bulk or be recovered and reused. They could be

disposed by incineration, land filling or by reuse for bio fertilizer, biogas, fuel generation and / or reprocessed in or animal feeds (Okafor 1985) for instance most cities in Nigeria do not have sanitary landfill, rather they have unprotected dumps sites located in indiscriminately in the cities, different strategies are used in managing Domestic waste, Adegoke (1990) Reported that waste management involves the collection, transport and storage, treatment and care of the disposal sites. Wastes are dumped in the nearest open space on land and surface water without regard to sanitary condition of the environment.

The study Area Named Akwanga town is a suburban area / Neighborhood or settlement with full characteristic at a complete slum area requiring a full renewal. The town is having occupants with low-income levels and fast-uncontrolled development. Domestic wastes in this state (Nasarawa state Nigeria) have been mostly difficult to manage. These management constraints are lack of available technology, the present socio-economic status of population and changes in food and textiles consumption patterns of people has created a higher level and proportional domestic waste these, therefore necessitates strategies for efficient waste disposal and treatment methods that should be developed in Nigeria in order to provide a healthy environment for its inhabitants.

1.1.0 BASIC CONCEPT AND CLASSIFICATION OF DOMESTIC WASTE

1.1.1 THE CONCEPT OF DOMESTIC WASTE

According to world health organization (WHO) scientific group on treatment and disposal of Domestic waste, (1996), Domestic waste include:- Domestic refuse, sewage and other discarded solid materials such as those from commercial, institutional, recreational and social waste generation.

These can be group into degradable and non-degradable waste

1.1.2 DEGRADABLE AND NON-DEGRADABLE WASTE CONCEPTS

According to the new encyclopedia Britannica VOL 14 1968 P. 752 acknowledge that degradable waste are those reduced in quality by natural process. These include organic waste and thermal discharges. They are converted to stable inorganic materials by bacterial and other organisms. The degradable process uses the oxygen in the water and constitutes natural "self-purification" if however the waters are too loaded with organic mater, degradation without sufficient free oxygen produce intensive odour such as hydrogen sulphur and methane.

Non-degradable wastes are soluble gases or particulate mater (tiny suspended particles). These may include a wide range of toxic metal arising from complex manufacturing process, cadmium, mercury or lead-settleable are suspended solids that are non degradable represent primarily as industrial problem-suspended particles of various sizes

sub-sorb others substances act as nuclei for bacterial growth aid by sedimentation deposit.

This project work will be base on non-degradable Domestic waste collection and disposal in our environment.

1.1.3 COMPOSITION AND QUANTITY OF WASTE GENERATION

WHO expert committee (1971) exported that, because waste are generated from many sources they naturally composed on almost infinite variety of materials, these ranges in size from plastic material to lead. The major constitute domestic and commercial waste are papers and emendable organic mater. The proportions of the constituent of domestic waste collected to a disposal site are virtually constant for a particular town and subject only to a seasonal and long term changes.

Below are the classifications of materials, comprising urban waste. This composition is due to the fact that in Nigeria it has been exceedingly difficult to quantify the amount of domestic wastes that are being generated. Therefore efforts are on the composition.

Table 1. Classification of domestic waste materials composition

TYPE	COMPOSITION/SOURCE
Garbage	These are Domestic solid waste results from food marketing, preparation and consumption that are also regarded as food waste. It contains patricide organic material and can be

	decomposed more rapidly, especially in warm or humid weather it needs special consideration due to its nature of affricating vermin and producing pungent and shocking odours.
Rubbish	This category consists of paper and paper products, plastics, can bottles glass, metals, it also include park and beach refuse. Except for garden wastes, their materials are non-patricide.
Ashes	This is the residual from any combustion process (i.e fire places or coal heating unit etc) resulting from household activities and outsides incineration.
Recreational and social waste	This class includes waste from packaging materials like cans, derived from used food eg. Tomatoes, geisha, soft drinks, paper plates and napkins, straws and troth pick, wrappers from glass cups, biscuits, sweet, packaging bottles of water, yoghurt, plastic cups, spoons, bottles etc.
Institutional waste	Used paper materials, sutures, carboard, obsolete furniture like broken chairs, tables wood, doors, plastic shoes, clothes cartoons leathers and food
Commercial, hotel restaurants and other waste	Polythene bags, polythene film wrappers for baked food, confectionery products, papers cardboards, wood and plastic obsolete furniture and equipments, pure water leathers and bottle cans, food waste rags, plastic and garbage. They decomposed under landfill or incineration.

1:2.0 STATEMENT OF THE RESEARCH PROBLEMS:

Environment being the totality of external conditions influencing the growth and development of an organism these factors could be physical, Biological, social and cultural (Keller, 1976) thus environment is considered abused when an injurious or degrade element is introduced whereby reduces the satisfaction and utility derivable from growing and development within it.

Element that defray or degrade environment are numerous and very from one point to another, but most commonly manifest as solid, liquid and gaseous (Savas, 1976) societal sensitivity of these form of pollutants vary, depending on differences in the level of awareness and technology, socio-economic development, development ideologies and philosophy.

Hence the problems identified in the study area during preliminary survey were as follows:

1. Indiscriminate dumping of refuse, which results in blockage of storm water channels, roads and footpath, drainages, unsightliness and health risk as a result of pollution.
2. Shortage of facilities and resources for collection and disposal of domestic waste.
3. Inadequate awareness of the community on the hazards of indiscriminate refuse disposal.
4. Inefficiency of administrative machinery for management of refuse in the study area.

5. Irregular clearance of waste from dumps. In view of this, it has become necessary to identify this problem and also proffer ways of achieving solution by recommending proposals.

1:3 JUSTIFICATION OF THE STUDY

The 1992 "Earth Summit" of world international conference on environmental protection at Rio de Janeiro succeeded in alerting the conscience of the world to the urgency of achieving sustainable development in our environment. If appropriate measure on rapid urbanization and industrialization are not taken, health of the environment can be threatened (Abubakar, 2001).

This study will assist in providing a guide for effective waste collection and disposal in Akwanga town Nasarawa State. It shall also proffer more conventional means refuse collection and disposal in order to achieve the goal of environmental sustainability.

1:4.0 AIM AND OBJECTIVE OF THE STUDY

1:4.1 AIM OF THE STUDY

The broad aim of the study is to appraise domestic waste generations, collection and disposal in Akwanga town, Akwanga LGC Nasarawa State with a view to evolving in cheaper and sustainable methods of collection and disposal for better performance.

1:4.2 OBJECTIVE OF THE STUDY

In order to realize the above aim, the following objectives will serve as a guide,

1. To examine the conventional method of household/easier and more effective methods of collections and disposal of domestic waste.
2. To determine the effects of various refuse dump on the people in the area.
3. To study, the innovation practice of applying municipal waste renovation and conservation cycle

1:5.0 SCOPE AND LIMITATION OF THE STUDY

1:5.1 SCOPE OF THE STUDY:

This study shall cover an examination of Domestic waste generation, type of collection/disposal and municipal waste re-cycle methods.

1.5.2 LIMITATION OF THE STUDY

The limitations encountered during the course of the study are itemized as follows

1. Some residents or respondents were not willing to answer certain question as a result of guilt and fear
2. Lack of conventional yardstick to measure the volume of refuse generated per day on site
3. Lack of review or availability of master plan of the local government area to plan for future refuse generation site.

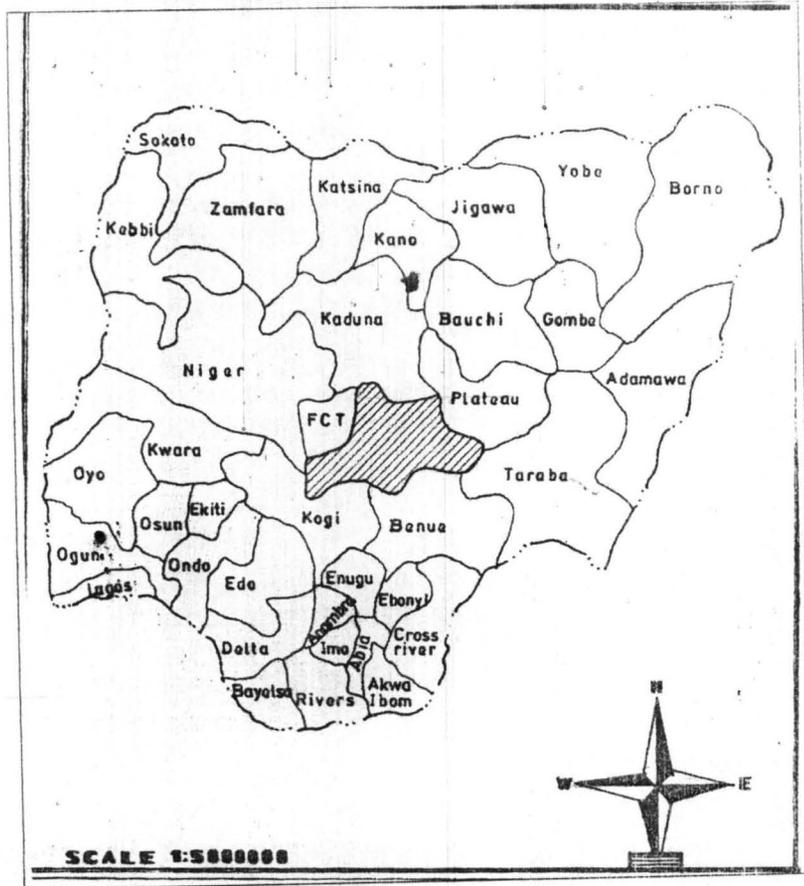
4. The Hotels, restaurants and school premises where most of the Domestic waste are generated could not allowed room refuse/cleanup environment discussion.

1:6.0 DESCRIPTION OF THE STUDY AREA

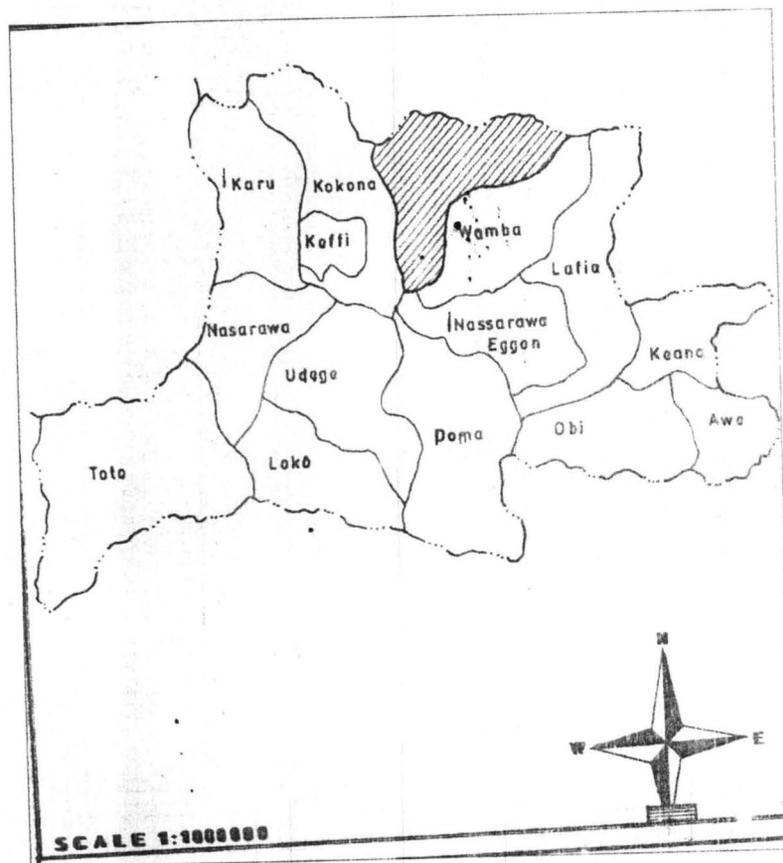
Nasarawa state is situated on a flat land with no part rising above 520 meters (164 ft) above sea level. It lies on latitude 8.5°N and longitude 8°E of Greenwich meridian. By implications, the state is situated within the southern Guinea Savanna region of Nigeria and share borders with Benue and Kogi states from the south, federal capital territories (FCT) from the west, Kaduna state from the North, Plateau state from the extreme north-east and Taraba State from the south-east. Nasarawa state was created on August 1996 during late General Sani Abacha's regime.

Akwanga local government is one of the earlier local government created in plateau state, but now under nasarawa state as a result of the creation of Nasarawa state out off plateau state. The local government is located between latitude 7° North and longitude 6° east it is surrounded by variety of land form features characteristic Jos plateau with height of about 3,000 feet above the sea level MADA Hill, which constitute the most prominent Topographical feature in the local government area. Bounded by Wamba LGC to the east, Kaduna state to the north, Nasarawa LGC to the south and Kokona LGC to the west centrally located for commercial activities it links Northern part of the country through Jos , Eastern part through Lafia Benue (Makurdi) and west through FCT Abuja.

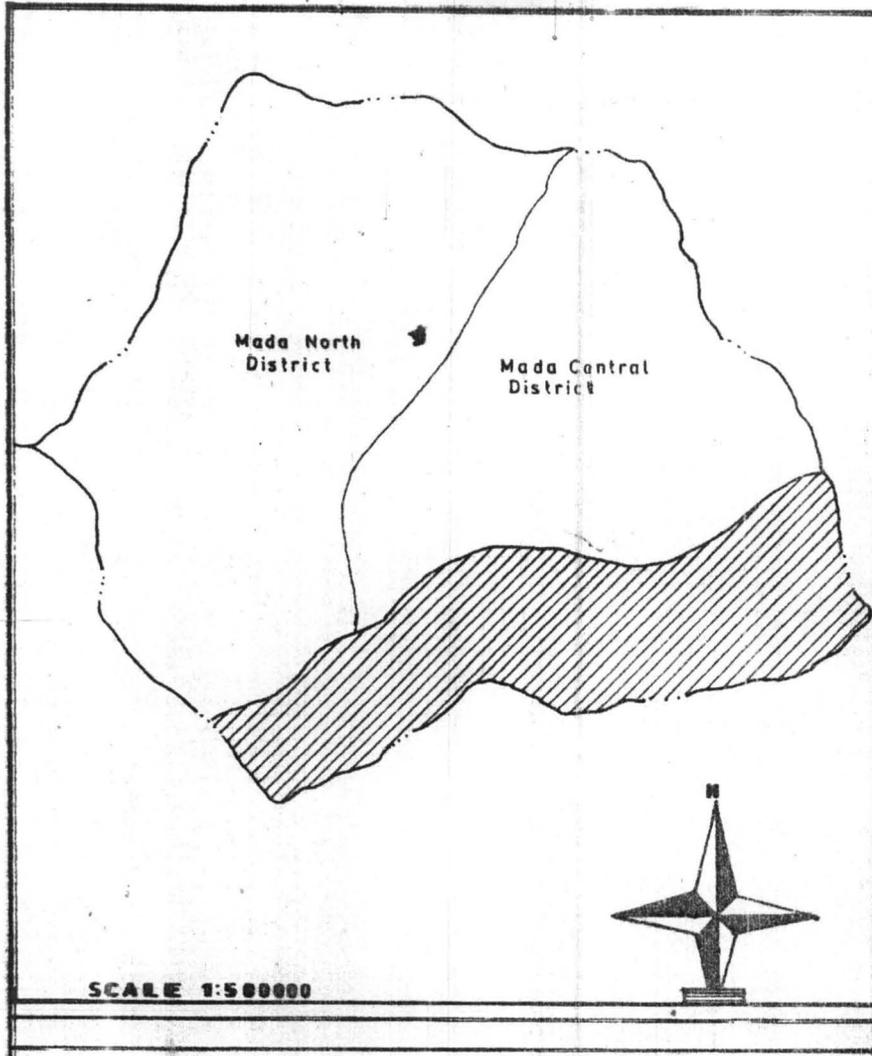
MAP OF NIGERIA SHOWING NASARAWA STATE



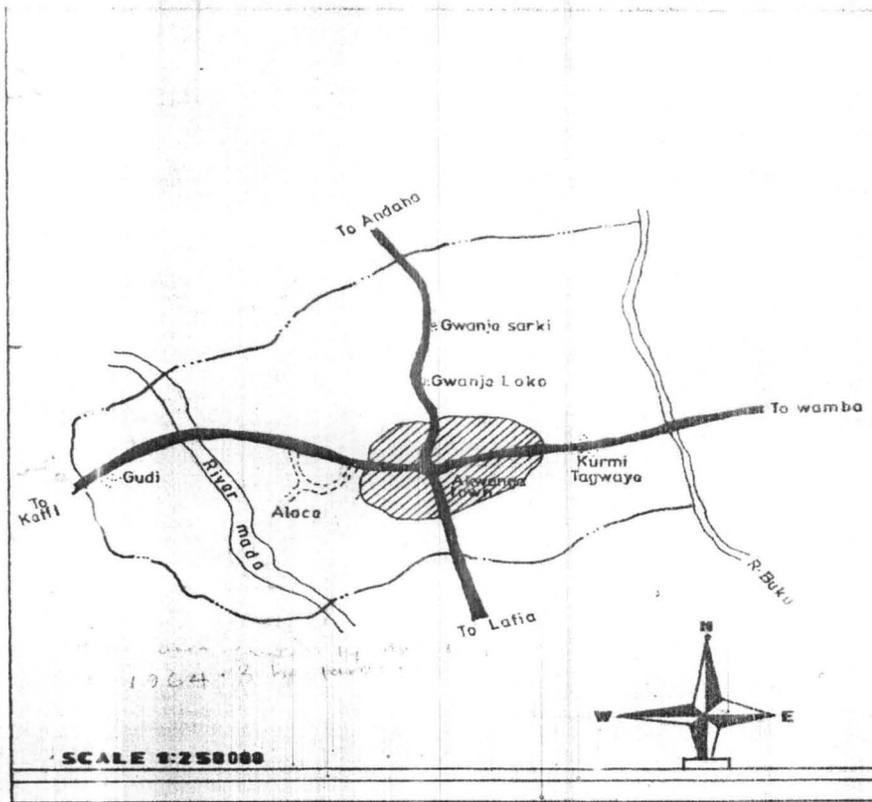
MAP OF NASARAWA STATE SHOWING AKWANGA



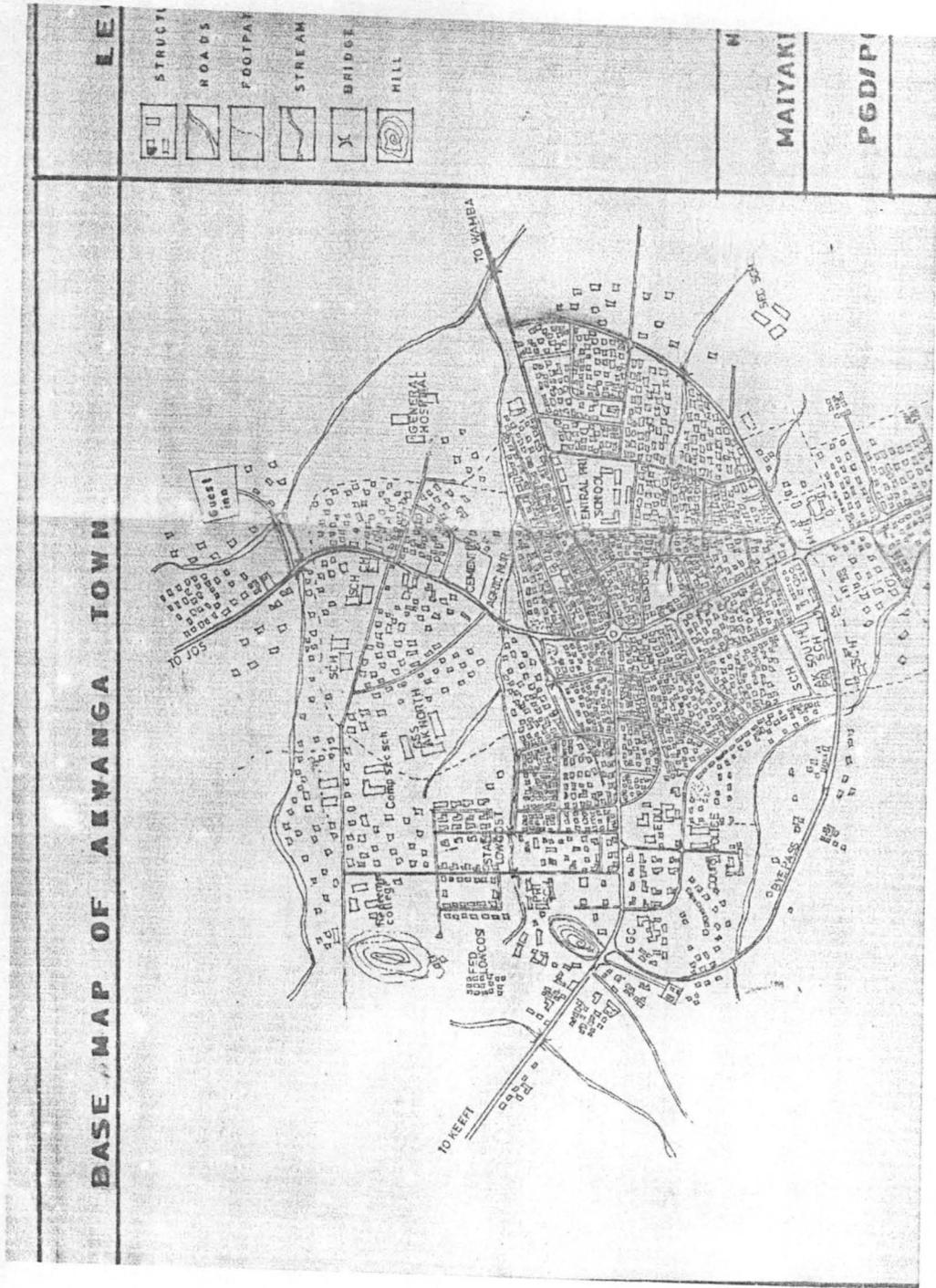
MAP AKWANGA SHOWING MADA SOUTH DISTRICT



MAP OF MADA SOUTH SHOWING AKWANGA TOWN



BASE MAP OF AKWANGA TOWN



1:6.1 POPULATION DISTRIBUTION AND DENSITY

Akwanga town in Nasarawa State has a conservative resident figure of about 518,269 people this statistical figure was provided by the 2006 national population commission headcount.

The total population comprise of about 281,016 males and 237,163 females. It has surrounding environs of about of about 3.628 square kilometers in Area, which can conveniently carry the above population in any circumstances. The population figure was projected by national population commission (NPC) to be 624,514 people as at 2006 based on 2.6% annual increase. To project it further, from the period between years 2010 to 2020, using exponential model with the growth rate of 3.8% according to the master plan will be

$A = PT (1 + r/100)^n$ where pt is the population, r is the increase rate and n is the year intervals.

$$\begin{aligned} A &= 624,524 (1 + 3.8/100)^{2003 - 2010} \\ &= 624,514 (1.038)^7 \\ &= 624,514 (1.35) \\ &= 624,51 \times 1.35 \\ &= 841,629 \text{ people} \end{aligned}$$

Based on the above compilations, Akwanga should now have total population of about 841,629 people including adults and infants.

1:6.3 URBAN GROWTH OF AKWANGA TOWN

Akwanga is settlement which started with only a tent as a farm shelter has expanded greatly to be an urban center which influenced by

tremendous growth in population as a result of growth in commercial, industrial and institutional activities.

The most busiest places in the town includes Jos road, Lafia road, Wamba road and Abuja road just about 500 km from the main round about, Anguwan TV, Hayi Mada, student village (opp. College of education Akwanga) low cost area, Dantsoho/new garage area along Lafia road Akwanga, these areas are highly or densely populated as a result of commercial activities, location of school and private public estates.

With a very high population density and fast developing areas towards Kini country Home Hotel at Andaha road, youth center layout wamba bypass is also developing fast. Behind Ngake village toward Baptist High. Secondary school and redeemer's secondary school this neighborhood is geometrically growing.

Directions of growth also tend toward Kurmi Tangwaye for the location of G.S.S Akwanga and sport Academic. The location of secretariat, Banks, police station and courts at Keffi road has a good phase of development in town. Areas like Angwan Tiv, individual householders, community and local government assistance to revamp this area by providing good access are affecting urban renewal gradually in Akwanga core area. Drainages refuse containers and a host of others determined programmed are gradually put in place. As a result of this trend, more wastes are generated from different activities. This growth must therefore go along with management of Domestic waste planning control for present and future.

1:6.3 TEMPERATURE:

The highest temperature always tend to occur at the end of dry season close to spring equinox, thus March has the highest temperature of about 32⁰C. The lowest temperature occurs in the middle of dry season in December/January with an average of about 24⁵⁰C, when outgoing radiation is encouraged by low humidity, clear sky and longer nights. The lowest monthly mean temperature of the year occurs in the middle of rainy season (August autumn) of about 26⁰ C when the daily range temperature is low.

1:6.4 RAINFALL

Akwanga town experience a marked seasonal rainfall of about 1300mm to 1700mm from may to October. It experience two different seasons namely

- a. A dry season without or with very little rainfall from November to March of about 95mm of all months
- b. A wet season from April to October. The mean rainfall of about 1300mm.

1:6.5 WIND

Akwanga town is determined by the seasonal movement of the inter-tropical convergence zone (ITCZ), which represents the moving frontier between the moist air from Atlantic Ocean and the dry air from arid and semi-arid zone these are the south-west monsoons and north-east trade winds. In winter (September to April) winds are North- Easterly bringing extreme aridity and harmattan. For the remaining months of the year, South-western winds are prevailing, generally, with the wind velocity exceeding 68 km/h coverage-over a

10 minutes interval has only been recorded once during all eleven year period in Makurdi.

1:6.6 GEOLOGY:

Akwanga geological composition from Jos Plateau which is an assemblage of basement complex metamorphic rocks, granites and basalt of two or more ages, the crystalline rock surface chops in steep step to the northern part of lowlands. This consists of rocks of the basement complex covered by shallow soil and shows a number of Iselbergs.

The accumulation of iron and aluminum has occurred, and it hardens by exposure to the surface.

1:6.7 SOIL AND VEGETATION

Akwanga town is situated in the valley between Nasarawa-Eggon and Kaduna. This area is part of the southern Guinea savanna. The vegetation has to a large extent influences extensive agricultural practices. The predominant vegetation type is park savanna which is characterized by a discontinuous canopy shades. Among the trees are the oil bean trees, shear-butters trees, locust bean trees, Isoberline trees etc. A large part of the vegetation is crops and pasture land. The most important crops are yams, Maize, Millet, Sorghum, cassava, cowpea, melon etc.

CHAPTER TWO

2.0 LITERATURE REVIEW

The issue of unsanitary environment is as old as human existence. It can be traced back to ancient times when man first started to converge or congregate into tribes, hamlets, villages and communities. Such waste emanated from human consumption pattern. As a matter of fact, the situation was terrible in the medieval towns as the waste so generated led to the breeding of rat and the eventual outbreak of epidemics, which killed about 50 % of the European in the 14th century. Later, more epidemics emerged which equally resulted into more death falls. (Ahmed, 2000) this essence means that improper environmental management, which may result to population, is capable of translating into a number of serious problems that have the potential of affect human lives.

2.1 SOLID WASTE MANAGEMENT IN DEVELOPED COUNTRIES

In most parts of the world today, there are various way by which domestic waste are being generated, collected and disposed. For instance the survey conducted in the united state of America revealed that 94%of the land disposal sites were inadequate and many state and municipalities have made major strides towards use of sanitary, land fill and other improved processing and disposal practices, (Richard

1995.) About 80% of all community waste in united state is disposed by sanitary land. About 10% is deposited in open dumps and about 10% is incinerated (Richard 1985). Other disposal methods, such as composting salvage and reclamation takes only small portions of the total. Table 2.1 below shows components and proportion of Domestic waste in united state of America.

Table 2.1 TYPE OF SOLID WASTE IN U. S .A

S/ NO	Components	Percentage (%)
1.	Papers	50.6
2.	Food waste	19.6
3.	Metals	9.9
4.	Glass	10.1
5.	Wood	3.5
6	Textile	3.0
7	leathers and Rubber	1.7
8	plastic	1.4
9	Miscellaneous	0.2
	Total	100%

Source: Encyclopedia Americana vol 28

2.2 CLASSES OF DOMESTIC WASTE GENERATION

The environment is made up of land, Air, water and living creatures' inhabiting different parts of it. Unfortunately degradation of the environment though the Act of indifference, ignorance and economic consideration reduces the quality of life and the richness of its bio-diversity. The combined effect of population growth and rapid

industrial libation is the Emergence of high level of environmental degradation with poor waste management as a major contributor.

Therefore the following waste generation occurs.

1. Domestic waste generation
2. Commercial waste generation
3. Institutional waste generation
4. Recreational and social waste generation.

2.2.1. DOMESTIC WASTE GENERATION

These are waste generation from daily human activities at home, which include environmental sanitation, food preparation and consumption of packaged foods (Traditionally prepared for processed by modern methods), discarding of unwanted household items or unserviceable household equipment and old furniture such as cardboard, paper, metal, glass, food matter, ashes, plastic, wood and other household appliances usually leads to huge loads of solid waste. Along with this solid waste is the generation of domestic effluents such as household sewage, water- waste from cleaning, washing domestic utensils, laundry and other similar activities?

2.2.2. COMMERCIAL WASTE GENERATION

Under these category activities includes relating and distributive trade, small medium and large scale commercial expirations resulting in the generation of both solid and liquid waste (effluents), the use of different raw materials derived from agro- allied, chemical and

biological sources often result in the production of unwanted by-products, off-cuts, discarded and imperfect materials which constitute waste requiring proper handling. For instance, in food catering/ services (restaurants) such as fast-food eateries waste from meal preparation, left in most urban areas. They also include waste generated through or discarded by markets, shops, offices and similar businesses such as refuse is growing in importance not only as a result of increasing business activity, but also because there are few opportunities to deal with it on-site commercial waste accounts for 6% (or 25 million tonnes) of total waste arising in the U.K. (waste factsheet info. Progr Aric ACE)

2.2.3 INSTITUTIONAL WASTE GENERATION

These are Domestic solid waste derived from the operations of an institution such as schools, hospitals, and prisons waste produced ranges from paper materials, bottle packages, and Nylon packages. Special handling is required for potentially dangerous waste e.g. in hospitals, international ports and forms using radioactive materials.

2.2.4 RECREATIONAL AND SOCIAL WASTE GENERATION

Social and recreational activities also result in appreciable waste generation. It is always a common sight in the country to see litter of different packaging materials such as cans, paper plates and other sundry items at venues where social gathering, carnivals and religious programmes are held. It is observed that quite a number of Domestic wastes are derived from the operations of social and recreational programmes.

2.4 DOMESTIC WASTE MANAGEMENT STRATEGIES IN NIGERIA AS A DEVELOPING COUNTRY.

The origin of environmental planning in Nigeria can be traced by the enactment of the town improvement ordinance in 1863 by the colonial government in Lagos. It was to control development and urban sanitation in Lagos. It was to control development and urban Sanitation in Lagos (OLa, 1984).

However, the first systematic environmental planning in Nigeria was the township ordinance No. 29 of 1917. This ordinance covers the whole country. The ordinance divided the town into first class, second class and third class towns. Lagos was classed as first class town while all towns along the rail lines and seaports as second class towns and other towns without European, influence were classed as third class towns. The ordinance was also concerned with urban sanitation through out the whole country.

Another attempt to control refuse disposal with the establishment of Lagos town planning ordinance of 1928 following the "BUBONIC PLAGUE" which broke out in Lagos in 1928. This was as a result of the in sanitary environment in 1929, the Lagos executive Development Board (LEDB) was established for that effect clearing refuse to restoring of sanity in Lagos. The Board is now being called Lagos state Development and property corporation (LSDPC) (OLa, 1984).

Until now that the administrative process of physical planning seems to be taking a good shape and Nigerian town and country planning ordinance of 1946 covers the whole country. Also the first organ to formulate and monitor this exercise was the federal ministry of housing, urban Development and environment in 1985 (Arowolo, 1990).

To be candid, proper refuse collection and disposal has for large being an illusion in this country until in 1975 when act tagged "Solid waste Act 1975" was passed by the federal Government for which it assumed the role of solid waste collection, disposal and management. The act clearly stated the responsibilities of each tier of Government, federal, state and local governments.

The federal government is responsible for the research, the technical manpower or assistance and disbursement in accomplishment of sanitary goal. Besides these there are other subsequent acts, programmed and a policy on how sanity could be attained in Nigeria for example in 1984, the environmental sanitation edict was enacted. The aim was to boost the morale of the citizens in the "War against felts and dirt's" and to show that the government was serious in 1985. It enmarked about one million Naira (₦1m) as a prize for the cleanest state. In 1988, the federal environmental protection agencies were set up especially in major cities to combat the filthy nature of our environments.

More so, along the line, Environmental sanitation Board was established at federal, state and local government levels. In the whole, the last Saturday of every month as from 7.00am to 10.00am is set aside specially for environmental sanitation in Nigeria except for other reasons beyond control. To be particular with refuse generated in the country, Adeniyi (1986) discussed the research work of Filani and Abumere where they forecasted for cities (Abubakar, 2001), Table 2.4 below: Shows domestic waste generation rates in some selected Nigeria cities.

TABLE 2.4 DOMESTIC WASTE GENERATION RATES (IN KG PER HOUSEHOLD AND PERCAPITAL PER DAY)

s/no	City	Whole town	Per capital
1	Lagos	2.9	0.34
2	Ibadan	3.3	0.39
3	Oshogbo	2.6	6.43
4	Kaduna	40.0	0.66
5	Suleja	37.0	.63
6	Kano	3.0	53
7	Jos	4.4	56
8	Potiskum	3.6	54
9	Portharcourt	3.2	38
10	Gusasan	3.1	39
11	Aba	2.8	18
12	Onisha	2.9	19
14	Uyo	3.1	21

15	Warri	3.3	41
16	New busa	1.3	10

Source: Adeniyi (1986)

From table above, it is clear to note that no city produces the same volumes of Domestic waste per household and per capital, because their activities differ from one place to another for instance, new Busa generate 1.3 kilos of refuse per household while potiskum generate about 4.4 kilo per household which shown the marked disparity between the two towns. This could be as a result of some towns managing their waste more than the others. It is safe that every where the amount of domestic waste produced each day per person is increasing also as a result of economic, social and technological changes.

Consequently, the rate of waste generation varies at different period or times of the year-during raining season, some areas generations of waste varies at different hour or times of the day. Some areas (per household) generate more waste during the morning hour as they carry out sweeping, tiding and clearing school, House, Hotel, restaurants, and other recreational or commercial places.

In a general survey, areas of high population density and low income earning generate more percentage of waste of up to 80% while low populated and high income generate less waste of 10-20% (Hale1972).

An estimated 12636 tones of Domestic waste are generated in Akwanga town annually as a result of increasing population and urbanization growth.

2.5 DOMESTIC WASTE MANAGEMENT PROCEDURES

2.5.1 REFUSE COLLECTION

Domestic refuse collection is a process of transferring wastes from storage receptacles either directly to the designated dumpsite or nearby temporary communal authorized or unauthorized site. In most cases authorized agency carried out this method, however the united Nations environmental programmed, UNEP (1987) recognized four basic system in waste collection in its guide lines for control of environmental pollution in urban areas. These include communal collection, block collection, curbside collection and door to door types of domestic waste collection.

2.5.2 OPEN DUMP AND SANITARY LAND FILL

open dumps are simply places to dump wastes, while sanitary landfills are engineered operations, designed and operated according to acceptable standards (veslilind, 1975). In land fill operation, the waste is deposited compacted with bulldozers and cover the material with at least 15cm of dirt at the close of each day's operation and a final cover of 60cm when the area is filled. The 60cm is necessary to prevent the rodents and insects from burrowing into the waste and to prevent the release of unpleasant odours from decaying organic matter (Lajide, 2003). The land fill operation is a biological method of waste

treatment into the absence of oxygen; the organic materials are slowly degraded to more stable forms.

2.5.3 SOURCE REDUCTION AND REUSE

Source reduction often called waste prevention is given the highest priority in integrated waste management. It is a preventive action that seeks to reduce the amount of waste that individual household, schools restaurant and Hotel or commercial and recreational places generate. It means consuming and throwing away less.

Another priority of an integrated waste management system is the promotion of his reuse of products and materials. This strategy is very popular among Nigeria. USEPA (2002) stated that when possible, is preferable to recycling because they do not need to be reprocessed before. It can be used again. This is because some people are being compelled to practice reuse do to economic circumstance and not that they are trying to solve the problem of waste disposal.

2.5.4 INCINERATION

Incineration is the burning of waste under controlled conditions, usually carried out in an enclosed structure. Incineration converts waste to energy and reduces the amount of waste for disposal (reduces 20-30% of the original volume and makes product stable).

The benefit of incineration include reduction in the weight and volume of waste, reduction in potential infectivity to medical waste, production of energy which can be recovered partially for electricity

generation and use of bottom ash for materials recovery (south west public health observation, (SWPHO) 2002).

2.5.5 RECYCLING OF DOMESTIC WASTE

Recycling or recovery of source from Domestic waste is the processing of waste material to produce other products. After collection, materials (e.g. textile, leather, ceramics, wood, metals, plastics, paper and corrugated cardboard) are sorted and processed into new materials or products.

A visit to municipal waste dumpsite in cities and town would convince one of the interest and readiness of the people to recycle waste as there is intense scavenging for recyclable materials in the discarded waste. This is unlike the developed world where municipalities have created recycling programmes where individual household, recreational and commercial places separate their recyclable materials in a different container before they are mixed with the rest of their refuse (Medina 2002). The developed countries make use of material recovery facilities (MRFS) which is a plant that uses magnetic and pneumatic equipment, conveyors or belts as well as human sorters to classify the recyclable material sorted and processed for sale to industries.

Recycling also occurs at the household level, particularly in low income areas. This begins with use of plastic, bottles, papers, cardboard and cans for domestic purpose. These materials are

disposed of only when they are no longer of any use to their owners.
(Boadi and Kuitumen , 2003)

2.5.6 ENVIRONMENTAL AND PUBLIC HEALTH IMPACT OF DOMESTIC WASTE

WHO expert committee on domestic waste disposal and control (1971), pointed out the following effects of domestic waste on health aspect. That domestic pollutes and contaminate surface and ground water, where mosquitoes breed. This leads to material damage fever and yellow fever, domestic waste heap up harbor pest and flies which spread germs and cause diseases such as cholera, typhoid and hepatitis. Rats from these sites not only destroy property and infect bites, but are carrier of insects that acts as vector. The plague of the middle ages were directly associated with rats population (vesilind, 1975)

In Nigeria, rivers and streams are polluted by Domestic waste particularly during the raining season when run off water drain to the water bodies. This enriches the water bodies with nutrients such as nitrates. This is known as entrophication. Entrophication promotes algal worm and deprives aquatic organism of oxygen.

Improper disposal of domestic waste is also associated with soul odor and unpleasant sight, particularly when waste is disposed on vacant plots, roads, drainage and other undesirable areas. During decomposition of domestic waste carbon dioxide (Co₂) and ammonia (NH₃) are produced. Co₂ is a green house gas, while NH₂ is an air pollutant of malodorous and potentially toxic nature (Komilis and Ham, 2006). As a green house gas, Co₂ acts in the atmosphere like the

glass of green houses to trap and retain around the earth, heat that would have escaped through the atmosphere into space (i.e. ozone layer), thus, keeping the earth warmer. (Global warming) (Okali, 2005). Garbage collectors can be injured when hazardous materials, broken glasses, used syringes and disposed off property. Hence, the reviews of domestic waste management have underscored the need for proper management from the country.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

The chapter deals with the methods used in gathering data, its presentation and analysis. In a broad term, the methods employed for the purpose of this project are divided into two stages, namely pre-field and main fieldwork.

3.1 DATA AND COMPUTATIONAL TECHNIQUES

3.1.1 PRE-FIELD WORK.

- (a) Preliminary (reconnaissance) survey of the study area was carried out, where the physical nature of the Area was observed.
- (b) A through visit to various Domestic waste generation sectors was accomplished.
- (c) Secondary source of data which was obtained from textbooks, journals, magazines and private agencies associated with Domestic waste management in the area was studied and presented.

3.1.2 COMPOSITION OF THE DOMESTIC WASTE

The field operations were carried out for two weeks by field assistants. A set of instruments and materials including plastic bag "Bag co bag, garden fork were all used for collections sorting and estimating the weight of the Domestic waste in percentage.

Each of the selected houses was supplied with a plastic bag and the occupants were instructed to put all the Domestic waste generated into it.

The Domestic waste was on nylon sheets and by using the garden fork, the waste was sorted into its components viz: leaves, food remnants, papers, polythens or plastic, sand metals and broken bottles, and their percentages. Compositions were established. The mean values for the whole town were computed for.

3.1.3 MAIN FIELD WORK

- (a) Questionnaire administration: A system sampling technique was adopted for the respondents of the area to express their opinion on the way out towards averting wastes management problems in the study area.
- (b) Photography approach to convey the scenic view of the Domestic waste problem areas.
- (c) Regular visit to organization / agency responsible for waste management in the study area, Regular contact was made to Akwanga local government sanitary officials and Nasarawa state Urban Development Board, Development control and sanitary until to address the matter more professionally.

3.2 A QUESTIONNAIRE ADMINISTRATION/SAMPLING REPRESENTATION.

For equal representation of information for all parts of the study area, sixteen neighbor were selected, the sample size of 400 household was chosen..50 copies of questionnaires were distributed and administered randomly in the selected sixteen stations within Akwanga.

The sixteen stations or neighborhood includes, Angwan TV, Angwan Attah, Angwan Kpandom , Angwan Affin, Angwan Abugame, Angwan Hakimi, Kurmin Tagwaye, Angwan Tsebe, Angwan salihu, Andaha/Jos road central, Nkaitse, Ngake, Angwan waziri, G.R.A, Low- cost Estate and Angwan sarki Noma areas in Akwanga town. Table 3:1 below, shows sampling representation in the sixteen neighborhoods within Akwanga

TABLE 3: 2
SAMPLING REPRESENTATION IN AKWANGA NASARAWA STATE

S/No	NEIGHBORHOODS	No Of QUESTIONNAIRE	PERCENTAGE (%)
1.	Angwan TV	30	7.5
2.	Angwan Attah	24	6.0
3	Angwan Kpandom	30	7.5
4	Angwan Affin	30	7.5
5	Angwan Sarki Noma	20	5.0
6	Angwan salihu	30	7.5
7	Angwan Tsebe	20	5.0
8	Angwan Abugame	15	3.7
9	Angwan waziri	10	2.5
10	Angwan hakimi	20	5.0
11	Angwan Ngake	15	3.7
12	Angwan Nkaitse	15	3.7
13	GRA	15	3.7

14	Low-cost Housing Estate Area	4	1,3
15	Andaha /Jos Road Centre	36	9.0
16	Kurmi Tagwanye / Hanya Wamba Road Area	15	3.7
	Total	400	100.0%
Source: Field survey March 2007			

3.3 TERRESTRIAL PHOTOGRAPHS OF WASTE DUMPING SITES



Unauthorized Dumping Site Central Primary School Ground Akwanga.



Authorized Dumping site at Primary School Ground



Refuse Dumping Blocking Drainage /Culvert



Open Dumping Site Angwan Salihu Akwanga Town



Household Discharge along the Road at Angwan Affi



Dumping Refuse along the Road site



Manual Dumping site along Andaha /Jos Road Akwanga Town



Open Dumping and Sanitary Land Fill

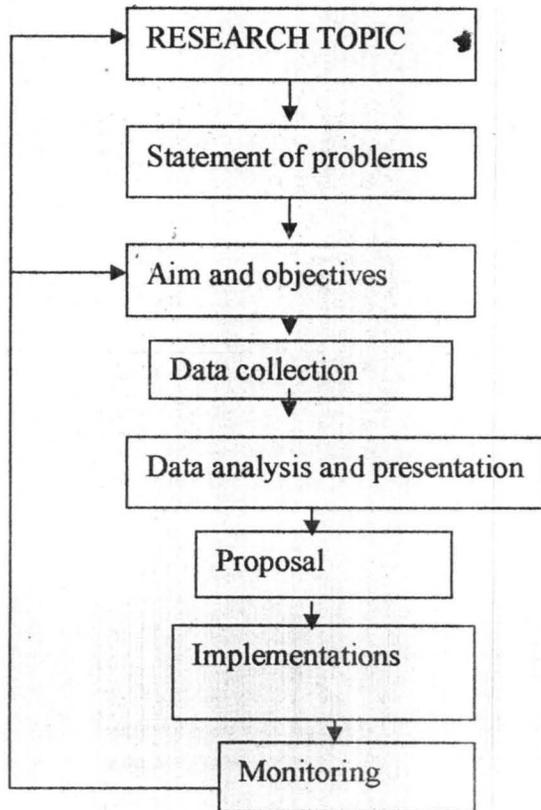


Indiscriminate Domestic Waste Disposal at Commercial Area

3.4 DATA ANALYSIS AND PRESENTATION:

For the purpose of this study, data collected from all sources which includes pre-field and main field work are organized and necessary part are stored respectively the not come of the research findings will be presented inform of figures and per cent ages. The may also be featured graphically through maps tables and plates. Figures and percentages could be presented inform of bar charts may be used for the basis of proposals and recommendations. Implementation and monitoring is the last stage of this research methodology, which needs to be reviewed if the need arises.

3.4.1 SCHEMATIC REPRESENTATION OF THE RESEARCH METHODOLOGY.



CHAPTER FOUR

4.0 RESEARCH FINDING AND ANALYSIS.

4.1 SOCIO- ECONOMIC STATUS

All classes of people in Akwanga local Government in Nasarawa state are involved in manual and mechanical operations and processing activities, which are the basic fundamental causes of different types of waste generated within the Area. Obviously, when there are activities, waste exists whether small or in large quantity depending on the type of activities taken place at a point in time.

areas. The rate of Domestic waste generation depends and varies from one density to the other. Off-course high density area such as Angwan Tiv, Angwan salihu down to Andaha / Jos road, Angwan Affi, Angwan Kpadom and Angwan attah are found within the core area of the old city. Medium density areas are Nkaitse , Ngake , Angwan waziri and Angwan mbugame wamba road Areas while the low density are the G.R.A and low-cost housing estate Neighborhoods. This also explains generation in different quality as indicated in table 4:1 below.

TABLE 4:1 MONTHLY INCOME EARNERS.

CLASSES OF PEOPLE	MONTHLY INCOME	NO.OF RESPONDENTS	PERCENTAGE
Low income Earners	Less than ₦ 5000	166	41.5
Medium income Earners	₦500-₦10,000	146	36.5
		88	22.0
High income Earners	Above ₦ 10,000		
		400	100%

Source: Field survey march 2007

4.2 TYPES OF REFUSE GENERATED

According to the survey conducted, it was revealed that 63% percent of the refuse generated belong to domestic type. This implies that

various types of refuse generated, domestic refuse accounted for the highest. Of the total percentage from domestic 65.5% percent comes from old city (core area) while the remaining 34.5% comes from new town (GRA).

The commercial refuse accounted for 10.05%. Out of this 10% is from old part of the town. This commercial refuse originate from commercial activities e.g. shops, printing and workshops etc.

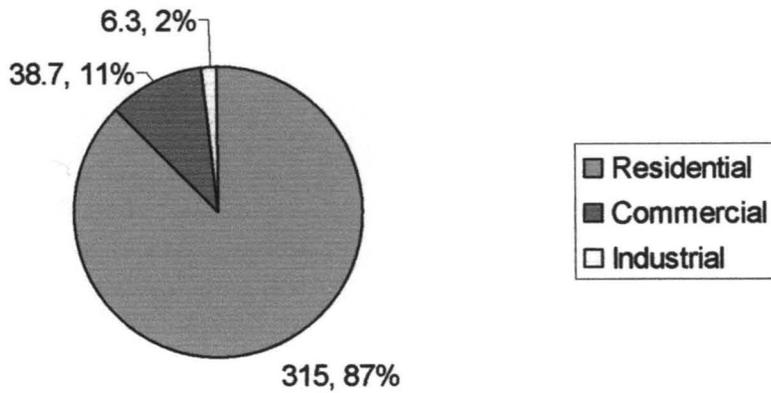
Industrial refuse accounted for 3.9% percent. These are refuse generated from yam flour and rice milling industries and also carpentry workshops which are counted to be light industries. Recreational and social activities also result in appreciable waste generation of about 12.5% while the operations of institutions such as schools, hospital and prisons produced ranges from paper material, bottle packages and nylon packages is 11.0% (fig. 4.2)

TABLE 4.2 TYPE OF RESUFE GENERATED

Origin / Type	No. of respondents			Total %
	Old Town	New Town	Total	
Domestic	73	75	225	63
Commercial	40	19	43	10.05
Industrial	10	10	7	3.95
Social/Recreational	49	25	50	12.00
Institutional	31	21	45	11.00
Total	250	150	400	100%

Source: Field Survey 2007

TYPE OF REFUSE GENERATED /ORIGIN



4.3 AVAILABILITY OF REFUSE STORAGE FACILITIES

In table 4.3 the availability of refuse storage facilities on ward bass is shown. It is apparent that 58.25% percent of the total sampled has storage facilities of various kinds used to store refuse. These facilities could be carton, sacks bucket or dustbin. Moreover, the table shown that 41.75% percent of the sample have no refuse storage facility at all. From the total 35.0% percent is from old town while the remaining 6.75% percent came from the new part of the town.

Out of the percent of those that that have storage facility, 30.7% percent came from the core area of Akwanga, while the remaining 27.

5% percent are from low-cost GRA. The higher percentage in the number of those that have refuse storage facility could be said to be as a result of educational standard and economic differences that exist between core areas and new areas of the town.

Most of the residents in the new part (GRA) have money to buy dust bin and more so they are aware of the impact un-kept refuse will have on the health of the individual and the environment in general fig. 4.3

AVAILABILITY OF REFUSE STORAGE FACILITY (TABLE 4.3)

Available	No. of respondents		Total	Total %
	Old Town	New Town		
Yes	No. % 100 (27.5)	123 (30.7)	233	58.25
No	140 (35.0%)	27 (6.75)	167	41.75
Total	250	150	400	100.00

Source: field survey 2007.

4.4 METHOD OF REFUGGE STORAGE

As shown in table 4.4, 22.3 percent of the total surveyed have standard dust bin with cover. Of this total 18.25% percent come from new area while the remaining 4.25% percent come from core area of the town. 26 percent of the respondents surveyed, stored their refuse in bucket for collection or disposal and 4.5 percent store their own in cellophane bag or sacks, 5.25 percent of the total surveyed stored their refuse in cartons. The number of respondents that do not kept their

refuse is 41.75 percent. This number corresponds to the number of those that have no facility for waste in table 4.4 and fig. 4.4.3

METHOD OF REFUSE STORAGE (TABLE 4.4)

Origin/type	No. of respondents		Total	Total %
	Old town	New town		
Cellophane	No. %	05 (1.25)	18	4.5
	13 (3.25)			
Dust bin	17 (4.25)	75 (15.25)	90	22.5
Bucket	73 (8.25)	21 (7.75)	104	26.0
Un-kept	140 (35.0)	27 (6.75)	167	41.75
Carton	67 (1.75)	14 (3.3)	21	5.25
Total	250 (62.3)	150 (37.3)	400	100.00

4.5 METHOD OF REFUSE DISPOSAL

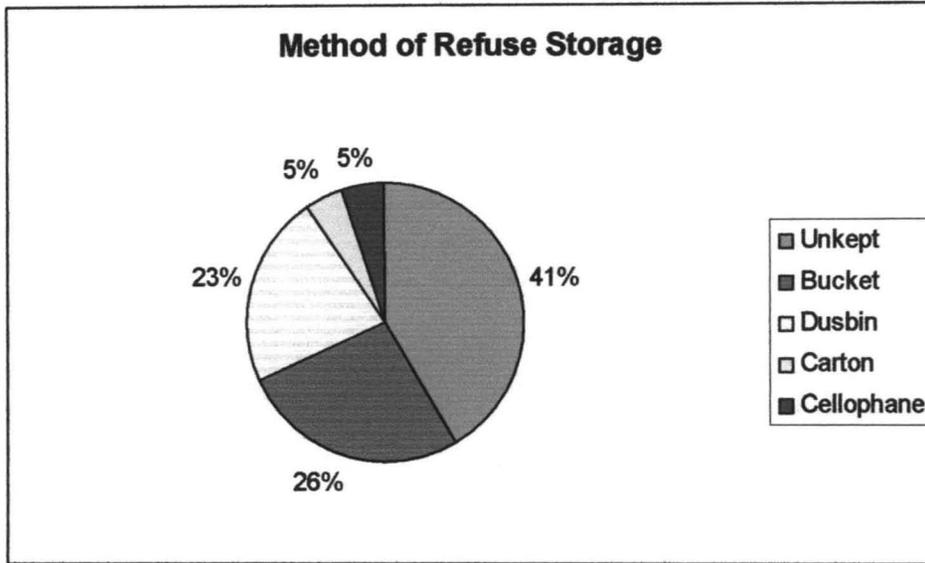
Table 4.5 gives a brief summary of the result on available method of refuse disposal. 41.75 percent disposed their refuse on government open dumping site (authorized). The remaining 58.25 percent constitutes other methods of refuse disposal which are mostly unhygienic and pose health hazards. Such methods include burning which accounted for 20.25 percent. Open space 21.0 percent (unauthorized). 6.5 percent thrown into the bush. 10.5 percent tipped their refuse into drainage or stream. The multi million naira drainage constructed by the government is almost full of refuse as it can be shown in table 4.5

TABLE 4.5 METHOD OF REFUSE DISPOSAL

Method of refuse disposal	No. of respondents		Total	Total %
	Old town	New town %		
Burning	67 (16.75)	14 (3.50)	81	20.25%
Open space unauthorized	84 (21)	--	84	21.0
Into the bush	-- --	26 (6.5)	26	6.5
Govt. refuse dump site	75 (18.75)	92 (23)	167	41.75
Tipped into drainage	21 (6)	18 (4.5)	22	10.5
Total	250	150	400	100.00

Source: field survey 2007.

Of the 20.25 percent that disposed their refuse by burning, 10.75 is from old city (core) residential area while 3.5 percent is from new residential layout of the town. (Fig. 4.5)



Source: Author's field survey.

MODE OF ACCESSIBILITY FROM HOUSE TO THE REFUSE DUMPING SITE FACILITIES

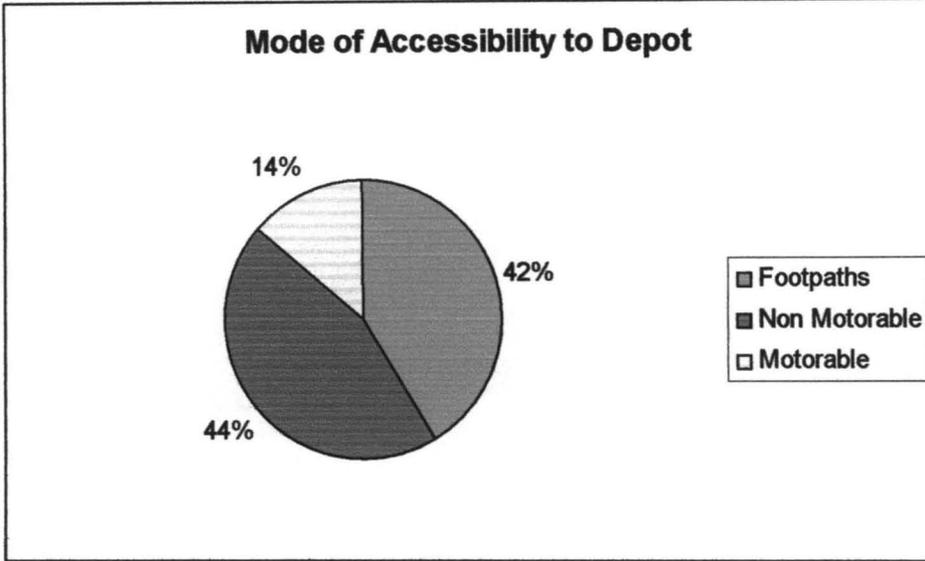
The data in table 4.6 shows that most of the respondents, 41.5 percent have access to the refuse dumping through footpath and they are mostly in the core area of the town. This makes house to house refuse collection a little more difficult with vehicle in the core area. Further, in the table it also revealed that 14.50 percent are motorable. Out of this total 12.75 percent are from the old part of the area while the remaining 31.75 new residential area. The implication or analysis shows that virtually all the houses in the new area are accessible by vehicles and houses to house collection can be easily carry out.

14.0 percent of the total respondents surveyed are of the opinion that the road that leads to the dumping site are not motorable because they are narrow, rugged and rough and more so it makes it difficult for

vehicles to get access to such site. Fig. 4.5 shows the bar chart of the mode of accessibility to refuse dumping site.

MODE OF ACCESSIBILITY FROM HOUSE TO THE REFUSE DUMPING SITE FACILITIES. (TABLE 4.6)

Mode of accessibility	No. of respondents		Total	%
	Old town	New town		
Footpath	166	--	166	41.4
Motorable	51	127	178	44.5
Non-motorable	33	23	56	14.1
Total	250	150	400	100



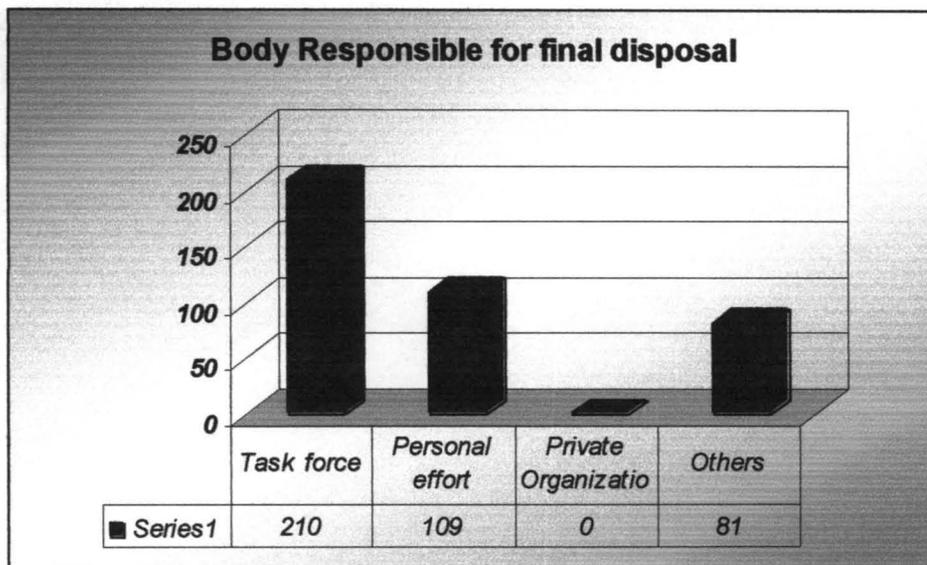
4.7 BODY RESPONSIBLE FOR FINAL DISPOSAL

Table 4.7 displays body responsible for final disposal of refuse. According to the table, it shows that 52.5 percent has their refuse being taken care of by task force on sanitation. Of the total 28 percent are from the old area part of the town (i.e core area), while the remaining 24.5 percent are from new town. Collective or personal effort accounted for 27.25 percent of disposal. This includes those that burn their refuse and those that tipped their refuse into the drainage. 20.25 percent and accounted for those who disposed their refuse through other means e.g through wheelbarrow. From the result it can be disclosed that the final disposal of refuse which ought to be the responsibility of the government has been neglected. Fig. 4.6 shows the bar chart.

Table 4.7 BODIES RESPONSIBLE FOR FINAL DISPOSAL

Body responsible	No. of Respondent			Total %
	Old town	New town	Total	
Task force on sanitation	112	98	210	52.5
Collection/personal effort	57	52	109	27.25
Private organization	--	--	--	--
Others	81	--	81	20.25
Total	250	150	400	100

Source: Author's field survey.



Source: Author's field survey.

4.8 FREQUENCY OF REFUSE DISPOSAL

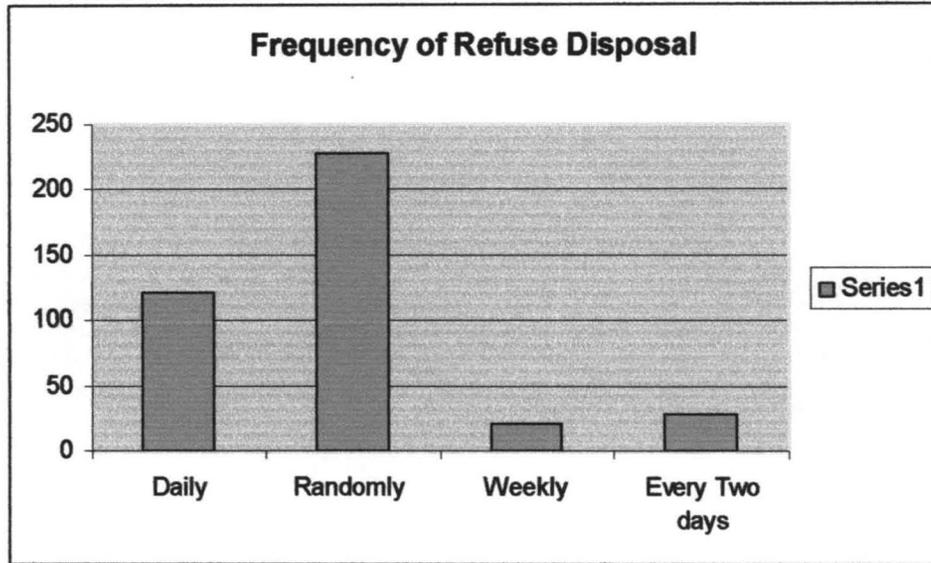
Table 4.8 illustrates the frequency of refuse disposal. Daily disposal accounted for 30.5 percent of the total surveyed. From this figure 21.0

percent are from indigenous core area, while the remaining 9.5 percent are new area. The total figure of daily disposal is very small in that refuse have to be disposed everyday as soon as it will result to decomposable material. Usually present in the refuse and more so, scavenging animal, May scattered the waste on the ground again. Those that disposed their refuse randomly accounted for the highest. They are the people who disposed their refused when they feel so or when the containers are filled. The resultant effect of this is that there will be accumulation of refuse and scattering of the refuse which litters the environment. 34.25 percent of those disposed randomly come from core area of the town and 22.75 percent from the new area (fig 4.8)

FREQUENCY OF REFUSE DISPOSAL Table 4.8

Frequency of refuse disposal	No of respondents		Total	Total %
	Old town	New town		
Daily	No % 84 (21)	No % 38 (9.5)	122	30.5
Randomly	137 (34.5)	91 20.75	228	57.5
Weekly	7 (1.75)	11 (3.5)	21	5.25
Every days	22 (5.5)	7 (1.75)	29	7.25
Total	250	150	400	100.00

Source: Author's field survey 2007



Source: Author's field survey.

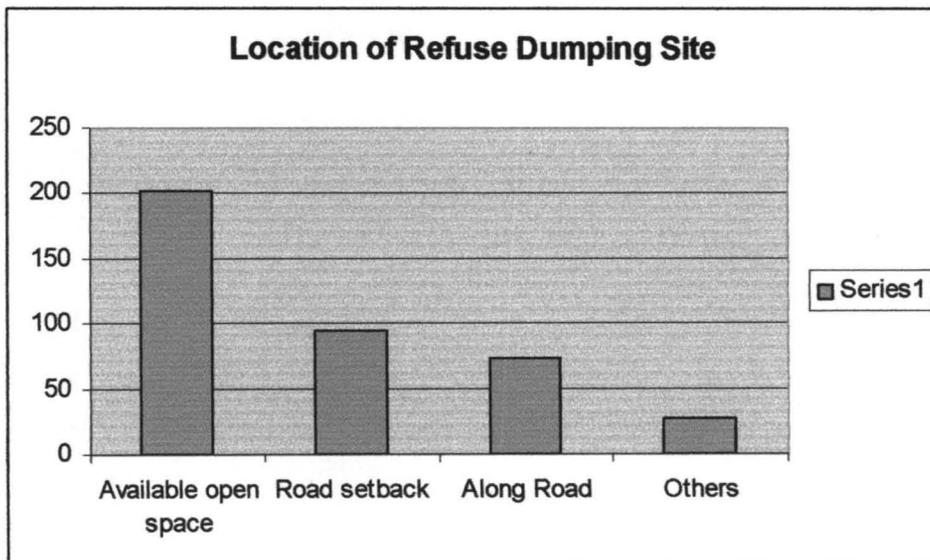
4.9 LOCATION OF REFUSE DUMPING SITE

The data in table 4.9 shows the respondent's view on location of refuse dumping site. 18.5 percent accounts for refuse dumping site located along the road side. Dumping site located on available open space accounted for the largest location (50.5 percent). The implication of this on the environment is that when left uncollected it will be accumulated and serve as an eyesore and pose health hazards to those living within such environment 24.25 percent responds that their refuse site is located within the road set back while 6.75 percent are located at other various location such as backyards, fig 48

LOCATION OF REFUSE DUMPING SITE (table 4.9)

Location	No	of				
	respondents					
Along road	No	%	No	%	74	18.5
	44	(11)	30	75		
Within road set back	46	(11.5)	51	12.75	97	24.25
On available open space	133		69	(17.25)	202	50.5
	(33.25)					
Others	27	(6.25)	-	-	27	6.75
Total	250		150		400	100.00

Source: author's field survey 2007



Source: Author's field survey.

4.10 DISTANCE OF THE DUMPING SITE FROM RESPONDENT'S HOMES

Table 4.10 shows the distance of dumping site from respondent's place, those that have their refuse site located at a distance less than one kilometer accounted for 48.75 percent. From this total 24.75 percent are from core indigenous Angwan of the town while the remaining 24.0 percent are from new part of the area.

Those that have to travel a distance between one kilometer and two kilometer accounted for 32.5 percent. This long distance journey before getting to disposal site discourage the public leading to

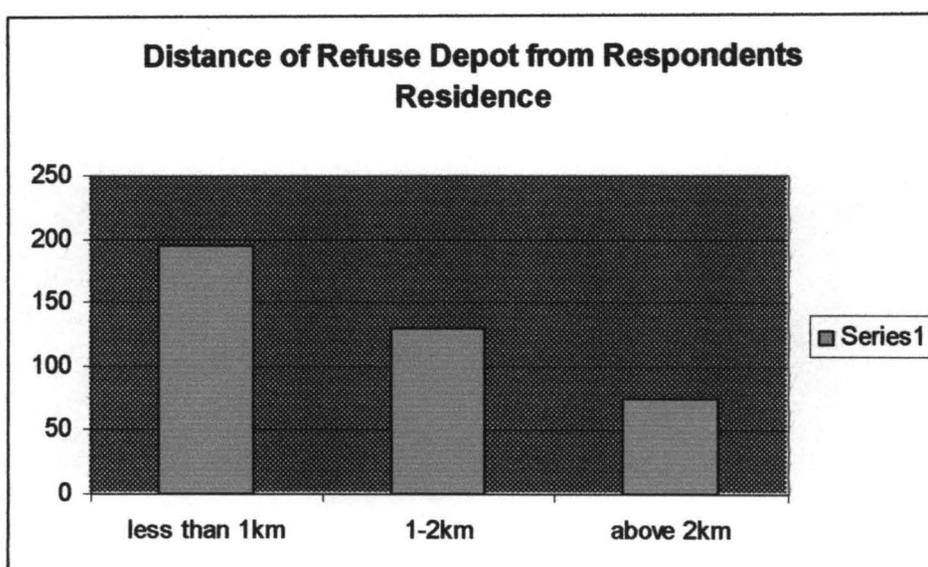
Disposal of their refuse on the way in any of available open space, drainage, gutter even along the street. The consequence of this is that refuse constitute an eyesore as they are hardly evaluated to final disposal points. Neither the state government nor, the municipal (local) governments have worked out any effective ways of domestic waste disposal.

DISTANCE OF THE DUMPING SITE FROM RESPONDENT'S RESIDENTS Table 4.9

Distance	No of respondents			
	Old town	New town	Total	Total %
1 km on	No %	No %	195	48.75

	99 (24.75)	968 (11.5)		
1 - 2 km	84 (21.0)	16 (11.5)	130	32.5
2 km	68 (17.0)	7 (1.75)	75	18.75
Total	250	150	400	100.00

Source: Author's field survey



4.11 AMOUNT WILLING TO PAY MONTHLY FOR REFUSE COLLECTION

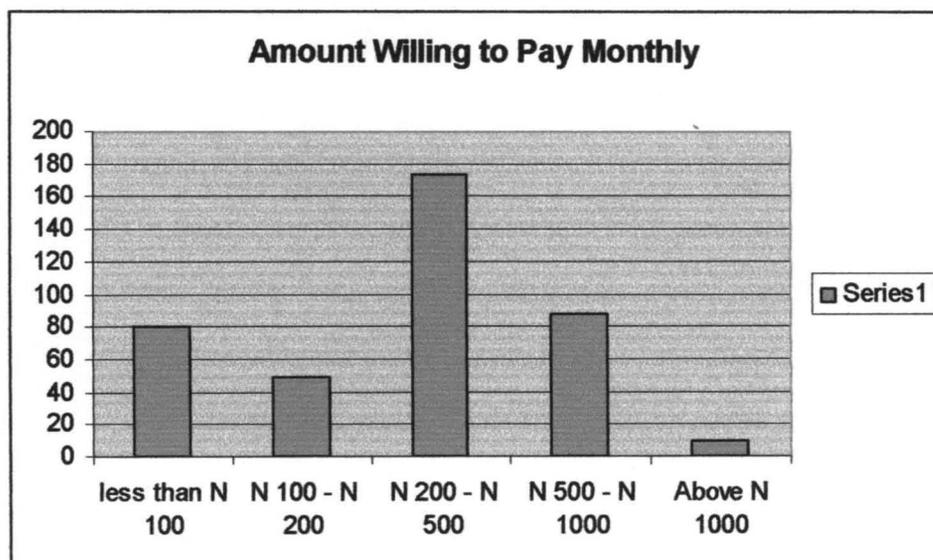
The data on table 4.11 shows the summary of the amount people are willing to pay if users charge are introduced for their refuse collection by the government, 20.0 percent accounted for those ready to pay less than one hundred naira monthly, 27.25 percent are willing to pay between 100 naira to 200 naira for the low income group and 22.0 percent between five hundred naira to one thousand naira monthly for

their refuse to be disposed appropriately by the medium and high income rate (earners).

Amount willing to pay monthly table 4.10

Amount	No of respondents		Total	Total %
	Old town	New town		
Less than N 500	No % 56 (14.5)	No % 24 (6)	80	20.0
N500-N200	82 (6.5)	27 (6.5)	1041	27.25
N200-N500	62 (15.5)	32 (13)	174	28.5
N500-1,000	45 11.25	43 (10.25)	88	22.0
Above 1000	N5 (1.25)	1 (1)	9	2.25
Total	250	150	400	100.00

Source: Author's field surveys.



Source: Author's field survey.

4.12 WASTE GENERATION RATES

Securing comparable data is difficult. It appears that efforts to collect and weigh samples also involved surveying of the residents participating in the sampling effort for the purposes of establishing generation rates, but due to the uncooperative attitude of the people the generation rate could not be determined. In view of this, various studies that have been carried out on generation rate are presented in the table below (table 4.12) and the result of the one carried out by world bank in Kano is chosen as the assumed generation rate for Akwanga (0.16kg/cap/day.)

World Bank study on Kano was chosen purposely because Kano and Akwanga is located in the northern belt of Nigeria and more so, Social and economic characteristics that affect the rate of generation that are similar.

STUDIES ON REFUSE GENERATION RATE (Table 4.12)

Source	Area where applicable	Generation rate/exp/day
Filanni and Abumere (1983)	Nigeria	0.4kg
G&C international (Nig ltd 1978)	Enugu	0.4kg
Usepa (1979) Nig eny Akency	Developing countries Nig in particular	0.5kg

World Bank survey (1987)	Dev. Countries (Kano Nigeria)	0.46kg
Madaren intern (1970)	Ibadan	
World bank project	Domestic waste planners (combined rate)	0.5 to 0.4kg

Source: world bank (1983)

4.13 QUANTITY OF REFUSE GENERATION

Before a determination can be made of the type of waste management plan which would be most effective, the quantity of waste generated within the area to be managed must be estimated to the highest degree of accuracies possible. This is necessary to properly site and design a waste management facility, whether it is a composting recycling, incineration or landfill facility. It is also necessary in order to estimate the cost of implementing and operating the program as well as the amount of labour, which will be required. The facilities should be able to handle both current waste generation loads and any anticipated increased in generation.

4.14 EFFECT OF REFUSE DUMP ON THE PEOPLE AND THEIR SURROUNDING ENVIRONMENTS.

The survey revealed that about 81% of respondents accepted that refuse dumps affect them directly and indirectly. While 19% of the

respondents answered no to the effect of solid waste dumps as it affect them, listed numbers of ways it affects them. These include unsightliness, blocking roads, polluting their natural sources of water supply, defray or degrade natural environment and at worst bring home disease carrying organisms causes malaria and amoeboid dysentery.

4.15 BODIES/AGENCIES RESPONSIBLE FOR DOMESTIC WASTE MANAGEMENT IN NASARAWA STATE

The study revealed that there are three bodies responsible for domestic waste management in Akwanga, namely; government agencies which include Nasarawa Urban Development Board, Nasarawa State Environment Agency now called Ministry of Environment, local Government Sanitary Department. Non-Governmental (NGOs) include the private sectors associated with solid waste management and lastly the communal effort which include the jointed efforts of the inhabitants on waste management.

However, the survey revealed that communal efforts on solid waste management constituted the highest proportion of about 74.2% of the respondents, 21.5% of governmental effort to the management of waste and Non-Governmental agencies accounted for about 4.3% of the respondent. The above expressions reveal the lapses from both Governmental Organization and non-government organization. Hence, there is a need for improvement both sides.

CHAPTER FIVE

SUMMARY OF RESEARCH FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.0 SUMMARY OF FINDINGS

The longing surveys, observations, interviewing and administration of questionnaires through random sampling techniques of 400 choice sample size has brought to light the various methods available for Domestic waste generation, collection and disposal in the study area.

Therefore, the followings form a summary of my research findings based on a tentative understanding of the problems and prospects in the area.

Several problems are responsible for the inadequacy of the domestic waste management, collection, transport and disposal in Akwanga town as it was reveal in the survey the major of these are outline below:-

- i. Any sort of receptacle is being used has households storage bin while in some places it is too small and grossly inadequate. In others it is too big thereby causing problem crew. And in many instance the bins lack covers causing flies breeding and objectionable and odours.
- ii. The depots available in some Angwans are grossly inadequate, the capacity is too small and the frequency of collection from available depot is not enough. This manifest itself in the waste dumped at the sites of the over-filled depot.

- iii. Some areas of the town still do not receive collection services and many others have inadequate service. This problem also manifests itself in the occurrence of wastes in dawn and available open space.
- iv. There are not enough collection Lorries and crews to collect the generated filled wastes in the town. The disposal sites are located at the edge of the public road and the buffer zones have been encroached upon by the developers, hence the operations are visible to the public who are often attracted by what they see.
- v. The disposal method that is supposed to be in operation is being grossly abused and the disposal operation as it were does not conform to the principles of engineering.
- vi. There is little or no generated data. This does not allow for proper planning of efficiency or some planning for the future.
- vii. The distance of the refuse depots to most of the respondents' residence or users is too far.
- viii. Food remnants accounted for the highest composition.

The estimated volume of refuse generation in the next ten years i.e. 2017 is 110002.56Kg/Cap/day. This assumed generation rate for Akwanga is 0.15Kg/Cap/day.

5.1 RECOMMENDATION AND CONCLUSION

The recommendations given here are based on the findings of the study. These are the recommended strategies, Enlightenment campaign.

This is the first stage, if any government programmed or policy on environmental sanitation should work. The government should increase the level of awareness on the need for a clean environment, the likely or possible negative effects of refuse littered environment. This foreign objective could be achieved through mass media, distribution of information, hand bills, stickers, posters etc. possibly committee forum should be organize to discuss the nature, and motoring the refuse depots. Training of environmental sanitation personnel e:g Community health supervisors, sanitation inspectors etc. should be intensify. As aware, the functions of sanitary inspector were numerous, but the major among them was going from house to house to check on the general cleaning ness of the housing environment. By so doing, it would alert the individual to take care of refuse within it vicinity. The people should encourage to have "plastic or mental containers" (Dust bin) if possible two per house hold the state government should provide more vehicles for collection of domestic waste generated from home. More so, more staff or workers should be employed to cope with the ever increasing refuse generation. But legal and financial backing should be giving to the task force on sanitation to enhance effective operation.

User charge should be introduced to supplement government effort on refuse management. Although it is pertinent to recall here the usual view that people are reluctant to pay for public services. This is erroneous. In most cases even the poorest people are prepared to pay for public services if such services are provided are readily available. Report finding as it show in the findings that 17% in the indigenious

areas are only to pay between N 500 to N 1000. What has generally failed is the delivery system for many of those services. What most people resent and are reluctant to pay for service that are not provided or not adequately provided in most part that most people can afford to pay full cost for services supplied at the appropriate standards. For the small proportion of the population in absolute poverty minimal services could be supplied on subsidized terms. If the services are adequately provided therefore, most people can afford and are willing to pay for the services.

The individual or groups can organize themselves into groups and make efforts to clean up environment regularly, widening of roads, footpaths and provision for refuse dumping facilities in each community, technological and financially practicable within the limit of government resources should be adopted. Strict enforcement of sanitary regulation or bye-law is also of tremendous importance. Creation of transfer stations most especially in old indigenous area cannot not be over emphasized as they have been found to improve productivity in advanced countries e:g Florida U.S.A as these minimize waste of productive time.

A good city layout by urban planners to ease accessibility is a prerequisite. This facilitates easier planning for collection and disposal of refuse by facilitating vehicle access to most parts of town and upgrading the slum area if possible.

Now that government is spending a huge sum of money on road rehabilitation, education etc through FERMA the same treatment should be extended to refuse management. This fund could be used to buy equipments and training of sanitation personnel. Availability of the right type and quantity of equipment are critically important and this must be accompanied by or backed up with a good and reliable replacement and spare parts schedule and a good preventive maintenance system. This requires maintenance of a well equipped mechanical workshop, with adequate skilled and competent technical personnel. This ensures that sufficient numbers of refuse equipment are operational at any time, so that interruptions in refuse collections and disposal are minimized. And non – productive time reduced. As the government are ready to set aside certain amount of money from petroleum income the same thing should done to refuse management so that enough fund will be available.

5.1 PROPOSAL ON REFUSE STORAGE

Refuse storage: here the proposal is that individual should have standardized refuse waste bins as in fig. 5.1. This waste bin could be galvanized on plastic bins with lids or covers.

The refuse can be stored in this containers pending the time the collection crews will come. It can be use in both old part of the town and the new area.

Collection/transportation of refuse: because of the differences in structural patterns that exist within the study area i.e. in terms of accessibility, it is impossible to give single or the same collection method in both areas. In the new part of the town house to house collection system is proposed. Here the collection vehicles or crews will go directly from house to house and collect the refuse empty into the vehicle and transport it to final disposal site.

In the older part (indigenous core area) where most of the houses are not accessible through vehicle as efficient refuse collection method is proposed. In this oil drums are placed at least 150m interval into which residents dump their refuse (stage 1). Since most of the area will not be accessible to collection vehicles, labourers employed will go around at least every day and empty the refuse into drums carried on hand carts (stage 2) and then transfer it to vehicles collection point or communal depots/trucks from where it is emptied (stage 3) from where it is emptied into collection vehicle. With the on going strengthening of governments at both state and local level in terms of manpower and financial resources it is hoped that the problem would be re-examined and given proper attention.

Thus, it is hoped that this study will go a long way in solving problems of refuse disposal through the recommendations.

5.2 CONCLUSION

This research work tried to identify the existing system of domestic waste management in the study Area. Survey and analysis revealed

that the existing methods of refuse collection and disposal are not efficient; this is as a result of inadequate refuse storage equipments. More so, the existing methods of disposal are by open dumping which accounted for about 63.5% of the total respondents. It was also discovered that there are no clear cut b/w the refuse collection and disposal points and so people dump their refuse indiscriminately the classes of refuse generation machineries, domestic wastes accounted for about 57.3% which highest. This could be due to daily use of house hold materials and also people are interesting mainly on refuse/waste thrown and burnt rather than waste reduction and recycling which could have save the virgin resources.

Finally the most striking issue is that people are still ignorant of the danger of uncontrolled waste on man and his physical environment some roads/streets within the study area simply because of the dumping of waste and burning of degradable and non-degradable refuse is taking place. This many cause pollution to the environment in the study area.

Based on the information available for the purpose of this work, this research proffers an easier and more effective way of Domestic waste management in Akwanga town Nasarawa State as in indicated on paragraph 5:0 above.

5.3 REFERENCES

1. Federal ministry of housing and environment (FMHE) (1985).
The State of the Environment in Nigeria: solid waste management in fifteen cities and urban areas of Nigeria monograph, No 2 FMHE Lagos.
2. Fulani M.O. and Abumere S.I. (1983) 'Solid waste generation in selected Nigeria cities' Nigeria geographical journal Vol. 28 No. 1
4. Gwoandolyn Holmes et. Al (1993) – Handbook of Environmental management and technology. Willey interscience publication.
5. Maderen international Ltd (1970), master plan for waste disposal and drainage, Ibadan, Draft Volume V: solid waste madaren Ltd, Joroto.
6. maklnwa P.K and Ojo O,A (1987). The urban poor in Nigeria. (Evas Brothers Nig, Ltd).
7. Okpaka D.C.I (1986). Institutional problem in the management Of Nigeria urban environment. NISER monograph 16 1986
8. Olukesusis Femi (1987) "Characteristics of environmental problems in Nigeria and management, prospects" The Environmental, Vol. 7.
9. Oloukesusis Femi (1994),Impact of the ring road solid waste Disposal faculty in Ibadan Nigeria. NSER Monograoph No.3 1994.
10. Onibokun, poju et,al (1986),urban growth and urban management in Nigeria with particular reference to public, utilities and infrastructure, research report, NSER Ibadan.

11. Oluwi J. I (1994) cost implication of refuse collection and disposal in environment, Journal of the Nigerian institution of estate surveyors and valuers vol.18 no.2 July 1994.)
12. Salvato J.A (1992) environmental engineering and sanitation 4th edition, wiley inter science publication.
13. Richard B.E (1985): "Waste disposal the Encyclopedia"
Americana international edition Glotier Inc.
USA Vol. 28

FEDERAL UNIVERSITY OF TECHNOLOGY MINNA (SCHOOL OF
SCIENCE AND SCIENCE EDUCATION, POST GRADUATE
STUDIES DEPARTMENT OF GEOGRAPHY)

QUESTIONNAIRE ON REFUSE DISPOSAL. IN AKWANGA MUNICIPALITY
COURSE: - PROJECT DISSERTATION

Note: - This research work has nothing to do with the Government. It is purely an academic exercise designed to collect data on households refuse it has also been design to make you as anonymous as possible. Where you feel convinced about the objective of this exercise, we wish that give honest answers.

Thank you.

1. Street Name Area.....
2. Type of refuse generate or origin:
(a) Domestic (b) Commercial (c) Industrial
3. Is there any refuse dustbin in your house/workshop? Yes No
4. If yes how many?.....
5. Dow many households use the dusbin?.....
6. Is the dustbin adequate Yes No
7. How do you get rid of your refuse? By burning
Open spaces Throwing into the bush
Government refuse deport Tipped into stream/drainage
Others

8. How often do you dispose the refuse?
 (a) Daily (b) Weekly (c) Every 2 days
 (d) Randomly
9. How satisfied are you with this method in 7 above?
 (i) Quite satisfied (ii) Satisfied (iii) Dissatisfied
 (iv) Utterly dissatisfied
10. Location of refuse depots/site
 (a) Along road
 (b) Within road set back
 (c) On available open space
 (d) Other specify
11. Distance of the refuse depots from respondents place.
 (a) 5/km (b) 1-2km (c) 2 and above
12. Accessibility from the house to the depots.
 (a) Footpath (b) Motor able (c) Non motor able
13. Who is responsible for final disposal of the refuse
 (a) Task force on sanitation
 (b) Collective or personal effort
 (c) Private organization
 (d) Others specify.....
14. How much are you willing to pay (monthly) for collection of your refuse.
 (a) Less than N20 (b) N21- 30 (c) N31 - 40
 (d) N41 - 50 (e) >N50
15. Weight of refuse generated
16. Is there any provision for public refuse dump site/depot?
 Yes No

17. If yes how many of these dumping site/depot you have within the municipality?.....
18. Do you charge people for service rendered?.....
19. How often or frequent of refuse collection?
- (a) Once in a week
 - (b) Twice in a week
 - (c) Fortnightly
 - (d) Once in a month
 - (e) Randomly
20. methods of disposal: (a) Land filling (b) composting (c) Incineration
21. Name of the disposal site.
22. How many kilometer away from Akwanga town
23. What is the attitude of people towards using the refuse dumping site/depots.
24. Number of vehicles you have for refuse collection.
25. types of the vehicle
- (a) Dinosaurs vehicles
 - (b) Ba compactors
 - (c) Tippers
26. Functional.....
27. Non functional.....
28. Number of workers (Both skill and unskilled).....