

Environmental Impact of Indiscriminate Waste Disposal

“A Case study of Nigerian Air force Base Kaduna”

I Abdullahi, M A Ajibike, A P Man-ugwueje, O I Ndububa

Abstract— Indiscriminate waste disposal, in this study refers to the disposal of solid and liquid wastes without taking necessary measures. The huge amount of refuse is clearly increasing all over the base, littering streets and causing pollution, all of which cause untidiness to the Nigerian Air Force Base, Kaduna. The study identifies different types of solid waste and their composition in both old and new layouts of the base, which are indiscriminately disposed in the study area. The study also examined the environmental implication of indiscriminate waste disposal in the Nigerian Air Force Base. Careful analyses of the study questionnaire revealed that, there is much needed to be ingested into the management of domestic wastes from the households in the Nigerian Air Force Base, Kaduna. Significant relationship between the provision of required services and imminent need to improve on the disposal of waste was also considered. The study area practices three forms of disposal methods which are incineration, landfill system and composting. The problems of collection and disposal (management) of domestic, solid waste in the Nigerian Air Force Base, Kaduna face insufficient facilities, coordination, shortage of manpower, inadequate supervision, staff attitude and relative ignorance on the adversity of a filthy environment. The result obtained shows that domestic solid waste with 90 percent is the dominant type of waste generated, which consist of bio-degradable and non bio-degradable materials e.g. bottles, metal rags, leaves etc. The lowest type of waste generated was commercial with 10 percent. Efforts are needed from both personnel and their families and the Air Force Base authorities to promote the quality of the environment and save the health of inhabitants.

Index Terms— disposal of solid and liquid wastes, bio-degradable.

I. INTRODUCTION

All living species generate by-products through their activities. In nature, diverse ecosystems notably rainforests and coral reefs have achieved sustainability by the coexistence of a wide range of different species, whereby the waste of one specie has become the resource of another, and there is an apparent balance in the system. According to Sridhar et al (1992), if for any reason one specie becomes dominant, the sustainability of the system is challenged, and ‘nature’ responds to that imbalance. On the global scale,

Manuscript received October 18, 2014.

I Abdullahi, Department of civil Engineering, Nigerian Defence Academy, Kaduna

M A Ajibike, Departments of Water and Environmental Engineering, Ahmadu Bello University Zaria

A P Man-ugwueje, Department of civil Engineering, Nigerian Defence Academy, Kaduna

O I Ndububa, Department of civil Engineering, Abubakar Tafawa Balewa University, Bauchi.

human beings have become dominant in the ecosystem. This has been possible because of their large numbers and their ability to modify systems as well as extract and transform natural materials into their use. Also, Sridhar et al reveal that human beings have been slower to respond than nature can, and only in recent decades have they acknowledged the need to copy the examples of nature (bio-mimicry) to avoid accumulation of waste and address the challenges of waste management holistically. Wikipedia.com (27 Nov2006), explained that waste is any substance or object which the holder discards or intends to discard or is required to discard. Also, Wikipedia.com (2014) identified waste management as the generation, prevention, characterization, monitoring, treatment, handling, reuse and residual disposition of solid wastes. All human activities give rise to residual materials which may not be of immediate use and thereby constitute waste which is ultimately released to the environment. Waste can be categorized based on its source of generation and production. Thus, waste can be broadly grouped into domestic, commercial, and industrial waste. Dede, (2006), categorized waste based on its composition such as organic and biodegradable waste, non-biodegradable waste, solid waste, liquid waste, gaseous waste, and regulated medical waste.

1. Consequently, there is a growing domestic waste disposal problem in most developing countries, which is gradually approaching crises level. This trend has gone unchecked for so many years that now; the situation appears to be intractable. In Nigeria, the domestic waste disposal problem is typified by overflowing dustbins, mountains of open refuse dumps at virtually every street corner; with their attendant problems (especially where burning also occurs) and the existence of improperly operated landfills which are often rodent infested, with potentials for surface and ground water pollution. So far, most of the solutions proffered to solve the problem have at best been short term in scope and have tended to view the problem as a localized household or area wide problem rather than a regional one.

2. Nature has the capacity to disperse, degrade, absorb or otherwise, dispose of waste in the atmosphere, waterways, oceans, sea and soil. However, according to Eliassen (1969), there is concern about those residues including the domestic wastes that may poison or damage the environment, adversely affecting species in the biosphere and destabilizing ecological balance. Solutions aimed at addressing the domestic waste problems should target the benefits of health, conservation, aesthetics and recreation as well as the past organization of refuse disposal. The modern Nigerian urban domestic waste is characterized by polythene (plastic) materials, garbage, bottles, cans, papers or foil wrappings and all throwaways of

all sorts from the household. The volumes of these wastes are increasing rapidly because of the constant desire of consumers to discard the old and acquire new items, completely disregarding the concept of recycling and this is a big problem to disposal management. The rate at which domestic wastes are being generated is great nowadays and only an organized waste management can handle it without any problem. To achieve a sound waste management, much information is required based on right research or wide collection of necessary data of the area of study.

3. Accordingly, under the Environment Sanitation Edit of 1983, refuse disposal and the recovery of waste materials are the responsibilities of the local government authorities. They are therefore, responsible for the collection, transportation, treatment and final disposal of domestic waste (FMHE 1984). Before this time, domestic waste management had been the responsibility of the state extra ministerial parastatal, like the Abia State Environmental Sanitation Agency (Abia State) and the present Public Health Unit of the Kaduna State Environmental Protection Agency. On the national scale, this responsibility is vested on the Federal Environmental Protection Agency, which was established on the 30th of December, 1988.

4 The management of waste constitutes one of the most immediate and serious environmental problems facing most towns in Nigeria. The conventional waste management approach based on collection and disposal has failed to provide efficient and effective results. Onibokan (1989) observed that 23% of Ibadan, 33% of Kaduna, and 44% of Enugu households do not have access to waste collection. A World Health Organization (WHO) Report (2006), has identified waste as one of the biggest challenges to the health of the people residing in Lagos. The report revealed that Lagos has been beset with the difficulties of clearing over 10,000 tones of solid waste generated daily. The lack of effective waste disposal service is becoming a major problem. According to the report, the growth in the population of Lagos from 5.7 million in 1991 to about 9 million in 2005 has made it difficult for the State Government to find a solution to Lagos waste problems. The Lagos Waste Management Authority (LAWMA) corroborated the report and further stated that indiscriminate dumping is an added complication.¹
5 Emily (2004) asserted that when waste is not collected, unsanitary conditions develop and pose environmental and human health risks. The prevalence of parasites, tetanus, malaria, hookworm, cholera and diarrhea in most cities in Nigeria is attributed to the unsanitary condition in these cities. Oyediran (2004) posits that insanitary disposal of solid waste promotes fecal-oral transmission of diseases through fecal contamination of the hands, food and water. He further states that solid waste dumps provide breeding grounds for mosquitoes, rats and other vermin, generating amongst others; yellow fever, Lassa fever, and trachoma mortality in Nigeria.. Isa (2006) also agreed to this when he asserts that, a further canter through the Nigerian condition and a focus on refuse disposal and access to sanitary means of excreta disposal may not be in your menu of good taste. The litters that abound in the environment contain the admissible evidences. He then poses some questions such as: “where are the facilities developed over the years or why have the facilities not been provided and maintained to teach the population how to live a good quality life”? The researcher shares the same thought with Isa, hence was motivated to seek answers to these

questions and more. Therefore, this researcher sets out to look at the environmental implication of indiscriminate waste disposal in the Nigerian Air Force Base, Kaduna. Household refuse will be the main focus of this project because Nigerian Air Force Base, Kaduna constitutes mainly of Nigerian Air Force Base Kaduna Headquarters, domestic houses, hospital and mammy market. In planning new methods of waste collection and disposal, labor requirement and route schedules with high efficiency would be researched into including methods with fewer expenses, easy operation like land filling method.

STUDY AREA.

The Nigerian Air Force Base, Kaduna (known as the 335 Base Services Group, Kaduna) is a major base in the Nigerian Air Force. It is one of the largest in West Africa consisting of about 10,000 personnel according to the Nigerian air force magazine *The Airman* (2007). The NAF Base, Kaduna is called the mother base of the NAF because it is the first air force base to be established in Nigeria, and it was established in the year (1964) according to the *Airman* (2007). It is under the Headquarters of the Nigerian Air Force Training Command, Kaduna (HQTC). The NAF Base accommodates independent six (6) units which are the; 325 Ground Training Group (325 GTG), 333 Logistics Group, 345 NAF Hospital, NAF Institute of Technology (AFIT), 301 Flight Training School (301FTS).

The NAF Base has some commercial areas such as the mammy market where economic activities thrive. All these have contributed immensely to the high population density which increased solid waste generation in the Base.

AIM AND OBJECTIVES

The aim of this research is to examine waste generation and disposal in the Nigerian Air Force Base, Kaduna.

The specific objectives are as follows:

1. To examine the pattern of waste disposal in Nigerian Air Force Base, Kaduna.

2. Characterization of wastes in the Nigerian Air Force Base Kaduna.

3. Suitable waste management practice involved or carried out in the Nigerian Air Force Base, Kaduna.

II. LITERATURE REVIEW

A. GENERAL BACKGROUND

Most of the works available on this study focused and based their discussions on towns, cities and commercial and industrial areas and not on any military barracks in Nigeria, especially the NAF Base, Kaduna. For example, Nwankwo (1998) focused on Domestic Waste Management Problems in Abuja Municipal Council. Also, Jemide (2009) concentrated on Solid Waste Collection and Disposal using Tudun Wada as a Case Study while Fawa (2005), researched on the Environmental Implication of Indiscriminate Waste Disposal: A Case Study of Ringim Town, Jigawa State. Analysis of the above studies showed that the problems are almost similar. Domestic disposal practices raise serious issues concerning health and environmental risks (Jackson, 1989). Such waste as domestic wastes, are wastes arising from households.

According to Mantel (1975), domestic waste is composed of materials that are not only considered to be a nuisance but the materials that need to be discarded because they are not worth the cost and effort required to recycle them. The domestic is of negative economic value and therefore cheaper to throw-away than to recover (Rimberg, 1975). The American Solid and Domestic Waste Disposal Act (1965), defines domestic waste as garbage, refuse and other discarded materials including solid and sewage resulting from the activities in the household. The term domestic waste was also described as that material which is solid, semi-liquid or liquid

which arises from animal or human activities usually discarded as unwanted or useless (Rimberg 1975). The American Solid and Domestic Waste Disposal Act (ASDWD) (1965) also define domestic waste as the heterogeneous mass of throwaways from urban centers, markets, public places and households (Smith et al., 1989). Haggai (2007) made a summary of various methods of solid waste disposal in Nigeria and their merits and demerits as shown in Table 2.1.

Table 2.1: METHODS OF SOLID WASTE DISPOSAL IN NIGERIA AND THEIR MERITS AND DEMERITS

Serial	Method	Merits	Demerits
(a)	(b)	(c)	(d)
1.	Open dump	Easy to Mange; low investment and operating cost; can be put into operation in a short time	Unsightly; breeds diseases carrying pests; foul odours; causes air pollution when wastes are burnt; can contaminate groundwater trough leaching and runoff; can damage ecological valuable markets and wetlands
2.	Littering	Easy	Unsightly; expensive to clean up; wasteful.
3.	Sanitary landfill	Easy to manage; relatively low initial investment costs; can be put into operation in a short land, time; if properly designed and operated, minimizes pest, aesthetic damage, diseases, air pollution and water pollution problems; methane gas produced by waste decomposition can be used as fuel.	Can degenerate into an open dump if not properly designed and managed; requires large amount of waste resources; difficult to find sites because of rising cost; leaching may cause waster pollution; methane gas from decomposing wastes can create fire or explosion hazards; obtaining adequate cover material sites is costly.
4.	Incineration	removes odours and diseases carrying organic matter; reduces the volume of waste by at least 80%; extends life of landfills; requires little land; can produce some income from salvage metals and glass and use of waste heat for domestic purposes	High initial investment; high operating costs; frequent and costly maintenance and repairs; requires skilled operator; resulting residues and fly ash must be disposed off; causes air pollution unless very costly controls are installed; fine particle-air pollution; wastes some resources.
5.	Composting	converts organic wastes to soil conditioner than can be sold for use on land; moderate operating costs; most disease-causing bacteria are destroyed	Can be used only for organic waste; waste must be separated; limited market as most people are not aware of the use of soil conditioners.
6.	Scavenging	Helps in recycling of waste; reduces waste of resources; extends life of landfills; can provide a source of income for the poor	Requires market for recovered materials; profitable only with high volume of waste; workers exposed to health hazards.
7.	Resource recovery	high public acceptance; properly designed and operated; produces very little air and waste pollution; reduces waste of resources; extends life of landfills; can provide a source of income for people in the informal sector; can be a source of domestic energy; may be easier to find site than landfill	High initial investment; high operating costs; technology for many operations not fully proven; requires market for recovered materials or energy produced; costly maintenance and repairs; requires skilled operation; can cause air pollution if not properly controlled; profitable only with high volume of waste; discourages low technology sustainable earth approach.

Source: Haggai (2007), "Solid Waste Management in Nigeria: Problems and Prospects.

B. COMPOSITION OF WASTE

Generally, solid waste is of varied composition that arises out of materials such as dust ash, rags, garbage, broken glasses, waste paper, food wastes, iron tins, cookery and vegetable garbage as well as scraps, old furniture etc. The composition of household waste emanating from water carriage includes:

- a) **Ashes and Residue:** According to Smith (1980) ashes and residues are materials remaining from burning of wood, coal, coke and other combustible materials in homes, stores, institutions, industrial and municipal facilities for any purpose.
- b) **Organic Matter:** Cheremisinoff and morresi (1976) defined food wastes, also called garbage are animal, fruit or vegetable residues resulting from the handling, preparation, cooking and eating of foods.
- c) **Mineral Matter:** It consists of iron, old tins, broken glass, grit, dust, stones, Those considered to be of value among these materials are mostly sorted out by those who may need them.
- d) **Agricultural Wastes:** Mantle (1975) and cheremisinoff and Morresi(1976), define or classify these as waste generated as a result of diverse agricultural activities such as growing, planting harvesting, processing, packaging, preservation and preparation are collectively called agricultural wastes.
- e) **Solid waste can be managed, therefore to speak on the fold of solid waste management one will take into consideration the consequences it has on lives, which are as follows:**
 - a. Generation of solid waste
 - b. The magnitude of solid waste problems in term of quantities generated.
 - c. Public health and ecological impact of solid waste
 - d. Nature challenges and opportunities with respect to solid waste management

C. SOURCES AND TYPES OF SOLID WASTE

- a) **Domestic/Household Waste:** According to Hoornweg (1999) Residential or household refuse is generated from Single or multifamily dwellings which give rise to food waste, paper, cardboard, plastics, yard waste, wood, glass, metals, ashes.
- b) **Agricultural Wastes:** Hoornweg et al explained that Wastes and residues resulting from diverse agricultural activities such as ploughing, harrowing, ridging, bush clearing, planting and harvesting of raw field and tree and vine crops, animal slaughter and operation are collectively called agricultural wastes.
- c) **Commercial wastes:** Commercial waste is gotten from stores, offices, hotels market and warehouses. These include packaging materials, cartons, paper, typewriter, ribbons. The waste from restaurants etc is similar in nature to household refuses but usually contains higher portion of paper and polytechnic, (Hoornweg et al).
- d) **Municipal Services/Wastes:** Some waste arise from street cleaning, landscaping, parks, beaches, other recreational areas which include litter, waste from road side vendors, animal droppings, unauthorized disposal of house and commercial waste, wastes from landscape and tree trimming, general wastes from parks and recreational areas, (Hoornweg et al).
- e) **Institutional Waste:** These waste usually generated from hospitals, schools, dispensary, pharmacy, barracks which maybe largely household types, but hospitals (medical wastes/clinical wastes) dispose more dangerous materials such as cotton wools, bandages, syringes, waste from

operating theatres and discharged drugs and cans, (Hoornweg et al).

- f) **Construction/Demolition Wastes:** In the most rural and urban areas, but as buildings increase in size, number and complexity, the waste increases too. A multistory building has two or more stores underground producing a vast quantity of excavated materials. Fortunately this is useful for covering a controlled tip and in any case the majority of the building waste is inert. An exception is gypsum plaster which can give off a foul smell when dumped in water, (Hoornweg et al).
- g) **Hazardous Waste:** According to Environment Protection Agency (EPA), hazardous wastes are wastes or combination of wastes that pose substantial threat to human health or living organisms because:
 - i. Such wastes are non degradable in nature
 - ii. They can be biologically magnified
 - iii. They can be lethal
 - iv. They may otherwise cause or tend to cause detrimental cumulative Effects.

They are two ways a waste material is found to be hazardous:

By its presence on the EPA developed list, the waste exhibits ignitable, corrosive, reactive or toxic characteristic.

D. SOLID WASTE PROBLEM

The management of solid waste is very important and needs to problem to be tackled with all seriousness. According to Uchegbu (1996) solid waste management can be taken to be the process of putting together those items of environmental nature where man exist so as man’s activities do not have adverse effect on the environment Enebong (1986) states that the problem of solid waste dates back to the time when urbanization started and since then, there has been an increasing rate of refuse generation in Nigerian towns and cities. The generation and accumulation of solid waste are beginning to produce social, economic and environmental problems in significant proportions. These problems are particularly acute in regions with the experience of high population growth, which result in the generation of high amount of waste with no land to dispose them, Rinberg (1975). The contemporary difficulties facing urban centre’s in Nigeria can be attributed to government’s incapability in financing solid waste management at various levels. It may not be possible to stop man from his different activities, however, it is his duty to effectively control waste from various life’s activities since government cannot do everything.

E. FACTORS AFFECTING GENERATION RATE

Solid waste generation is affected by several factors and some of them are:

- i. Economic status
 - ii. Ethnic composition
 - iii. Social habits of the neighborhood
 - iv. Seasons
 - v. The horticultural choice of the neighborhood
 - vi. The geographical characteristics of the land
 - vii. Rainfall
 - viii. Climate
- The habits of the people, what they eat, drink and the packaged material they buy.

F. ONSITE AND DOMESTIC STORAGE OF SOLID WASTES

Factors that must be considered on the site storage of solid waste include:

- i. The type of container
 - ii. The container location
 - iii. Public health and aesthetics
- The collection method adopted

a) CONTAINERS

The characteristics of the solid waste to be collected will be determined by the type and capacities of the container to be used, the collection frequency and the space available for the replacement of containers. Containers normally used for storage are:

- (i) **Small Containers:** They include disposable plastic bags, disposable paper bags, and standard leak proof container (plastics, galvanized metal, barrel, aluminum or fiber)
- (ii) **Large Containers:** They have open top (also called debris box) and are also trailer mounted containers. The storage of household solid wastes in residential areas is normally carried out by storing the volume of solid waste generated every now and then, by keeping them in ash pits and ash bins. Ash pits have to be situated at reasonable distances and in fact not closer than 2.70 (10ft) from the residential houses. The ash pit has to be made up of bricks that have been lined inside with concrete, water tight, flagged floor of about 6.73m (3 inches) above ground level. It should be properly roofed, making provision for sufficient ventilation as well as adequate means of cleaning. It is very important to note here that, it should not have a drain. The ashbin and ash pit system is a satisfactory sort of solid waste storage for residential houses. The process therefore, tends to prevent any likely exposure of solid waste in the bins or vehicles in such a manner that no provision is made for escape of dust in the atmosphere.

G. COLLECTION AND TRANSPORTATION OF SOLID WASTE

- a) **Collection of Solid Waste:** According to Smith (1979), the gathering of generated domestic waste for disposal varies between residential, commercial and recreational facilities. Mantel (1975), states that as the generation pattern varies, the quantity of waste increases and the logistics associated with collection become complex. Qoun et al (1970) reported that, the collection of domestic wastes constitutes about 80% of the total cost of handling solid waste.
- b) **Transportation of Solid Waste:** Transportation of the waste stored at waste storage depots at regular intervals is essential to ensure that no garbage bins/containers overflow and waste is not seen littered on streets. Curled from (Wikipedia, 2014). Hygienic conditions can be maintained in cities/ towns only if regular clearance of waste from temporary waste storage depots (bins) is ensured.

H. BENEFITS OF SOLID WASTE DISPOSAL

Waste is not something that should be discarded or disposed of with no regard for future use. It can be valuable resource if addressed correctly, through policy and practice. With

rational and consistent waste management practices there is an opportunity to reap a range of benefits. Those benefits include:

- a) **Economic:** Improving economic efficiency through the means of resource use, treatment and disposal and creating markets for recycles can lead to efficient practices in the production and consumption of products and material resulting in valuable materials being recovered for reuse and potential for new jobs and new business opportunities, (Wikipedia 2014).
- b) **Social:** By reducing adverse impacts on health by proper waste management practices, the resulting consequences are more appealing settlements. Better social advantages can lead to new sources of employment and potentially lifting communities out of poverty especially in some of the developing poorer countries and cities, (Wikipedia 2014).
- c) **Environmental:** Reducing or eliminating adverse impacts on the environment through reducing, reusing and recycling and minimizing resource extraction can provide improved air and water quality and help in the reduction of greenhouse emissions, (Wikipedia 2014).
- d) **Inter-generational Equity:** Following effective waste management practices can provide subsequent generations a more robust economy, a fairer and more inclusive and cleaner environment, as stated by the United Nations Environmental Programme (2014).

III. METHODOLOGY

A. METHODS

Firstly, a reconnaissance survey was carried out, aimed at identifying the best sampling method for this study. The primary information was obtained using a set of questionnaires designed to source various information relevant to the study. Other sources of information used are direct interviews with the staff of the NAF Base, Kaduna involved in collection and disposal of waste.

B. PRIMARY SOURCES

These questionnaires are administered to get information from resident in the study area. Such information covers collection, transportation and final disposal of the domestic solid waste on the Base. An interview was conducted randomly as an attempt to cover the entire area concerned with waste collection and disposal in the study. An in-depth knowledge was sought on the facilities available for refuse collection and disposal, staff strength and the number of automated refuse collectors. The maintenance, expenditures and overhead operational cost of the NAF Base, Kaduna Works/Services outfit was discussed. Further information was sought to obtain data on generation and quality of wastes on the Base, field observations were undertaken and photographs of some areas of interest taken.

C. SECONDARY SOURCES

These were obtained from printed materials such as published books, journals, seminar papers, gazettes and non-published materials among others. Sampling techniques employed was done by dividing the Nigerian Air Force Base into districts based on the high populated settlements. Random distribution

Environmental Impact of Indiscriminate Waste Disposal “A Case study of Nigerian Air force Base Kaduna”

of questionnaires within streets was carried out making sure they get evenly to all streets. Few problems were encountered during the course of this study particularly in administering questionnaires. It was time consuming and costly to visit various quarters where the respondents live or work. Respondents in the study area could not give answer immediately because of the multiplicity of the questions in the questionnaire. The actual quantity of the waste could not be gotten through questionnaires, so the Nigerian Air Force Base was divided into sections or districts due to time restraint, so the Nigerian Air Force Base was divided into; Headquarters (Base services Group), Academic area and residential quarters. The use of small containers “waste baskets” were used, the containers were weighed empty before been place at strategic locations for resident of the areas to dispose of their waste.

IV. DATA PRESENTATION AND ANALYSIS OF RESULT

This chapter discusses the analysis of data derived from the study area by observation, reconnaissance, oral interview and questionnaire administration. 70 copies were administered which consisted of items related to the aim and objectives of the research. But only 50 copies were retrieved forming a percentage of 90 of the total questionnaires produced. Below are detailed analyses posed and the responses obtained.

A. Analysis/results of the questionnaires administered to the public

TABLE 4.1.1 Distribution of level of education in Nigerian air force base

ITEM	FREQUENCY	PERCENT
No formal education	5	10.4
Primary	4	8.3
Secondary	10	20.8
Tertiary	29	60.4
TOTAL	48	100.0

Source: Survey data, 2014

Table 4.1 shows that 60.4% of respondents acquired up to tertiary level of education while 20.8% acquired secondary education. From the table above 8.3% have only primary school education while 10.4% of the respondents did not have any formal western education. From this distribution, it is evident that at least 82% of the respondents had at least secondary education while the remaining 18% have little or no formal western education. This shows a high degree of enlightenment, which could indicate some degree of awareness of the ill of mismanaged solid wastes.

B. Possession of garbage/refuse bin in the Nigerian air force base

Table 4.2.1 Responses in possession of garbage/refine bins

ITEM	FREQUENCY	PERCENT
Yes	37	77.1
No	11	22.9

Total	48	100.0
-------	----	-------

Source: Survey data, 2014

Table 4.2 shows that 77.1% of the total population sampled possessed garbage/refuse bin while 22.9% of respondent do not possess any. It is not certain how then 22.9% of respondents handle their wastes but since they do not possess any refuse collection, it could imply that they handle their waste on their own. This may be by burning, wild dumping or any other method that is carried out within the same area. This means that the refuse are not gathered for eventual disposal by the local government authority which is responsible for its fixed disposal.

C. Payment for collection of waste in the Nigerian air force base

TABLE 4.3.1: Response on payment for collection of refuse

ITEM	FREQUENCY	PERCENT
YES	29	60.4
NO	19	39.6
TOTAL	48	100.0

Source: Survey data, 2014

Table 4.3 shows that 60.4% of respondents are paying for the collection of their refuse, while 39.6% do not pay. Nigerian Air force base are paying some amount to the contractors for removal of pure solid waste.

However, those who do not pay for their refuse collection could indicate mostly those who do not have collection bins for gathering their solid wastes for a centralized disposal by the Nigerian Air force base authority. They could therefore be responsible for littering the environment with their solid waste or indiscriminately dump the wastes around.

D. Frequency of collection of waste in the Nigerian air force base

Table 4.4.1 Response on Frequency of collection of waste

ITEM	FREQUENCY	PERCENT
Daily	17	35.4
Weekly	23	52.1
Monthly	6	12.5
Above a month	0	0
TOTAL	48	100

Source: Survey data, 2014

From table 4.4, 52.1% of respondent reported weekly collection intervals while 35.4% of respondent reported daily collection. Such daily collection was reported on how the collection made by the Nigerian Air force Base Environmental Authority (AFBEA)

E. Adequacy of present system of disposal in Nigerian air force base

Table 4.5.1 Response to the present system of disposal adequacy

ITEM	FREQUENCY	PERCENT
YES	19	39.6
NO	29	60.4
TOTAL	48	100.0

Table 4.5 shows the response to the adequacy of the present disposal system in the Nigerian Air Force Base Kaduna 60.4% of the respondent are not satisfied with the present adequate. This portion of respondents probably gave their response because of lack of system of disposal or waste disposal include. However, majority of the respondent are not satisfied with the present method of disposal as they believe that entire environment is filthy.

F. ANALYSIS/RESULTS OF THE CONDUCTING WASTE AUDIT

a) Quantifying waste sector or management at the point of generation.

The process of quantifying waste for the Nigerian air force base Kaduna involves several steps starting with the measurement of waste taken at the generation point/sector visited.

The general procedure applicable in most instances is described below. The Nigerian air force base would be divided into sections due to time restraint. They are:

1. Headquarters
2. Academic area
3. Accommodation area

Weight of empty waste paper basket = 200g

CALCULATIONS (HEADQUARTERS)

Day 1

Weed = $0.55/6.44 \times 100 = 8.34\%$
Nylon = $1.4/6.44 \times 100 = 21.7\%$
Paper = $1.10/6.44 \times 100 = 17.08\%$
Plastic = $1.15/6.44 \times 100 = 17.86\%$
Glass = $2.24/6.44 \times 100 = 34.78$

Day 2

Weed = $0.71/10.07 \times 100 = 7.03\%$
Nylon = $1.2/10.07 \times 100 = 11.92\%$
Paper = $2.16/10.07 \times 100 = 21.3\%$
Plastic = $2.7/10.07 \times 100 = 26.8\%$
Glass = $3.3/10.07 \times 100 = 32.7\%$

Day 3

Weed = $1.2/7.44 \times 100 = 16.13\%$
Nylon = $0.0/7.44 \times 100 = 0\%$
Paper = $1.5/7.44 \times 100 = 20.16\%$
Plastic = $2.8/7.44 \times 100 = 37.6\%$
Glass = $1.9/7.44 \times 100 = 25.54\%$

Day 4

Weed = $0.34/8.04 \times 100 = 4.23\%$
Nylon = $1.2/8.04 \times 100 = 14.93\%$
Paper = $2.5/8.04 \times 100 = 31.1\%$
Plastic = $1.4/8.04 \times 100 = 17.41\%$
Glass = $2.6/8.04 \times 100 = 32.34\%$

Day 5

Weed = $0.99/8.49 \times 100 = 11.7\%$
Nylon = $2.2/8.49 \times 100 = 25.9\%$
Paper = $3.4/8.49 \times 100 = 40.1\%$
Plastic = $1.4/8.49 \times 100 = 22.4\%$
Glass = $0/8.49 \times 100 = 0\%$

CALCULATIONS (ACADEMIC AREA)

Day 1

Nylon = $1.5/5.12 \times 100 = 29.3\%$
Paper = $0.15/5.12 \times 100 = 2.93\%$
Plastic = $0.7/5.12 \times 100 = 13.7\%$
Glass = $1.77/5.12 \times 100 = 34.6\%$
Weed = $1.0/5.12 \times 100 = 19.5\%$
Day 2

Nylon = $0.5/4.19 = 11.93\%$
Paper = $1.10/4.19 = 26.25\%$
Plastic = $0.4/4.19 = 9.55\%$

Glass = $1.20/4.19 = 28.64\%$
Weed = $0.99/4.19 = 23.63\%$

Day 3

Nylon = $0.66/3.23 \times 100 = 20.43\%$
Paper = $1.21/3.23 \times 100 = 37.46\%$
Plastic = $0.45/3.23 \times 100 = 13.93\%$
Glass = $0.00/3.23 \times 100 = 0.00\%$
Weed = $0.91/3.23 \times 100 = 28.17\%$

Day 4

Nylon = $0.71/5.58 \times 100 = 12.72\%$
Paper = $0.92/5.58 \times 100 = 16.49\%$
Plastic = $1.45/5.58 \times 100 = 25.99\%$
Glass = $1.5/5.58 \times 100 = 26.9\%$
Weed = $1.00/5.58 \times 100 = 17.9\%$

Day 5

Nylon = $1.52/5.89 \times 100 = 25.81\%$
Paper = $1.92/5.89 \times 100 = 32.6\%$
Plastic = $1.45/5.89 \times 100 = 24.62\%$
Glass = $0.00/5.89 \times 100 = 0\%$
Weed = $1.00/5.89 \times 100 = 16.98\%$

CALCULATIONS (RESEDENTIAL AREA)

Day 1

Nylon = $6.5/42.05 \times 100 = 15.5\%$
Paper = $4.10/42.05 \times 100 = 9.75\%$
Plastic = $9.15/42.05 \times 100 = 21.76\%$
Glass = $3.10/42.05 \times 100 = 7.372\%$
Weed = $10.10/42.05 \times 100 = 24.02\%$
Vegetables = $9.10/42.05 \times 100 = 21.64\%$

Day 2

Nylon = $3.6/30.15 \times 100 = 11.94\%$
Paper = $2.10/30.15 \times 100 = 6.97\%$
Plastic = $7.15/30.15 \times 100 = 23.72\%$
Glass = $2.10/30.15 \times 100 = 6.97\%$
Weed = $8.1/30.15 \times 100 = 26.87\%$
Vegetables = $7.10/30.15 \times 100 = 23.55\%$

Day 3

Nylon = $2.6/25.05 \times 100 = 10.38\%$
Paper = $1.15/25.05 \times 100 = 4.59\%$
Plastic = $6.10/25.05 \times 100 = 24.35\%$
Glass = $3.00/25.05 \times 100 = 11.98\%$
Weed = $7.1/25.05 \times 100 = 28.34\%$
Vegetables = $5.10/25.05 \times 100 = 20.36\%$

Day 4

Nylon = $4.60/31.82 \times 100 = 14.46\%$
Paper = $3.00/31.82 \times 100 = 9.43\%$
Plastic = $8.15/31.82 \times 100 = 25.6\%$
Glass = $2.30/31.82 \times 100 = 7.23\%$
Weed = $5.22/31.82 \times 100 = 16.41\%$
Vegetables = $8.55/31.82 \times 100 = 26.87\%$

Day 5

Environmental Impact of Indiscriminate Waste Disposal “A Case study of Nigerian Air force Base Kaduna”

Nylon = $5.0/24.42 \times 100 = 20.48\%$

Paper = $3.0/24.42 \times 100 = 12.30\%$

Plastic = $3.2/24.42 \times 100 = 13.10\%$

Glass = $2.33/24.42 \times 100 = 9.54\%$

Weed = $4.23/24.42 \times 100 = 17.32\%$

Vegetables = $6.66/24.42 \times 100 = 27.27\%$

V. SUMMARY, RECOMMENDATION AND CONCLUSION

The wide spread litters and heaps of solid waste occupied a very huge area of land in the study area. As the physical survey shown, so much value of solid waste generating daily and are inefficiently managed. This can be attributed to the high influx of population and urbanization that the study area is experiencing. These outstretched the existence of waste disposal facilities and consequently led to the indiscriminate waste accumulation along roadside, gutters, drainage, open spaces etc, hence causes a lot of nuisance to environment and destruction of lives and properties. Domestic waste constitutes the largest proportion of the waste generated which is earlier biodegradable or non-biodegradable materials. Areas with largest population generation have more waste than areas with low population. The generation is basically dependent on the socio-economic status and the nature of the activities of the people. The waste contribute to different environmental implications such as land pollution, which changes the aesthetic view of the environment, bad odor production, air pollution and underground water pollution. The Nigerian air force base sanitary unit is the authority responsible for household solid waste collection and disposal, unfortunately facing so many problems. Such as gross inadequate budgetary allocation, the unit is poorly structured and grossly understaffed, as the trained environmentalist are nearly equal to the numbers of laborers and waste collection and disposal are usually done manually, regulation are not enforced. Waste management facilities are poorly designed, private waste collection firms were absent, lack of participation and cooperation apart from the inhabitants which are necessary ingredients of good government, have greatly hampered the success of waste management in the study area. All these put together and result to proper inefficiency of solid waste management in the study area. And effect of growing waste can daily be seen in our various communities as a whole. But if the Nigerian air force base Kaduna provide an effective and efficient waste collection, transportation and disposal facilities available provide enough running cost, employ more personnel especially laborers public and private firms are to fully participate into the scene and environmental laws are to properly enforce in the study area, the problems will certainly be alleviated.

APPENDIX

TABLE 4.7.1 (HEADQUATERS)

	Day 1 (kg)	Day 2 (kg)	Day 3 (kg)	Day 4 (kg)	Day 5 (kg)
Weed	0.55	0.71	1.24	0.34	0.99
Nylon	1.4	1.2	0	1.2	2.2
Paper	1.10	2.16	1.5	2.5	3.4
Plastic	1.15	2.7	2.8	1.4	1.9
Glass	2.24	3.3	1.9	2.6	0
Total	6.44	10.07	7.44	8.04	8.49

4.7.2 ACADEMIC AREA

	Day 1 (kg)	Day 2 (kg)	Day 3 (kg)	Day 4 (kg)	Day 5 (kg)
Nylon	1.5	0.5	0.66	0.71	1.52
Paper	0.15	1.10	1.21	0.92	1.92
Plastic	0.7	0.40	0.45	1.45	1.45
Glass	1.77	1.20	0.00	1.5	0.00
Weed	1.0	0.99	0.91	1.00	1.00
Total	5.12	4.19	3.23	5.58	5.89

4.7.3 RESIDENTIAL AREA

	Day 1 (kg)	Day 2 (kg)	Day 3 (kg)	Day 4 (kg)	Day 5 (kg)
Nylon	6.5	3.6	2.6	4.60	5.0
Paper	4.10	2.10	1.15	3.00	3.0
Plastic	9.15	7.15	6.10	8.15	3.2
Glass	3.10	2.10	3.00	2.30	2.33
Weed	10.10	8.1	7.1	5.22	4.23
Vegetables	9.10	7.10	5.10	8.55	6.66
Total	42.05	30.15	25.05	31.82	24.42

REFERENCES

- [1] Asomani-Boateng, R. et al (2007) “Reusing Organic solid waste in urban farming in African cities: A challenge for urban planners” (unpublished), p.3.
- [2] Akintola, W.T. (2011): Urban Waste Management and National Development in Nigeria: Challenges and Prospects, being a project submitted to National Defence College Abuja, Nigeria.
- [3] AIT (2011). An interview on Malaria pandemic in Africa. Aniameka, C.J.(2009). Non Biodegradable Material and the Environment: A Case Study of Polyethylene Material Disposal in Nigeria. Being a project submitted to the National Defence College, Abuja, Nigeria.
- [4] Bony, H and Honton, G.(1974) Publication on Industrial Waste Handling, Disposal and Reuse.(Printed by Noble and Bredon Limited Publisher) BB Limited, London, p.63.
- [5] Barbour, I. (1980) Technology Environment and Human values. (West point: praeger), p.149.
- [6] Dede, E.B. (2006). “Realizing effective Medical Waste Management from Cradle to Gravel in Nigeria.” Paper presented at the Fourth Annual National Conference of the Senate on the Environment Port Harcourt, Rivers State, Nigeria, p.28.
- [7] Daily Trust Newspaper (2014). Nigeria Refuse Generation hits 65 mill tonnes per annum, Abuja p.43. Waste Management Society of Nigeria (2014), Lagos.
- [8] Emily, W. (2004). Municipal solid waste Management in Developing Countries: Nigeria, a case study, (New York; USA), P.4
- [9] Federal Ministry of Housing and Environment (1984). The state of environment in Nigeria Environmental Planning and Protection Division Monograph Series No.2, Solid Waste Management in 15 cities and urban areas in Nigeria; pp.22-27.
- [10] Egunjobi, L (1993) “Issues in Environmental Management for Sustainable Development in Nigeria”, The Environment, Vol. 13, No.1, 33-40, p.35.
- [11] FEPA Monograph 2 “State Environmental Edits and Harmonization with the provision of the Federal Environmental Protection Agency (FEPA) Decree No. 58 of 1988: The Lagos State Experience”. E.O.A Aina and N.O. Adedipe (Eds), Towards Industrial Pollution Abatement in Nigeria, (Ibadan University Press), p.198.1992.
- [12] Fawa, H. (2005). Environmental implication of indiscriminate waste disposal: A case study of Ringim Town, Jigawa state. Being a project submitted to the Nasarawa State University, Nasarawa state.
- [13] Fadipe, G.O. (2008) Solid Waste Management in Environmental Consciousness for Nigeria National Development (eds)
- [14] .O.A Aina et al, FEPA 1991 Abuja, p.35.
- [15] FMHE (1984)
- [16] Halsey, A.H.(2004) “Urban Environment”, Article contributed to Encarta Premium Suite

- [17] Hoorweg, Daniel & Laura Thomas (1999) "What A Waste: Solid Waste Management in Asia. Working paper series, Urban Development Sector Unit, East Asia and Pacific Region p.5.
- [18] Haggai, K.T.(2007). Solid Waste Management in Nigeria: Problems and Prospects. Being a project submitted to the National War College, Abuja, Nigeria.
- [19] Isa, A.A.A. (2006). Demographic Trends and Human Development in Nigeria. Commandant National War College Inaugural Lecture to participants of NWC course 15, Abuja, Nigeria.
- [20] Junaid, K.S.A. (1999) "Conventions, Codes of Practice and conditions for Disposal of hazardous wastes", paper presented at the workshop on Dredged soil environmental waste minimization/waste Management, Lagos, Nigeria.
- [21] Jackson, M.H. et al (1989): "Environmental Health Reference Book". Butterworth's publishers, England.
- [22] Jemide (2009). Solid waste collection and disposal: Tudun Wada, Kaduna as a case study. Being a project submitted to the Nigerian Defence Academy, Kaduna. National Waste and Recycling Association, (2013) "History of solid waste management". Washington, DC.
- [23] Nwankwo, I.M. (1989) Domestic waste Management problems in Abuja Municipal Council, a project submitted to the Ahmadu Bello University, Zaria, and Kaduna state.
- [24] Onibokan, A. (1989). Urban Growth and Management in Nigeria(New York).p.69
- [25] Osibanjo, O. (2008). Pollution and waste: Issues and Management Strategies A paper delivered at a conference organized by the Federal Ministry of Environment in Abuja.
- [26] Oyediran, A.B. (2004). War on filth (Ibadan: Oluben Printers), p.11.
- [27] Quon, J.E et al (1970). "Efficiency of Refuse Collection Crews". Journal on Sanitary Eng.DivASCE(96) 2: 437-452, London
- [28] Rimberg, D. (1975). "Municipal waste management" Noyes Data Corporation, USA.
- [29] Science Direct (2013): "Waste Management". Volume 33, Issue 1, PP 220-232.
- [30] Smith, H. (1980). Solid Waste: Origin, collection, processing and Disposal. John Wiley and Sons Publication.(New York), p.36.
- [31] Sridhar, M.K.C and Boker, J (1992) Waste Management, Processing and Detoxification, (Ibadan), p. 315.
- [32] The Airman (2007). The Nigerian Air Force Magazine, HQ NAF, Abuja.
- [33] The Guardian Newspaper (2009). Waste Management in Nigeria, P.12.
- [34] United Nations Environmental Programme (2013) "Guidelines for National Waste Management strategies, moving from challenges to opportunities". ISBN 978-92-807-3333-4.
- [35] United States Environmental Protection Agency (USEPA) 1996 Guide to Environmental Issues. (Washington: US Government Printing Office, p.28.
- [36] Uchegbu, S (1996). Environmental Management and Protection. (Spotlight: Enugu), p.41
- [37] Wikipedia (2014). Accessed 20 April
- [38] World Health Organization Report(2006). International view point. Journal of Environmental Health, Vol. 44K, No.5
- [39] Wikipedia.com (2006): Waste Management.
- [40] Waste Management (2013). (Retrieved from <http://www.Sciencedirect.com/science/article/pii/S0956053X14000269>. "Editorial Board/ aims & scope")