AN ASSESSMENT OF SOLID WASTE MANAGEMENT IN MINNA LOCAL MILITARY CANTONMENT NIGER STATE

BY

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DECEMBER, 2004

DECLARATION

I hereby declare that this project was carried out by me under the close supervision of Dr. A.A. Okhimamhe and has not been submitted anywhere else for the award of any degree. All published works of other authors have been duly acknowledged.

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CERTIFICATION

I certify that this work "An assessment of solid waste management in Minna Military Cantonment" was carried out by Abdu Garba under my supervision and that it meets the regulations governing the award of the Postgraduate Diploma in Environmental Management of Geography Department, Federal University of Technology, Minna and is approved for its contribution to Knowledge and literary presentation.

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DEDICATION

I dedicate this project to my dear wife Amina.

ACKNOWLEDGEMENT

Praise be to Almighty Allah for enabling me accomplish this programme culminating into the completion of this research.

My sincere thanks and gratitude goes to my indefatigable supervisor Dr. A.A Okhimamhe for her untiring effort and guidance in this study. I also commend my other lecturers, Prof D.O. Adefolalu, Prof J.M. Baba, Dr M. T. Usman, Dr Odafen, Dr A.S. Abubakar, Dr P.S. Akinyeye, Dr G.N. Nsofor, Dr H.A. Shaba and Mall. Salihu Sa'idu.

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ABSTRACT

This study assesses the problem of solid waste management in Minna Military cantonment. Waste management is an environmental problem that gets more intractable and complex with the passing of time. Problems of solid waste management in the cantonment were examined. These problems range from lack of waste disposal facilities, misuse of open spaces as disposal sites and failure to comply with Military sanitary regulations.

An appropriate research methodology suitable to the problem under study was formulated. These were basically the instruments used in data collection and subsequent analysis. Direct observation and questionnaires were employed to obtain data. Information on health related problems was obtained from medical records in the medical centre. A high incidence of malaria and other diseases were observed. Data collected from field surveys and documented records were further analysed to discern their meanings. The research revealed that there was acute shortage of waste disposal facilities, non-compliance with military sanitation regulations as well prevalence of diseases associated with unsanitary condition. Other findings of the research include susceptibility of the environment to general degradation and a desire by the residents for a proper waste management

The study drew conclusion and ended by preferring some recommendations that hope to address the problem by way of ameliorating it to the barest minimum and eventual out right solutions.

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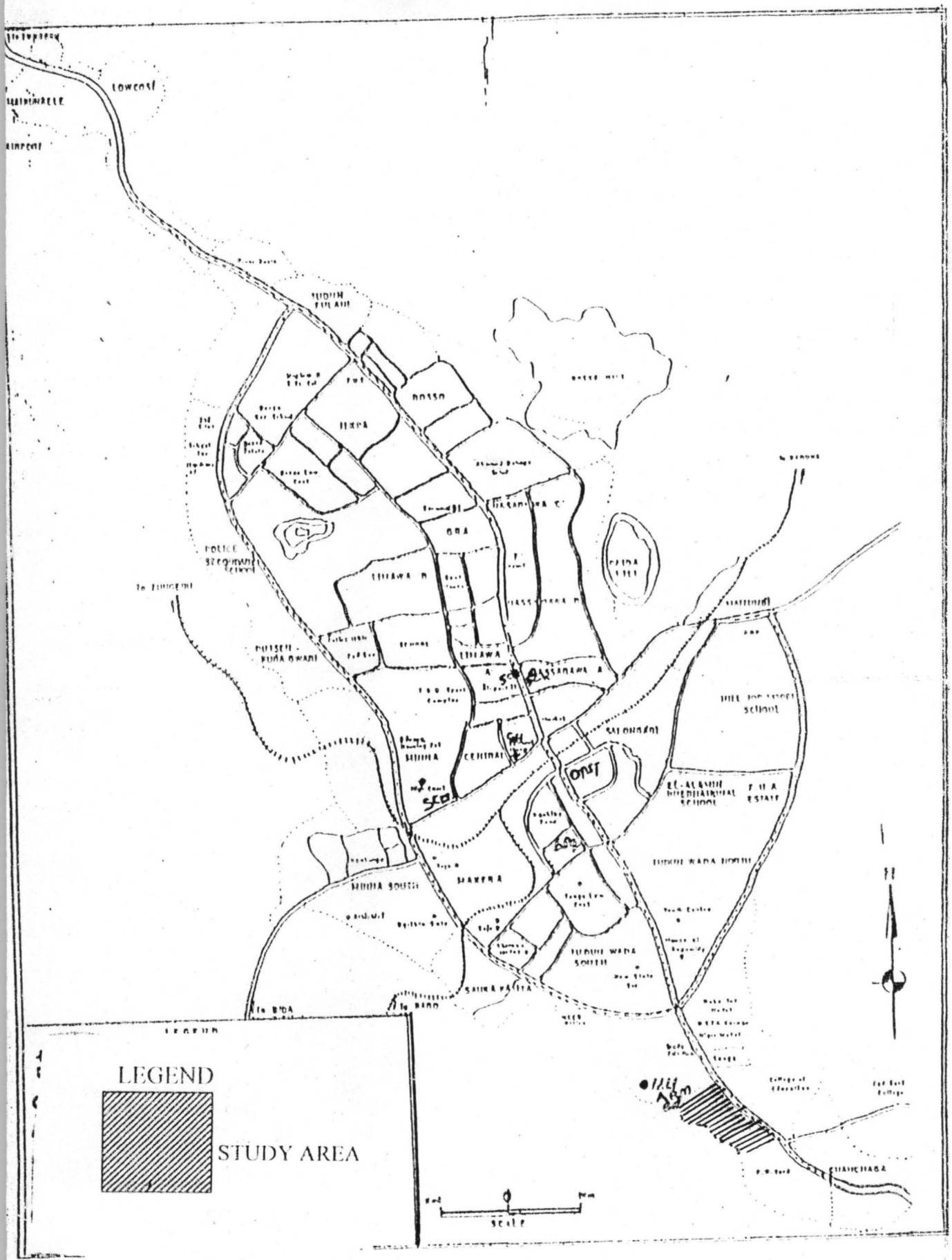

Fig 1.1 **MAP OF MINNA METROPOLIS**

CHAPTER ONE

GENERAL INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Minna Military cantonment is located in Niger State and comprises both the Training and Doctrine Command (TRADOC) and 31 Artillery Brigade. The cantonment is a Military land use, which also comprises both administrative and residential accommodation for the officers and soldiers. Other sites for recreation and training do exist within the cantonment. The residential accommodation as is typical of all Military barracks, are categorized according to the different hierarchies in the Military. Thus, their exist the married officers' quarters, the single officers' quarters, the senior non-commissioned officers and the corporal below quarters. It is pertinent to note that all the Military personnel working in the cantonment also reside there in.

Wherever human beings live in an environment, there is bound to be the issue of waste management. This is necessary in an environment so that the waste generated and disposed will be managed efficiently to ensure a clean and aesthetically sound environment that will be devoid of pollution and other negative impact associated with improver disposal and management. The Military being a highly regimented society abhors all actions or inactions that give rise to a filthy environment. Periodic inspections of the living environment to ensure and enforce good sanitary conditions are often carried out. Landfills within accommodation blocks are a common sight in Military barracks. It is equally interesting to note that the knowledge of first Aid which encompasses proper waste disposal among others are imparted to Military personnel in their initial training both at the Depot and the Defence Academy. Diseases such as malaria and typhoid resulting from unsanitary conditions have

greatly led to high casualty rates for the Military right from the world wars. This was among the factors that led to the defeat of the Allied forces during the 'Arakan campaign' in Asia.

It is however a paradox that in spite of the aforementioned Military tradition of sanitary conditions, the reverse is the case in Minna cantonment. The cantonment is dotted with numerous indiscriminate dumping sites of solid waste whose environmental impact is presently leading to a squalid environment. The degree of degradation is bound to excercabate if current trend is not checked.

1.2 Statement of problems

Lack of solid waste disposal facilities: There are no waste disposal facilities like litterbins throughout the entire length and breadth of the cantonment. It is customary within residential areas to have litterbins placed at the frontages of individual blocks. This is the practice in all the Abuja barracks where the Abuja Environmental Protection Board (AEPB) allocated litterbins to all the blocks.

The collected waste in such bins are periodically emptied into a truck and subsequently disposed off in a landfill located away from the source of generation. This lack of waste disposal facility has tremendously resulted in the existing indiscriminate dumping within residential apartments. (See relevant attached plates).

Lack of awareness on the environmental impact of improper waste management: The current disposal trend in the cantonment glaringly portrays a general ignorance, lack of awareness or nonchalant attitude towards the impact of improper waste management. Domestic solid wastes are dumped both at the front and back of residential apartments as well as roadside. These constitute an eyesore vis-à-vis foul and offensive odour within the living areas. This study intends to find out the perception of the soldiers and their families as regards to this issue.

Misuse of open spaces as disposal sites: A notable feature of waste disposal within the cantonment is that of converting some open spaces into dumping sites. This attitude has led to the degradation of those sites. The scenic beauty of the open spaces has been lost.

It has been observed that this dumping at the open spaces is done with an intention of having a fertile land for crop cultivation. The picture in plate 1c buttresses this fact.

Failure to comply with Military regulations: The Military has a laid down rules and regulations concerning sanitation in the barracks. All the afore-mentioned problems are at variance with the articulated sanitary conditions expected of a Military cantonment. The regulations will be discussed in details in the next chapter of this study.

1.3 Aim and Objectives

The aim of this study is to assess the problems of solid waste management in Minna Military cantonment.

The objectives of the study are as follows:

1. To identify the various sources of solid waste in the cantonment
2. To identify the waste disposal system within the cantonment
3. To evaluate the existing and potential physical and health hazards of the waste
4. To make appropriate recommendations on ways to ameliorate the problem

1.4 Justification of the study

Waste is a product of our daily consumption and activities in the human environment. In other words, waste must be generated and disposed wherever human

beings agglomerate. These generated and disposed waste must be efficiently managed to rid the living environment of the menace of unmanaged waste.

The pattern of solid waste disposal vis-à-vis a total absence of management within the Military cantonment spurred me and generated a feeling of disgust for the current practice. Thus, all the afore-mentioned problems there led to the need for an in-depth study of the situation, which has been earlier, highlighted to be highly unmilitary. It is therefore hoped that the findings and subsequent recommendations of this research will go a long way in sensitizing the Military authorities with a view towards formulating appropriate measures to ameliorate the existing problems.

1.5 Description of the study area

Minna cantonment is located adjacent to the Niger State College of Education along Minna-Abuja road and also a kilometre away from Chanchaga and two kilometres from Tunga in Minna west local government. It occupies an area of 390.77 hectares. Minna lies at latitude 9^0 37 North and longitude $6^0$33 East.

The study area falls within the Guinea savannah. Thus the vegetation consist of orchard trees 10m to 12m high with grasses. The soil laterite found from the deposits of sedimentary rocks. The soil has fine texture, which is relatively difficult to work because it tends to become water logged when there is hearty rain. When dry the soil becomes cracked.

The basic geology of the study area is a mixture of rock granite; the surface is decomposed of laterite, erosion and small streams that cut deep gullies. This leaves the residual laterite crops generally eaten away by natural forces such as rain, wind and vegetation.

In terms of climate, the area has a mean rainfall of 1334mm. The highest mean monthly rainfall is usually in September with almost 300mm. The highest

temperature is experienced in April between 95^{C} F to 100^{0} F and the lowest is between 400 F – 560F. Humidity in the dry season may be below 10% in the afternoon and 30% at down. While in August which is cooler because of rain, the humidity at mid-day can be over 70% and 90% at down.

1.6 Scope and Limitations

The scope of this research is limited to the following:

i. Disposal and management of solid waste in the Military cantonment

ii. Ascertain the level of awareness if any concerning solid waste disposal by the personnel of the cantonment.

iii. Examine the physical and health implications of the existing situation

CHAPTER TWO

LITERATURE REVIEW

Waste is defined as the non-gaseous and non-liquid matter resulting from domestic activities of the inhabitants of particular residential area (Adedibu,1982).The phenonmenon of waste generation is common to all urbanization process, especially when both the natural and the migratory net gains are relatively large. In other words, urbanization as a spatial process has its common constraints. For example, when population explodes, consumption tends to be elastic and people create refuse from all sort of material used as packaging material, (Ahmed, 1999).

The gathering and disposal of solid wastes is a major public health issue of our time and this needs some urgent attention if our environment is to be protected. Man's activities on domestic, commercial and industrial processes produce some undesirable effects which are pollutants of all categories. According to Adedibu and Okekunle (1989) rapid population growth is a significant factor that is causing poor environmental sanitation. They went further to add that there are other factors such as inadequate knowledge of the composition of solid wastes, the rate to which population generates wastes, inadequate and uncoordinated infrastructural facilities. For waste disposal and rural-urban drifts. Adedibu (1986) also described the phenomena of sources of waste generation as a result of changes in the wage earning by workers. For instance, higher income earning can lead to a greater propensity of buying specifically the packed items which can also increase the wastes generated by the high income class.

The Federal Environmental protection Agency (FEPA) Categorized wastes into three main types. One of the types is municipal wastes arising from residential,

institutional, commercial and street leftovers including pieces of papers, food waste plastic, pieces of mental, tins, cans, leaves and grasses among others. Adedibu (1985,1989) observed that the amount of waste generated in every environment varies from individuals to and from one area to the other. Thus, it is worth noting that the Military cantonment is designed according to hierarchies of rank. There is the married officers' quarters, single officers' quarters, the senior Non commissioned officers' quarters as well as the corporal and below quarter. The consumption pattern of these different hierarchies is bound to differ significantly based on the wage differential among them with a consequent waste generation and disposal levels. To some people, a perfect or utopian system for waste disposal would be a technology that is capable of accepting and unlimited amount of waste and safely containing it forever outside the sphere of human life (Botkin and Keller :1998). They opined that this is an impossible dream and is not environmentally sound. The environmentally preferable concept with respect to waste management is to consider wastes as resources out of place. Even though waste may not soon be reused and recycled, it seems apparent that the increasing cost of raw materials, energy and transportation and land will make it financially feasible to reuse and recycle more resources. This environmental view posits that there is no such things as waste, but only resources, in other words waste would not be produced or if produced would be a resource to be used again.

Of particular importance is the growing awareness that many of our waste management programmes involve simply moving waste from one site to another and not really managing it. For instance, waste from urban areas may be placed in landfills, but eventually these may cause new problems is they produce methane gas or noxious liquids that leak from the site and contaminate the surrounding areas. If

managed properly, however methane produced from landfills is a resource that may be burned as a fuel. Botkin and Keller emphasised that a concept emerging today is known as 'integrated waste management'.

2.1 Waste management in the United States

Waste is everyone's business. We all produce unwanted by-products and residues in nearly everything we do. According to the Environmental Protection Agency (EPA), the United States produces 11 billion tons of solid waste each year. Nearly half of that amount consists of agricultural waste, such as crop residues and animal manure, which are generally recycled into the soil on the farms where they are produced. They represent a valuable resource as ground cover to reduce erosion and fertiliser to nourish new crops, but they also constitute the single largest source of non point air and water pollution in the country. About one-third of all solid wastes are mine tailings, over burden from strip mines, smelter slag, and other residues produced by mining and primary metal processing. Much of this material is stored in or near its source of production and isn't mixed with other kinds of wastes. Improper disposal practices, however, can result in serious and widespread pollution.

Municipal waste, a combination of households and commercial refuse amount to about 180 million metric tons per year in the United States. That is approximately two thirds of a ton for each man, woman and child every year-twice per capital of Europe or Japan and five to ten times as much as most developing countries.

2.1.1 Open dumps

For many people, the way to dispose of waste is to simply drop it some place, open, unregulated dumps are still the predominant method of waste disposal in most developing countries. The giant Third World megacities have enormous garbage

problems. Mexico city, the largest city in the world, generate some 10,000 tons of trash each day. Until recently, most of this torrent of waste was left in giant piles, exposed to the wind and rain, as well as rats, flies and other vermin. Manila, in the Philippines, has at least ten huge open dumps. The most notorious is called "Smoky Mountain" because of its constant smouldering fires. Thousand of people live and work on this 30-m-high heap of refuse. They spend their days sorting through the garbage for edible or recyclable materials. Health conditions are abysmal, but these people have nowhere else to go. The government would like to close these dumps, but how will the residents be housed and fed? Where else will the city put its garbage?

Most developed countries forbid open dumping, at least in metropolitan areas, but illegal dumping is still a problem. We have undoubtedly seen trash accumulating along roadsides and in vacant, weedy lots in the poorer section of cities.

2.1.2 Landfills

Over the past 50 years, most American and European cities have recognised the health and environmental hazards of open dumps. Increasingly, cities have turned to sanitary landfills, where solid waste disposal is regulated and controlled. To decrease smells and litter and to discourage insect and rodent populations, landfill operators are required to compact the refuse and cover it everyday with a layer of dirt. This method helps control pollution, but the dirt fill and also takes up as much as 20 percent of landfill space. Since 1994, all operational landfills in the United States have been required to control such hazardous substances as oil, chemical compounds, toxic metals and contaminated rainwater that seep through piles of waste. An impermeable clay and/or plastic lining underlie and enclose the storage area. Drainage systems are installed in and around the liner to catch drainage and to help monitor

chemicals that may be leaking. Modern municipal solid waste landfills now have many of the safeguards of hazardous waste repositories.

More recent attention in now paid to the citing of new landfills. Sites located on highly permeable or faulted rock formations rarely passed over in favour of sites with less leaky geologic foundations. Landfills are being built away from rivers, lakes, floodplains, and aquifer recharge zones, rather than near them, as was often done in the past. More care is being given to a landfill's long-term effects so that costly dumps and rehabilitation can be avoided.

Historically, landfills have been a convenient and relatively inexpensive waste-disposal option in most places, but this situation is changing rapidly. Rising land prices and shipping cost, as well as increasingly demanding landfill construction and maintenance requirements, are making this a more expensive disposal method. The cost of disposing off a ton of solid waste in Philadelphia went from $20 in 1980 to more than $100 in 1990, union country, New York, experienced an even steeper price rise. In 1987, it paid $70 to get rid of a ton of waste, a year later that same ton cost $420, or about $10 for a typical garbage bag. The United States now spends $10 billion per year a dispose off trash. A decade from now, it may cost $100 billion per year to dispose off trash and garbage.

Suitable places for waste disposal are becoming scarce in many areas. Other uses compete for open space. Citizens have become more concerned and vocal about health hazards, as well as aesthetics. It is difficult to find a neighbourhood or community willing to accept a new landfill. Since 1984, when stricter financial and environmental protection requirements for landfills took effect, more than 1,200 of the 1,500 existing landfills in the United States have been closed. Many more cities are running out of local landfill space. They export their trash, at enormous expense,

to neighbouring communities and even other states. More than half of the solid waste from New Jersey goes out of the state, some of it up to 800 km (500 ml) away (Cunningham and Cunningham: 2002).

Solid waste management is a problem in urban and rural areas; particularly developing countries have inadequate waste management. Poorly controlled open dumps and illegal road side dumping remain a problem such dumping spoils scenic resources, pollutes spoils and water resources and is a potential health hazard to plants, animals and people. This situation is probably both a social and physical problems. Many people infact may not see dumping their garbage as an environmental problem. In areas where illegal dumping has been reduced, the keys are awareness, education and alternatives. Environmental problems of unsafe unsanitary dumping are made known and funds are provided for cleanup and inexpensive collection and recycling of trash at sites of origin.

2.1.3 Ocean Dumping

The oceans are vast, but not so large that we can continue to treat them as carelessly as has been our habit. Every year some 25,000 metric tons of packaging including half a million bottles, cans and plastic. Containers are dumped at sea. Beaches, even in remote regions, are littered with the non-degradable flotsam and jetsam of industrial society. About 150,000 tons of fishing gear including more than 1000km of nets are lost or discarded at sea each year. Environmental groups estimate that 50,000 northern fur seals are entangled in this refuse and drown or starved to death every year in the North pacific alone.

Until recently, many cities in the United States dumped municipal refuse, industrial waste, sewage and sludge in the ocean. Federal legislation now prohibits this dumping. New York city, the last to stop offshore sewage sludge disposal, finally

ended this practice in 1992. Still, 60 million to 80 million m^3 of dredge spoil, much of it contaminated, are disposed off at sea. Some people claimed that the deep abyssal ocean plain is the most remote, stable and innocuous place to dump our wastes. Others argue that we know too little about the values of these remote places or the rare species that live there to smother them with sludge and debris. (Cunningham, P. and Cunningham, M:2002).

2.2 Environmental sanitation in Military operation areas

The Handbook of Military First Aid has some provisions for ensuring a hygienic and sanitary condition during combat operations. The aim is to remind troops that whether in period of battle or peace, their personal hygiene and environmental sanitation is very important and essential. Once the health of troops is neglected, the commander will find himself fighting two wars at a time. One with his known enemy while the other with an unknown enemy, which is disease. In addition to refuse disposal pit, disposal pit, provision of pit latrines and urinal are emphasised. The size of a refuse is recommended as 4^{ft} by 4^{ft} by 4^{ft}, which amounts to 64 cubic feet. (Military Hygiene booklet, pp 32 1990).

2.3 Environmental cleanliness within the barracks

The rules and regulations concerning environmental cleanliness in the Military barracks are hereby reproduced as follows:

i. The grass in the barrack and the surrounding must be cut low to the ground; gutters, toilets, kitchens and so on are to be kept clean.

ii. The dustbins are to be covered always to prevent multiplication of flies and they are to be disposed off in a sanitary way.

iii. There should be no indiscriminate defecation in an around the barrack.

iv. The barrack and its surroundings should not be littered with empty tins or containers, which can hold, water and thereby aid in the spread of mosquitoes.

v. No stagnant water in the ground and around the barracks should be allowed and if this is not possible such stagnant water should be sprayed regularly with anti-malaria oil to prevent mosquito breeding.

2.4 Barrack inspection and places to be inspected

Barrack inspection is to be carried out regularly and frequently by the commanding officer, Hygiene Officer and the unit Regimental Sergeant Major (RSM). Places to be inspected by them include the surrounding of the buildings in the barracks, the rooms, kitchens, bathrooms, dustbins, gutters, toilets, canteens and messes. The purpose of the inspection is to detect unsanitary conditions in the barracks, overgrown weeds or grass, defective drainage, dirty toilets, bathrooms, kitchens and septic tanks. (Military Hygiene Booklet, pp 35, 1990).

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter explains the type of data to be used in the study. It details the methodology for its collection and fieldwork carried out for the data collection.

A very important ingredient of any research work is data collection. There are basically two types of data, namely primary and secondary sources. The primary sources are observation and questionnaires, while the library, Internet and other research works constitute the secondary sources.

3.1 Description of data

The observational method of survey is to be adopted in part of this study. This is a method that simply looks with intense accuracy at a phenomenon understudy and then record accurately what the researcher sees. Thus, the issue of waste management will be observed with close scrutiny and a careful record of what is observed would be done to discern its meaning.

There are basically four methods of data collection namely direct observation, interviewing, extraction from published statistics and postal questionnaire (Harper, 1982). All the four methods mentioned above were employed less the postal questionnaire. Therefore direct observation, interviewing and extraction from previous works were used.

The direct sites have been assessed by direct observation. Photographs were also taken directly at the dumping sites. Other published relevant information were extracted from published sources. Information on the health situation of the residents was acquired from the Cantonment Medical Centre.

A systematic sampling technique was employed in administering questionnaires to the residents of the cantonment. A structured questionnaire was designed to find out the data that will determine the waste management practices. The questionnaire comprise of those questions that have direct bearing on the subject matter. Both the spatial, temporal and quantities of waste being generated were covered by the questions (see Appendix I for more details of the questionnaires).

The study area being a Military cantonment as earlier mentioned has four types of residential accommodation viz Married Officers' Quarters (MOQ), Single Officers' Quarters (SOQ), Senior Non-Commissioned Officers' Quarters (SNCOQ) and Corporal and Below Quarters (CBQ). There are a total 306 houses out of which a sampling frame of 70% of the various types of quarters was covered. This gives a total of 214 as shown in table 3.1 below.

TABLE 3.1: SAMPLING FRAME OF THE QUESTIONNAIRE

S/NO	TYPE OF QUARTERS	% COVERED	NO OF QRTS INVOLVED
1	MOQ	70	36
2	SOQ	70	25
3	SNCOQ	70	36
4	CBQ	70	116
	TOTAL		214

CHAPTER FOUR

PRESENTATION AND DISCUSSION OF RESULTS

This chapter explains the results of data analysis using descriptive and inferential statistical tools. Descriptive tools of percentile, mean, bar chart and pie charts were employed.

The second part of the chapter explains the findings both as it relates to hygienic and environmental aspect of the solid waste disposal to the study area.

4.1 Analysis of the Composition of solid waste

Table 4.1 below highlights the composition of solid waste being generated by the residents. The data indicates that about 40% of the waste is house ware and 45% synthetic waste. These are mostly used polythene bags. Food waste constitutes only 5% accounting for the least generated waste.

Table 4.1 Waste compositions

S/no	Waste type	Percentage (%)
1	Food	50
2	House ware	40
3	Synthetic	45
4	Others	10

Source: Field survey, 2004

4.2 Disposal system of solid waste

Table 4.2 reveals the various locations in which residents dump their generated waste. These include house frontage, roadside, open dump and others. The

data indicated that 50% of the respondents dump their refuse by their house frontage, 24% at road side, 20% open dump while only 5% dump in other places like landfill.

Table 4.2 Waste Disposal systems

S/no	Place of disposal	No of respondents	Percentage (%)
1	House frontage	108	50.4
2	Roadside	52	24.3
3	Open dump	43	20.3
4	Others	11	5.0
	Total	214	100

Source: Field survey 2004

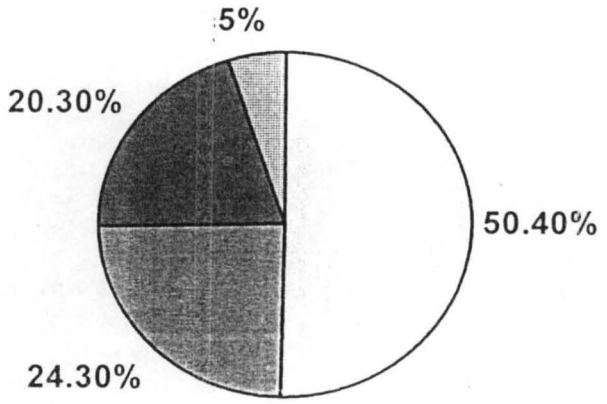

Fig 4:1: Chart showing waste disposal system

The respondents were equally asked on the safety of this dumping practice. Over 98% felt it was not safe, while about 2% were not concerned about the safety.

4.3 Waste Disposal facility

The respondents were asked on whether they have an organized waste disposal facility. The survey revealed that only 5% of the respondents have a disposal facility in the form of landfill within their residences. Therefore, 95% of those interviewed do

not have access to any form of organized disposal facility. There are no litterbins within the residential dwellings. In all the Military barracks of Abuja, there are litterbins provided by the Abuja Environmental Protection Board (AEPB). These are evacuated for safe disposal on a weekly basis with the aid of trucks. The researcher sought to find out whether those in command positions regarding the existing indiscriminate pattern of waste disposal checked the respondents. The survey revealed that about 97% of the respondent were never checked on their method of disposal, while only 3% confessed to having being admonished on the way they dispose refuse.

4.4 Amount of solid waste generated

On the weight of the weekly-generated waste in the cantonment, the survey revealed that 90% of the respondents generate below five kilogramme. Only 10% of the respondents produce a little over five kilogramme. See table 4.4

Table 4.4 Generated waste by weight

S/no	Place of disposal	No of respondents	Percentage (%)
1	< 5kg	193	90
2	5-10kg	21	10
3	>10kg	-	-
	Total	214	100

Source: Field survey 2004

4.5 Burning of solid waste in the cantonment

It was observed in the course of this study that some respondents burn their solid waste as a method of reducing the volume. The researcher sought to determine those engaged in this practice. The survey revealed that about 62% of the respondents burn their disposed refuse, while the remaining 38% do not. See figure 4.2.

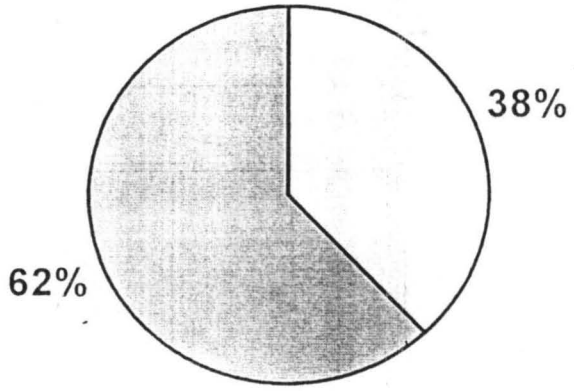

Fig 4.2: Chart showing those engaged In burning of refuse

4.6 Use of waste as manure for farming

It was equally observed that some residents of the cantonment use the waste disposal sites within their residences for farming. This is based on the fact that the soil there is rich in humus content which results in better yield of cultivated crops. 30% of the respondents confessed to this practice, while the remaining 70% do not engage in this practice. See figure 3 below and plate 1c for this.

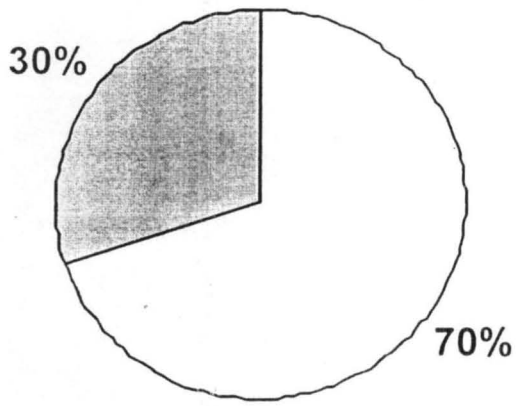

Fig 4:3:Chart showing the use of waste for manure



PLATE 1 **A typical open dump in M.O.Q.**

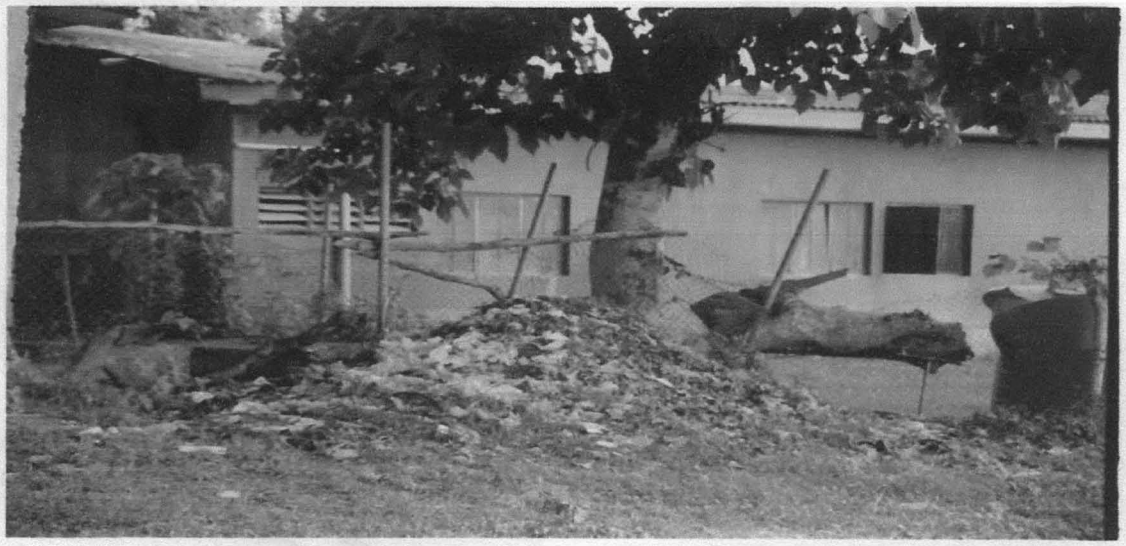

PLATE 2 **Example of use of open space for waste dumping**



PLATE 3 **A typical dumping site in C.B.Q.**

4.7 Opinions on solid waste management

Opinions of the respondents were sought concerning the issue of improvements they wish to see on the proper management of waste. There was a unanimous agreement that waste containers should be provided for them in each residential block with a disposal truck available for evacuation periodically.

4.8 Physical implication of the waste disposal system

The solid waste disposal system being practiced in the cantonment has effect on the environment. It is obvious that all the dumping sites are undergoing some form of land degradation. These sites have a short-term benefit of a fertile land for farming for the soldiers, but the long-term degradation to the land by erosion caused by an aggressive agricultural practice is of paramount importance.

Also, the non-biodegradable waste will constitute a hazard to the environment. Narrowing of the access roads within the residential areas as a result of roadside dumping is equally a menace to road users. See plate 4

The environment could be susceptible to flooding due to blockage of drainage as a result of dumping there. See plate 5

4.9 Health hazards of the waste disposal system

It has been earlier highlighted that the cantonment is littered with a lot of open refuse dumps located within residential areas. This is highly unhygienic and has an attendant implication for the residents of the cantonment. See table 4a, 4b and 4c for the health records of some common diseases associated with unsanitary conditions.



PLATE 4 Example of dumping inside drainage line



PLATE 5 A typical example of road side dumping of waste.

Note the use of the site for farming

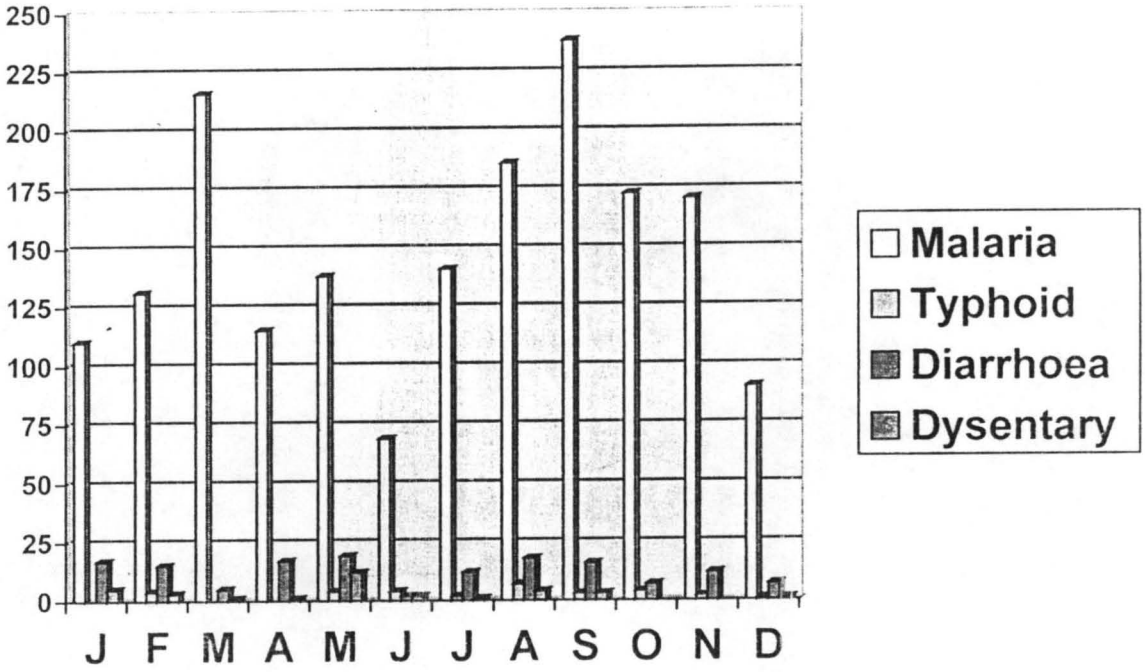

Fig.4a: 2002
HEALTH RECORDS OF SOME COMMON DISEASES ASSOCIATED WITH UNSANITARY CONDITIONS

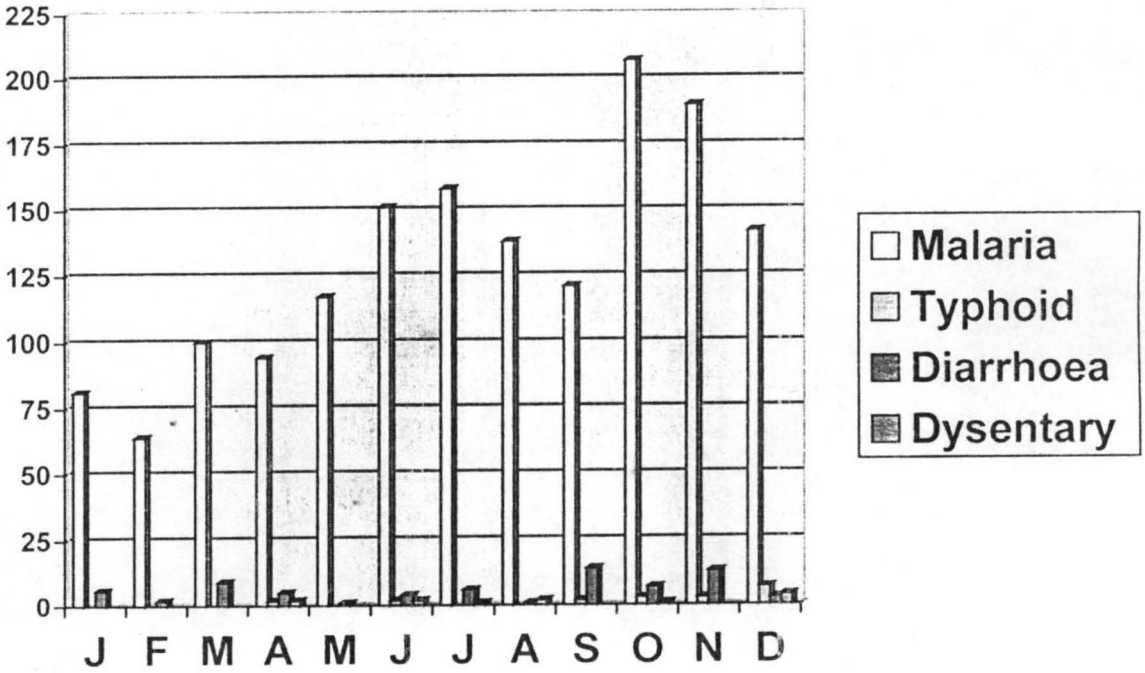

Fig. 4b: 2003
HEALTH RECORDS OF SOME COMMON DISEASES ASSOCIATED WITH UNSANITARY CONDITIONS

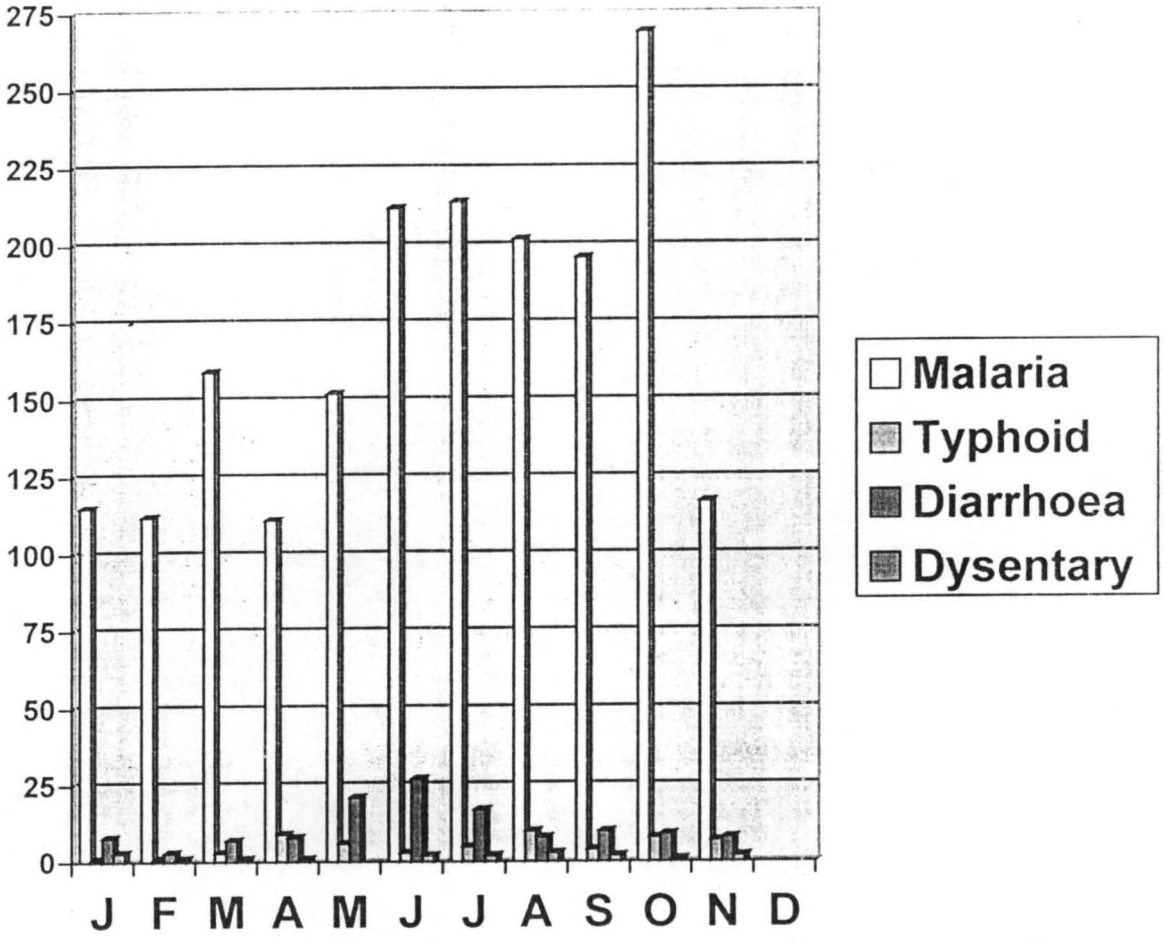

Fig 4c: 2004
HEALTH RECORDS OF SOME COMMON DISEASES ASSOCIATED WITH UNSANITARY CONDITIONS

SOURCE: CANTONMENT MEDICAL RECORDS

These are records obtained for the last three years. The record revealed that there are high cases of malaria among the soldiers and their families. This can be attributed to the stagnant water in the open refuse dumps, which serves as breeding ground for mosquitoes. It is noteworthy that those figures are the reported cases, as some people will resort to self-medication. Other identified diseases are typhoid, diarrhoea and dysentery.

From the table above, there is thus an average of 1,653 reported cases of malaria among the 12,000 people in the cantonment. The month of October 2004

recorded an all time high of 269 cases. This is not good for a Military establishment where the soldiers are supposed to be medically and physically fit for any combat operation.

The researcher also sought to find out the incidences of diseases among the respondents as will as the rate of occurrence. Table 4 shows the information on health related problems, 63% of the respondents had malaria attack, 27% had diarrhoea with 10% dysentery. There was no recorded case of cholera in the cantonment.

In terms of occurrence, about 97% of the respondents were affected by the diseases between one to three times, with about 3% being affected more than three times.

Table 4.9 Diseases caused by poor waste disposal

S/no	Diseases	No of respondents	Percentage (%)
1	Malaria	135	63
2	Cholera	-	-
3	Diarrhoea	58	27
4	Dysentery	21	10
	Total	214	100

Source: Field survey 2004

4.10 Findings

The findings of the research are as follows:

1. Acute shortage of solid waste disposal facilities only 5% of the respondents have access to landfills for solid waste disposal, conversely about 95% do not have access to such facilities.

2. Non-compliance with Military sanitary regulations. The laid down rules and regulations of environmental sanitation in Military barracks are not being enforced in Minna cantonment. This lackadaisical attitude and dereliction of duty by the stakeholders is further aggravating the situation.
3. Prevalence of diseases: There is a general prevalence of diseases especially malaria caused by breeding of mosquitoes. This s due to the indiscriminate dumping of solid waste within residential areas. An average of 1,563 cases of malaria occur annually among the 10,000 inhabitants of the cantonments.
4. Susceptibility of the environment to general degradation. In the long term, the land would be degraded due to the intensive agricultural practice at the dumping sites. The non-biodegradable waste would constitute a hazard to the land, while there is a high risk of flooding due to blockage of the drainage lines.
5. Desire by the residents for a proper waste management in the cantonment. From survey carried out, all the respondents expressed their wish for a proper management of solid waste.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

This research examined the problems of solid waste management in Minna Military cantonment, These problems are mainly lack of solids disposal facilities, misuse of open space and failure to comply with Military Sanitary regulations.

The research was also limited to the issue of disposals and management of solid waste, ascertaining the level of awareness of the implication of the disposal methods as well as examined the physical and health implications of the existing disposal methods.

A review of literature related to the issue of solid waste management with additional emphasis on Military Sanitary Standards was equally carried out in the study. This brought to the fore the existing problems as a deviation from the established norms of professional standard in the military.

In terms of research methodology, direct observation and questionnaire were employed to obtain data for the study. Health related information was obtained from medical records in the Medical Centre.

It was subsequently discovered that there was acute shortage of solid waste disposal facilities with only 5% of the respondents having access to landfills. There was prevalence of some common diseases associated with unsanitary conditions in the cantonment. There was an average of 1,563 cases of malaria occurring annually. There was also high susceptibility to environmental degradation in the long term, if current trend continues unchecked. The study discovered that there was a desire by the residents of the cantonment for a proper waste management

5.2 Conclusion

Solid waste management in Nigeria cities and urban areas remains an environmental problem that gets more intractable and complex with the passing of time. (Bayonle, et al: 2002). The challenge of waste collection, storage and safe disposal calls for meaningful co-operation between the generators of the waste and the agency responsible for waste management.

This study has been able to thoroughly assess the problems of solid waste management in Minna cantonment. A review of related literature to the subject matter was carried out emphasising in the process, specific policy guidelines regarding sanitation in Military barracks. Physical and social survey on the waste issue was carried out with a view to ascertaining the actual information on the problem. The study ended with formulating appropriate recommendations aimed at solving the problems or at least ameliorating them to the barest minimum.

5.3 Recommendation

The following recommendations are hereby presented.

1. Solid waste disposal facilities should be provided for the residents of the cantonment. It has been highlighted that there are no standard refuse bins in the cantonment. A galvanised mild steel dustbin should be provided for every house in the MOQs, SOQs and SNCOQs, while at least three should be provided in every CBQ. A standard mild steel dustbin is round in section and tapers from top to bottom to facilitate emptying and also stacking. It has a reinforcing turn over rim, slightly dished bottom, lifting handles and a loose lid with a capacity of $0.028m^2$ (Barry, R:1998). See Appendix 2 for a standard design of a galvanised steel bin.

2. The rules and regulations of Environmental sanitation in the Military should be enforced in the cantonment. As previously discussed in chapter two of this study, the Military has some laid down rules and regulations forbidding the indiscriminate dumping of waste within residential quarters. The authorities in the cantonment are not applying those provisions in checking the existing practice, thus exacerbating the problem. It is therefore strongly recommended that all those in positions of authority in the cantonment should be awake to their responsibility in ensuring a decent ensure a sustainable use of the environment for both the present and future inhabitants.
3. The authority in the cantonment should strive towards procuring a waste disposal truck from the Army Headquarters. Military barracks are usually provided with waste disposal trucks. However it is sad to note that non exist in Minna cantonment. It is highly necessary for the cantonment to be provided with a truck for solid waste disposal.
4. Sanitary Landfills should be utilised and sited at a safe distance from residential accommodations. The use of landfills would be appropriate as an option for waste disposal in the cantonment. Landfills are convenient and relatively inexpensive waste disposal option in most places. It is better than the practice of dumping by house frontages with its attendant health implications for the residents.
5. A request should be made to Niger State Urban Development Board (NUDB) to extend its services of waste management to the Military cantonment. The Military environment at present does not enjoy the services of NUDB in terms of waste disposal. It is therefore expedient in the light of the existing problem for the Military command to reach out to the NUDB to solicit for their assistance. This is

to be maintained pending the attainment of self-sufficiency by the Military vis-à-vis the procurement of the logistic requirements for waste management.

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APPENDIX 1

Department of Geography
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P.M.B. 65,
Minna,
Niger State.

ASSESSMENT OF SOLID WASTE MANAGEMENT IN MINNA MILITARY CANTONMENT NIGER STATE

RESEARCH QUESTIONNAIRE

Dear Respondent,

You are please requested to complete this research questionnaire on the above title. Your response should be made independent and personal as possible and ensure honesty. All responses shall be treated with strict anonymity and confidentiality. It is purely an academic.exercise and the responses will be used for the purpose of the research project.

Thanks for your anticipated co-operation.

PGD/GEO/2004/290
Abdu Garba
Department of Geography
Federal university of Technology,
Minna

APPENDIX 11

QUESTIONNAIRE

1. Type of Quarters

    a. Married Officers' Quarters

    b. Single Officers' Quarters

    c. Senior Non-Commissioned Officers' Quarters

    d. Corporal Below Quarters

2. Block Number _____

3. Do you gene

4. Rate waste in your household? Yes/No

5. What is the composition of your waste?

    a. Food waste

    b. House ware waste

    c. Synthetic waste

    d. Others (specify)

6. Where do you dispose your solid waste?

    a. House frontage

    b. Roadside

    c. Open dump

    d. Others (specify)

7. Do you have a solid waste disposal? Yes/No

8. If Yes specify _____

9. What is the approximate weight of your waste per week?

    a. Below 5kg

    b. 5-10 kg

c. Above 10 kg

d. No idea

10. Do you burn your generated waste? Yes/No

11. Do you use generated waste as manure for farming? Yes/No

12. Do you consider as safe this open dumping within residential area? Yes/No

13. Have you ever being checked by the authority on the method of your waste disposal? Yes/No

14. Have you or any member of your family being affected with any of the following diseases?

    a. Malaria

    b. Cholera

    c. Typhoid

    d. Diarrhoea

    e. Dysentery

    f. Others (specify)

15. If answer above is yes, state how many times?

    a. 1-3

    b. 4-6

    c. >6

16. What improvement do you wish to see in the management of waste in the cantonment?