

A Review on Municipal Solid Waste Management in Nigeria

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Abstract: Municipal Solid Waste Management is a global issue and has proven a key challenge facing African countries. It constitutes one of the most crucial health and environmental problem facing African cities. Most cities spend 20-50% of their annual budget on Solid Waste Management and only 20-80% of the waste is collected. The UNEP states “The World Bank estimates that in developing countries, it is common for municipalities to spend 20-50 % of their available budget on Solid Waste Management (open dumping with open burning is the norm), even though 30-60% of all the Urban Solid Wastes remain uncollected and less than 50% of the population is served. In low-income countries, collection alone drains up 80-90% of Municipal Solid Waste Management budget. In mid-income countries, collection costs 50-80 % of total budget. In high-income countries, collection only accounts for less than 10% of the budget, which allows large funds to be allocated to waste treatment facilities”. One of the consequences of population growth and globalization is increased waste generation, generation varying between cities and city part in Africa, with reliable data being difficult to come by. This has become a concern for developing countries and is one of the greatest challenges facing Environmental Protection Agencies in developing countries. This paper aims at reviewing the issue of Municipal Solid Waste Management in Nigeria. Data was obtained from past literature, interviews, government agencies and documents. The qualitative data was analyzed descriptively and the quantitative data was analyzed using basic statistical methods, aimed at giving a clear and detailed overview of the situation. Based on the findings it can be concluded that Municipal Solid Waste Management is becoming a serious problem that is yet to be properly addressed in Nigeria.

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1.0 Introduction

Solid Waste Management (SWM) is an integral part of urban and environmental management in every city (Manaf *et al.*, 2008). Solid Wastes are the useless and unwanted products in the solid state derived from the activities of and discarded by society. According to Tchobanoglous, 1993 the term Municipal Solid Waste (MSW) normally is assumed to include all of the waste generated in a community with the exception of industrial process waste and agricultural waste; sources as residential, commercial, institutional, construction and demolition, municipal services excluding treatment facilities, treatment plant sites; municipal incinerators. Currently Municipal Solid Waste Management (MSWM) is a globally challenging issue especially in developing countries, due to its adverse environmental effects (Zamorano *et al.*, 2009; Jalil, 2010; Adekunle *et al.*, 2011). Mankind naturally depends on the environment to sustain their lives but Solid Waste is one of the three major environmental problems in Nigeria. Many other developing and even the developed countries are threatened by this (Ogu, 2000; Jalil, 2010). Waste Management generally plays a significant role in the ability of nature to sustain life within its capacity. Solid Waste Management is a reoccurring challenge

for local authorities and environmental bodies in many developing countries (Zamorano *et al.*, 2009), with standards of Waste Management being poor and outdated. Improper Solid Waste Management has contributed greatly to river pollution and also to climate change; decomposing waste produces methane (Jalil, 2010). Issues reoccurring that affect MSWM are; poor documentation of waste generation rates and its composition, inefficient storage and collection systems, disposal of municipal wastes with toxic and hazardous waste, indiscriminate disposal or dumping of wastes and inefficient utilization of disposal site space. The global waste generation was estimated at 318 million tons as of 2002, with an annual increase of approximately 6%. Global Solid Waste generation is expected to reach about 518 million tons in 2008 and 585 million tons in 2010 (UNEP, 2002; Periathamby and Hamid, 2009).

The rapid population increase due to urbanization in Abuja and other major cities in Nigeria has caused difficulties for the state and local environmental protection in providing an effective and efficient municipal Solid Waste Management System (Olanrewaju and Ilemobade, 2009; Zamorano *et al.*, 2009). Urbanization affects land use and when not controlled causes the emergence of illegal structure and neighbourhoods which is characteristic

of some areas within and outside the metropolis. This has ultimately affected the city plan, thereby affecting services such as; waste collection, eventually leading to illegal dumping. These illegal dumps with time have become mountain like open dumps in the middle of residential areas, with odours and rodent. These open dumps causes health risks and reduces the aesthetic value of the surrounding environments, deterioration of the urban environment, as well as contaminate natural resource (Ogu, 2000). The rapid growing waste generation rates and high cost of waste disposal, depletion of landfill space and the problem of obtaining new disposal sites resulting in open dumping are unresolved issues. It has become necessity due to the above mentioned to have an overview the current status and challenges with this regard.

2.0 Methodology

This paper is a case study which involved obtaining data from past and present studies, government and non- government bodies and existing literature. The study relied on secondary data. The data obtained was analysed using basic statistics and descriptive method, logical deductions and sequential presentation of facts from the data obtained.

3.0 Literature Review

Tanskanen, (2000) developed and applied a computer model to study the Integrated Municipal Solid Waste Management in Helsinki Metropolitan Area (Finland). The model was developed for analyzing on-site collection systems of waste materials separated at the source. The study aimed at finding and analyzing separation strategies, fulfilling the recovery rate targets adopted for Municipal Solid Waste in Finland. Chang and Davila, (2008) offered a unique Municipal Solid Waste investigation with regard to both physical and chemical characteristics illuminating the necessary management policies with greater regional relevancy. Zotos *et al.*, (2008) developed a systematic approach for Municipal Solid Waste Management at both the household and non-household level. It aimed at providing a framework in the Municipal Solid Waste Management field for municipalities in Greece, as well as other countries facing similar problems. Turan *et al.*, (2009) presented a brief history of the legislative trends in turkey for Municipal Solid Waste Management; the study presented the Municipal Solid Waste responsibilities and management structure, together with the present situation of generation, composition, recycling and treatment. Bovea *et al.*, (2010) compared from an environmental point of view different alternatives for the management of Municipal Solid Waste generation in a town within Spain. In (2010), Tunesi analyzed local Waste Management strategic and management planning

documents. In the paper three different emerging energy recovery strategies were identified, with each energy recovery strategy resulting in different solutions in terms of technology selection.

Ahiamadu, (2007) carried out a comparative analysis on various Waste Management options, with emphasis on the health and environmental impacts of Municipal Solid Waste and the challenges confronting Municipal Solid Waste Management in Nigeria. In (2009), Olanrewaju and Ilemobade researched on Ondo state Integrated Waste Recycling and Treatment Project in Nigeria, looking into the issue in terms of Municipal Solid Waste Management before and after the introduction of this system. They documented the success of the project in turning waste to wealth. Babayemi and Dauda, (2009) evaluated the Solid Waste generation, categories and disposal option in developing countries. They used Nigeria as a case study; their study results indicated large generation at high rates without corresponding efficient technology to manage the waste. In (2010) Onwughara *et al.*, studied the issues of road side disposal habit of Municipal Solid Waste in Nigeria. The paper emphasized on various Waste Management options; Integrated Waste Management, environmental impacts under health, social effects and the legislation of extended producer responsibility were suggested. Several studies over the years have been carried out towards addressing these issues, different methods have been applied toward resolving different aspect of Solid Waste and Waste Management issues as a whole.

3.1 Municipal Solid Waste

Municipal Solid Waste (MSW) is generally defined as waste collected by municipalities or other local authorities. However, this definition varies by country. EPA AU, (2009) defined municipal Solid Waste as the solid component of the waste stream arising from domestic premises, commercial, government and public premises. Municipal Solid Waste typically includes: durable goods, non-durable goods, containers and packaging, food wastes and yard trimmings, and miscellaneous inorganic wastes (EPA US, 2012). MSW consist of all community waste, with the exclusion of industrial process waste and agricultural waste.

3.2 Municipal Solid Waste Management

Industrial revolution brought the rise of the world of consumers. With the concentrated population developed springing up at and around industrial area. This then Results in rapid urbanization processes which pose many challenges to planning authorities, government and local administrations. Managing waste generated due to the large population became a difficult challenge for administrator. Municipal Solid Waste generation is a

continually growing problem at global, regional and local levels due increasing population levels, economic growth and higher living standards (Zamorano *et al.*, 2009). Municipal Solid Waste Management (MSWM) is the planning and implementation of systems to handle MSW.

3.3 Concept of Integrated Solid Waste Management

This is the management of the entire waste process as shown in Figure 1 below which includes; generation, storage, collection, management transportation, resource recovery, treatment and disposal. Integrated Solid Waste Management (ISWM) system is based on 3R principle (UNEP, 2009). Integrated Solid Waste Management employs several waste control methods based on the waste hierarchy; including avoidance, reduction, recycling, reuse, recovery, treatment and disposal. This is the backbone of ISWM as shown in Figure 2; the 3-R waste hierarchy. Aimed at minimising the environmental impact of waste (EPA AU, 2009). The concept of ISWM is developed out of experiences to address problem that are common with MSW in low income and developing countries. Presently the concept of ISWM requires a more formal structure of facilities and political action at both state and federal government levels (Manaf *et al.*, 2008).

3.4 Waste Hierarchy

Waste Hierarchy classifies waste management strategies according to the best option; reduce, reuse and recycle. The 3Rs are a hierarchy of

ranking of waste management operations according to their environmental benefits as shown in Figure 2 below. The aim of the waste management hierarchy is to make waste management practices as environmentally sound as possible (UNEP, 2009).

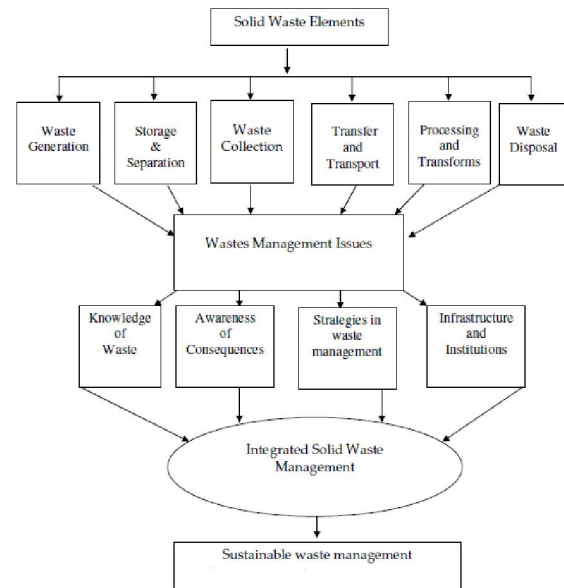


Figure 1: Concept of Integrated Solid Waste Management

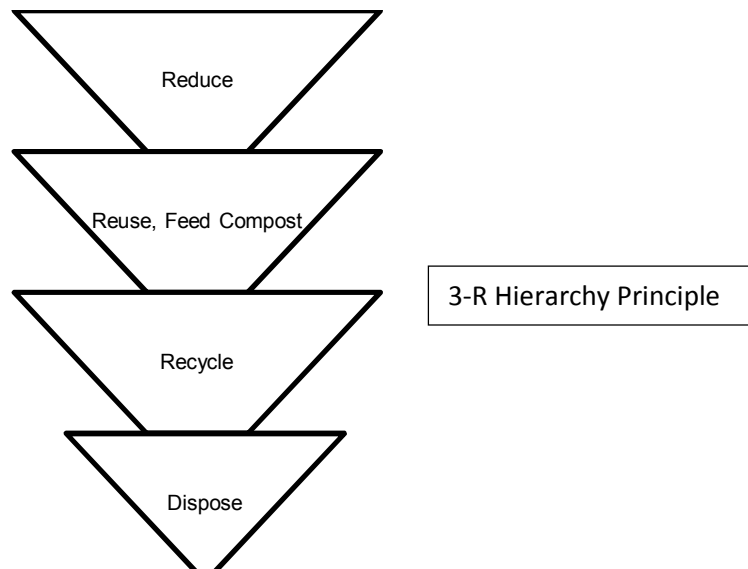


Figure 2: Waste Hierarchy

4.0 Municipal Solid Waste Management in Nigeria

Waste generation is an integral part of human activity influenced by social dynamics and

economic development. Although nature has the capacity to dilute, disperse, degrade, absorb and reduce the impact of unwanted residues in the

environment. Ecological imbalances have occurred where the natural assimilative capacity has been exceeded (Tchobanoglous *et al.*, 1993). Improper waste handling and management pose great threats to the environment and public health. In Nigeria, The commonly practised waste management option in the country, basically involves the collection of mixed waste materials and subsequent dumping at designated dumpsites. It is not a practice to separate waste materials at source or any point during its management (Adekunle *et al.*, 2011). In Nigeria waste stream generally consist of putrescibles, plastics, paper, textile, metal, glass. It is generally reported that enormous quantities of Solid Waste are generated daily in the major cities of Nigeria as shown in Table 1 below are high. But exact figures are difficult to determine due to the fact that proper records of collection and disposal are not kept by the authorities responsible. Waste generation and composition is greatly influenced by population, income, economic growth, season, climate and social behavior.

In Nigeria waste density generally range from 280-370kg/m³, Waste generation rate is 25 million tons annually and at a daily rate of 0.44-0.66 Kg/capital/day (Ogwueleka, 2009). Per capital rate of MSW production in Lagos, Nigeria is reported to range from about 0.21kg per day per person (Bamgbose, 2000; World Bank, 2004) to about 0.35kg per day per person (CSL, 2002; Aboyade, 2004). This is equivalent to about 49 million kg waste per day (17.9 million metric tons per year) in Nigeria. With a population of about 140 million as of 2006 population and currently 167 million at a growth rate of 3.2% as of 2012 (CIA, 2012; NPC, 2012). Refuse is stored in 1.5 m³ containers in the residential areas while 1.6 m³ containers and built-up dumps are used in the commercial, industrial and some residential areas. Vehicles for waste collection include; open tippers, side loaders, liftable container trucks and rear-loading compactors (Agunwamba *et al.*, 1998). The curb system of collection is used in single detached residential areas and apartments; 1.5m³ bins. The set-out/set-back system is practised in some residential areas in places like Onitsha (Agunwamba *et al.*, 1998). In apartments, institutions and commercial areas communal bins; movable and stationary containers are used.

In a study by Onwughara *et al.*, (2010) about the disposal habit, environmental impact of MSW in Nigeria. An overview was given about the various management practicing and necessary rules to achieve sound management. Umuahia, a town in the Southeast of Nigeria; the capital of Abia State was the selected case study. With a population of about 1.2 million people who produced 250 metric tons of

waste in 2005 and 350 metric tons of waste in 2007 daily. In their study 80% of the MSW was generated from market trader, the MSW consists generally of mixed waste containing hazardous and non-hazardous component. Which are neither separated, treated nor recycled before disposal by the municipality. While waste collection projects had been planned and conducted successfully in some parts of Nigeria both by the private and public sector, there is rarely any concrete plan for proper disposal of waste in Nigeria (CPE, 2010).

Table 1: Waste Generation in Some Urban Cities in Nigeria

City	Population	Agency	Tonnage per month	Density (Kg/m ³)	Kg/Capita/Day
Lagos	8,029,200	Lagos State Management Authority	255,556	294	0.63
Kano	3,348,700	Kano State Environmental Protection Agency	156,676	290	0.56
Ibadan	307,840	Oyo State Environmental Protection Commission	135,391	330	0.51
Kaduna	1,458,900	Kaduna State Environmental Protection Agency	114,433	320	0.58
Port Harcourt	1,053,900	Rivers State Environmental Protection Agency	117,825	300	0.60
Makurdi	249,00	Urban Development Board	24,242	340	0.48
Onitsha	509,500	Anambra State Environmental Protection Agency	84,137	310	0.53
Nsukka	100,700	Enugu State Environmental Protection Agency	12,000	370	0.44
Abuja	159,900	Abuja Environmental Protection Agency	14,785	280	0.66

Source: All Sites Engineering Ltd (Ogwueleka, 2009)

4.1 Institutional and Policy Framework for Solid Waste Management in Nigeria

During pre-independence; 1900-1960 several legislative controls were put in place to address environmental sanitation problems. Cantonment Proclamation of 1904 on the layout and Sanitation of Government Reservation Areas;

1. Public health act of 1909 on environmental sanitation;
2. Township ordinance No.29 of 1927 on sanitation and environmental management; Lagos colony ordinance of 1928 outbreak of bubonic plague;
3. Mineral act of 1945 trench and drainage pollution;
4. Town and country planning ordinance of 1946 cap 123 (west), cap 130 (north) and cap (east); Building line regulation of 1948;
5. Public health laws of 1957 to combat overcrowding, disease and squalor;
6. Local government ordinance 1950/54-58.

Due to indiscriminate disposal and dumping of waste, a common practice in Nigerian cities. The Federal Government of Nigeria passed Decree number 58 for the establishment of a Federal Environmental Protection Agency (FEPA) on 30

December 1988 (Federal Military Government 1988). Laws and regulations were created and implemented to safeguard the environment. Presently the Federal Ministry of Environment administers and enforces environmental laws in Nigeria. It took over this function in 1999 from the Federal Environmental Protection Agency (FEPA). Source: (Onibokun and Kumuyi, 1999; FME, 2005a; FME, 2005b; Imam, *et al.*, 2008; CPE, 2010).

In the current dispensation; 1981 to date the three tiers of government have developed more legislative/regulatory instruments to further address sanitation issues;

1. Harmful (Toxic) Waste Criminal Provision Decree 42 Of 1988;
2. Federal Environmental Protection Agency (FEPA) Decree No. 58 Of 1988 And No. 59 Of 1992 As Amended;
3. National Policy On Environment (1989) And 1999 As Amended
4. National Environmental Protection (Effluent Limitations) Regulation S.1.8 Of 1991 Mandatory For Industries To Install Anti-Pollution Equipment For Effluent Treatment;
5. National Environmental Protection (Pollution Abatement In Industries And Facilities Generating Wastes) Regulation S.1.9 OF 1991;
6. National Environmental Protection (Management Of Solid And Hazardous Waste) Regulation S.1.15 Of 1991;
7. Environmental Impact Assessment (EIA) Decree No. 86 Of 1992;
8. Nigerian Urban And Regional Planning Decree No. 88 Of 1992
9. National Urban Development Policy 1992;
10. Guidelines On Hazardous Chemical Management 2001;
11. Guidelines On Pesticides Management And Handbook On Safe And Effective Use Of Pesticides 2001;
12. Blueprint On Municipal Solid Waste Management 2001
13. The Blueprint On Environmental Enforcement 2001;
14. Promulgation Of State Edicts/Laws And Local Government By-Laws
15. National Environmental Sanitation Policy 2005
16. Policy Guidelines on Solid Waste Management 2005

In 1985, the Federal Government of Nigeria introduced the Environmental Sanitation (clean-up

campaign). All Nigerian residents were mandated to conduct mandatory environmental clean-up every last Saturday of the month, which was a good effort by the government was, but lacked proper implementation. After each exercise waste gathered by residents is not collected by the responsible authorities. This eventually washes into the storm drains and gutters during rainfall.

5.0 Municipal Solid Waste Management in FCT Abuja

In Abuja Municipal area waste composition is heterogeneous and mixed; non-degradable materials and degradable components. The waste is not segregated at the source and comprises of hazardous and non-hazardous waste. The hazardous components usually consist of household cleaning agent and left over chemical from renovations. In Abuja waste bulk mainly consist of plastics, paper, glass, metal and other recyclable components. The degradable portions of the waste consist of food waste and yard waste.

5.1 MSW Generation

Waste generation in FCT Abuja is quite high due to the economic status and population density of the Federal Capital. Households generate high quantities of mostly organic waste from food waste and yard waste. High quantities of plastic waste is generated from food containers; beverages and packaging. Studies have shown a high correlation between income level and waste generation quantities. But with the high dependency of many countries on modern technology and packaged food products this has caused suburbs and rural areas to have high waste generation rates. Table 1 above shows the waste tonnage for FCT Abuja and other urban cities within Nigeria.

5.2 MSW Composition

The waste composition in FCT Abuja is quite the same like any other developing country. Organic and plastic waste make up the highest composition in term of quantity in the waste stream as shown in Table 2 below. The Table 2 also shows the waste compositions based on the districts located in the central area of FCT Abuja; the Federal Capital City (FCC).

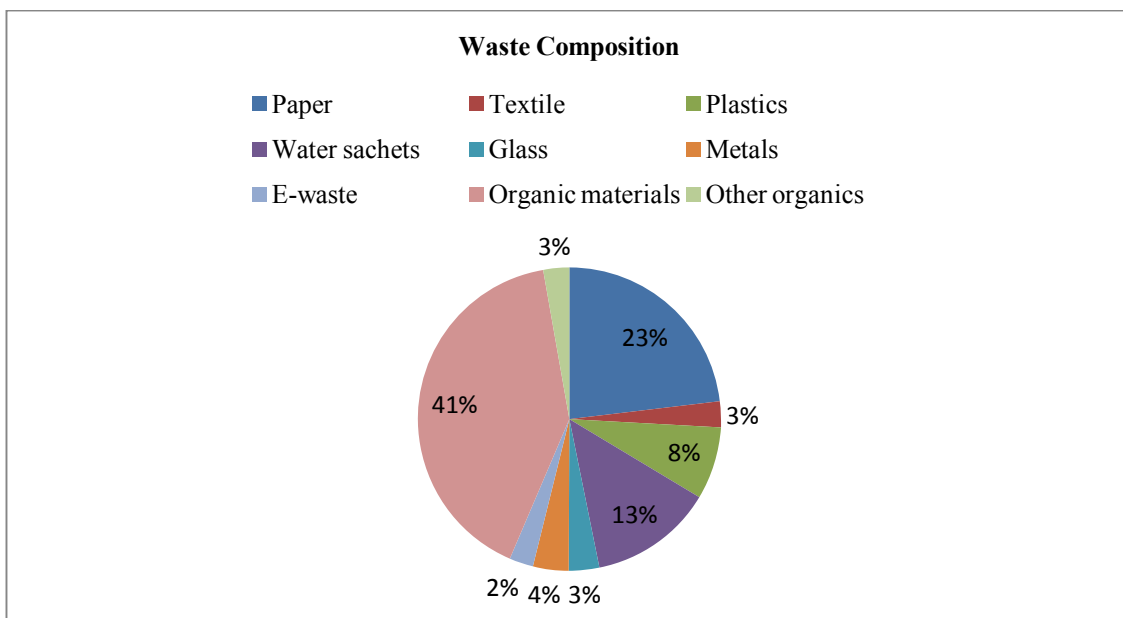
In 2012 the Abuja environmental protection board estimated the waste composition for FCT Abuja as shown in figure 2 below. Paper, organic and waste sachets make up the highest composition of waste. This also shows that water sachets; made of polyethylene is fast becoming an environmental problem due to its wide use and non-degradable properties.

Table 2: Household Waste Composition for different Districts in Abuja

Waste type and %	District Names					
	Garki	Wuse	Maitama	Asokoro	Gwarimpa	Apo
Paper	13	12	13	13.6	6.9	10.1
Metal	5.6	3.3	5.3	6.7	5.4	4.9
Glass	5.5	4.4	5.32	4.1	4.1	-
Plastic	16.2	17.3	20	15.1	21.3	18.7
Food Remnants	52	54.3	54.8	53	61.2	65.3
Textile	2.2	4.7	0.1	3.1	-	-
Rubber	3.4	1.5	0.19	0.7	-	0.9
Others	1.8	2.4	0.6	2.8	1.1	-
Person/Household	8	8	6	6	13	6

Others includes wood, sanitary pads and diapers

Source: Federal Ministry of Environment Report, (2004)



Source: AEPB, 2012

5.3MSW Storage

Abuja Environmental Protection Board has specific waste storage containers which can be bought from their office. The waste storage containers vary in type and sizes, they are bought based on the size desired and kind of usage. The commercial areas, housing complexes and offices have different sizes and specific types designated for their usage. The waste storage container range from; 10L, 50L, 100L, 240L and more. The smaller sizes come in hard plastic while the larger storage containers are made of metal. The location of the storage container is based on building layout and type of housing unit.

5.4MSW Collection

There are twelve private companies contracted for waste collection, with variations in number of weekly collections in different districts

and neighborhoods as of 2004. Collections in some neighborhoods are periodically consistent, while in others it is not. Influencing factors such as insufficient collection vehicles, insufficient number of staff, unplanned neighborhoods and high costs. House to house waste collection is carried out with home owners being responsible for placing their waste bins in front of their houses. The collectors take the waste bin from the front of each house, roll it to the collection vehicle usually parked in front of the house, empty the waste bin and then place it back to the frontage of the house. Based on the policy guideline for Solid Waste Management the below waste collection methods should be used; Table 3 below. For communal bin an adequate number is required based on the policy within 200-250 meters walking distance to residence.

Table 3: Waste Collection Method for Nigeria

Residential Area	Collection Method
Well planned, high income and low density areas	House to house
Medium density residential layouts	Kerb side
High density low income districts	Communal depots

Since waste segregation at source is nonexistent in Nigeria, the vehicles are not compartmentalized. For commercial, housing estate, housing complexes and office areas the size of the bins and the collection mode differs. The large metal bins are placed behind the office buildings, housing complexes and estates, commercial complex. The waste is collected weekly or as arranged with the Abuja Environmental Protection Board. The waste collected is also mixed with no segregation at the

source. The collection is also inconsistent here. Waste collection has been a challenge for several years with increasing generation rates, development, changes in road networks, illegal structures, traffic conditions, insufficient collection vehicles, traffic density, vehicle conditions, hauling distant, collection time, collection route, all prove a challenge in Abuja. The collection vehicles vary in Abuja from manual to mechanized, but the problem is maintenance with most of the vehicles grounded.

Table 4 below shows the waste collection, transportation and disposal vehicles operation within the FCC. Half the AEPB vehicles have compactor, but only 30% of these vehicles are operational, while the private contractors in contrast only 15% of their vehicles have compactor (Imam *et al.*, 2008).

Table 4: Summary of Waste Collection, Transportation and Disposal Vehicles Operating in Abuja.

Type	Owned by AEPB			Owned by Private Sector		
	Existing units	Operational number	Operational %	Existing units	Operational number	Operational%
Lorries	4	4	100	12	10	83
Trippers	8	2	25	48	32	67
Roll-on Roll-off skip vehicles	2	2	100	1	1	100
Tractors	3	2	67	1	1	100
Automated Compactor trucks	17	5	29	9	8	89
Side Loader trucks	2	2	100	-	-	-
Total	36	17	47	71	52	73

Source: Federal Ministry of Environment Report, (2004)

Abuja has one transfer Centre but it remains unclear whether it is operational yet and since waste segregation isn't practiced yet to confirm if at the landfill or at any point waste sorting is carried out. It would seem the waste is directly buried at the land fill after collection in the past.

5.5MSW Disposal

Majority of the waste composition consist of materials that can be recycled, but the AEPB doesn't recycle. Recycling is usually carried out by the informal sector and scavengers. Paper, aluminum cans, and glass are sort and some recycle collectors go house to house to purchase recyclables from home owners. In terms of disposal there is presently no sanitary landfill in Abuja. The F.C.T has four waste dumpsites Mpape, Gosa, Ajata and Kubuwa. Mpape dumpsite was open in 1989 and closes in 2005, spanning 16 hectares with waste depth of 15-30 meters. Ajata dumpsite was open in 1999 and Kubuwa dumpsite was opened in 2004 but the Kubuwa dumpsite was forced to close due to odour and random fire outbreaks. The dumpsites are characterized by indiscriminate dumping on ground surface without compaction efforts. Wastes in the dumpsites are continuously set on fire in order to

reduce the volume of the wastes. Waste is dumped at Mpape dumpsite but due to complaints of odor, air pollution from residents residing in close proximity to the dumpsite was closed in 2005. There is no landfill regulation or standard that provides a basis for compliance and monitoring.

6.0 Findings/Discussion

1. Lack of institutional arrangement is a major problem in the Solid Waste Management System in Nigeria
2. Lack of expertise and manpower to run Solid Waste Management programme in Nigeria. Majority of environmental agency workers have little or no functional background or training in engineering and management. So the operations result in ineffective and inefficient Solid Waste Management.
3. There is no reliable measurement of generated waste and non-appreciation of the magnitude of the waste management is a problem.
4. Polyethene is fast becoming an environmental problem due it its wide usage and non-degradable properties.

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