

Assessment of Solid Waste Management in Lokoja, Nigeria

Musilimu Adeyinka Adetunji*¹, Tolu Isaac Atomode¹, Ismaila Okino Isah¹

¹Department of Geography, Faculty of Arts & Social Sciences, Federal University Lokoja, Kogi State Nigeria

Received 22 January, 2015; Accepted 15 September, 2015

Abstract

Urbanization has constituted a great environmental challenge to human existence in all countries of the world. The situation in urban centers of developing economies is more serious and has become unbearable because the access to basic necessities, such as portable water and functional health facilities, is very poor. To worsen the matter, in some of these cities, there is a delayed and uncoordinated waste disposal system which makes many people vulnerable to the outbreak of diseases. It is against this background that the present study is designed to assess the waste management system in the rapidly developing city of Lokoja which is located in the north central part of Nigeria. Basically, primary sources of data were employed in this research to collate information about waste disposal and its health implications on the inhabitants of the city. An average of forty structured questionnaires was distributed to the heads of households in each of the three residential densities identified in Lokoja on how the waste is managed in the city. Descriptive and inferential statistics were employed to analyze the data collected. The findings revealed that 64.6% of residents in Lokoja burn the waste generated in their household; 20.8% dump their waste along the roadsides for public waste disposal vehicles to collect and dispose of them at the approved waste disposal site located in the city suburb. Approximately, 16.8% of the residents who live close to the trenches of streams and erosion channels dispose their waste in the water bodies for onward transmission to bigger water bodies like Meme River and the River Niger. This impedes the free flow of drainage water and consequently results in the flooding of the roads especially during heavy down pour in the Metropolis. The nonchalant attitude of people towards better waste management has therefore resulted in various forms of pollution including air and water pollution which is inimical to human health. The present study concludes that there is need for public enlightenment and campaign on modern methods of waste management in Lokoja and other cities in Nigeria.

© 2015 Jordan Journal of Earth and Environmental Sciences. All rights reserved

Keywords: Health, Waste, Transport, Environment and Planning.

1. Introduction

According to Nwigwe (2008), "refuse disposal is one of the major environmental problems that developing countries are faced with. Health hazard, traffic congestion, unsightliness, unpleasantness and blockage of drainages are some of the problems caused by lack of efficient waste management practice in Nigeria." Solid waste disposal is treated with levity in developing countries of the world, most especially in Nigeria which has experienced high rate of urbanization within the last four decades. The nonchalant attitude of people in African countries toward modern methods of waste disposal has posed serious environmental health challenge to human existence in their natural environment (Afangideh et al., 2012). Meanwhile, one of the aspirations of the western world is to achieve sustainable environment.

According to Mansoor et al. (2005), "proper solid waste disposal is an important component of environmental sanitation and sustainability." A sustainable environment and improved waste management offer opportunities for income generation, health improvements and reduced vulnerability. This could hardly be attained in some of the developing countries, most especially in Nigeria because of non-readiness, uncoordinated and laissez faire attitude

toward better ways of solid waste disposal methods in spite of their high rate of urbanization and growth in commercial and industrial activities (Afangideh et al., 2012). The situation of solid waste disposal methods in some of the Nigerian cities lives more to be desired as garbages of waste generated litter all nook and cranny of the towns and cities.

In a study on municipal solid management in China, Dong et al. (2010) report that the amount of municipal solid waste generate increased tremendously from 31.3 million tons in 1980 to 212 million tons in 2006, and the waste generation rate increased from 0.50 kg/capita/day in 1980 to 0.98 kg/capita/year in 2006. According to them, the waste composition in China is dominated by the concentration of kitchen waste in urban solid waste which accounted for 60% of the waste stream. The report on municipal solid waste of Dong et al. (2010) in China further stressed that the total amount of municipal solid waste collected and transported was 148 million tons in 2006, of which 91.4% was landfilled, 6.4% was incinerated and 2.2% was composted. The overall municipal solid waste treatment rate in China was approximately 62% in 2007. In 2007, there were 460 facilities, including 366 landfill sites, 17 composing plants, and 66 incineration plants. The report of Dong et al. (2010) was able to throw more light on

* Corresponding author. e-mail: maadetunji@yahoo.com

the waste generation and composition in the Asian continent most especially in China where the research was conducted.

Several studies conducted in different parts of the world, particularly in major urban centers in Europe and United States of America, show that the types of waste generated and management techniques vary with the level of civilization, industrialization and socio-economic well-being of the nation involved (Herbert, 2007). However, the solid waste generated from industrial products, such as polythene bags, plastics from beverages, electronic materials, broken bottles and empty cartons, constitute hidden places for vector diseases. Also, offensive odor emanating from dumping sites constitutes environmental risks to human health.

It is worrisome that much research on waste management has been conducted in Nigeria and other developing countries. However, some of the studies do not adequately examine the environmental impact of waste disposal methods on human health which is the main focus of this research. The principal objective of this study is to examine the methods of waste disposal and their associated health implications on the urban residents in Lokoja Metropolis. This will give city planners and other stakeholders a chance to develop appropriate database for proper sanitation in urban environment with the aim to reducing the risk of urban residents from being

vulnerable to outbreak of diseases which is inimical to human health.

2. Study Area

Lokoja, the capital city of Kogi State, can be found between latitude 7°45' 27.56" - 7°51' 04.34" N and longitude 6°41' 55.64" - 6°45' 36.58" E of the equator with a total land coverage of about 63.82 sq. km. (Adeoye, 2012). It is a former capital territory of the British Northern Protectorate under the leadership of Lord Lugard. According to Olawepo (2009), Lokoja became the headquarters of Kogi Local Government Area as far back as 1976 and was later made Kogi State capital in 1991. Since then, there has been a massive change in all activities of Lokoja, including its size, structure, population and other socio-economic development.

The city is located in the confluence of river Niger and Benue (See Figure 1). These two rivers serve as a driving mechanism for the movement of agricultural products from riverine areas of the state to Lokoja where a bulk of the population resides. Within the last three decades, Lokoja Metropolis, like many other urban centers in Nigeria, has witnessed a tremendous population increase. The phenomenal increase in the population over the years in the city has led to a high demand for goods and a resultant increase in waste generation.

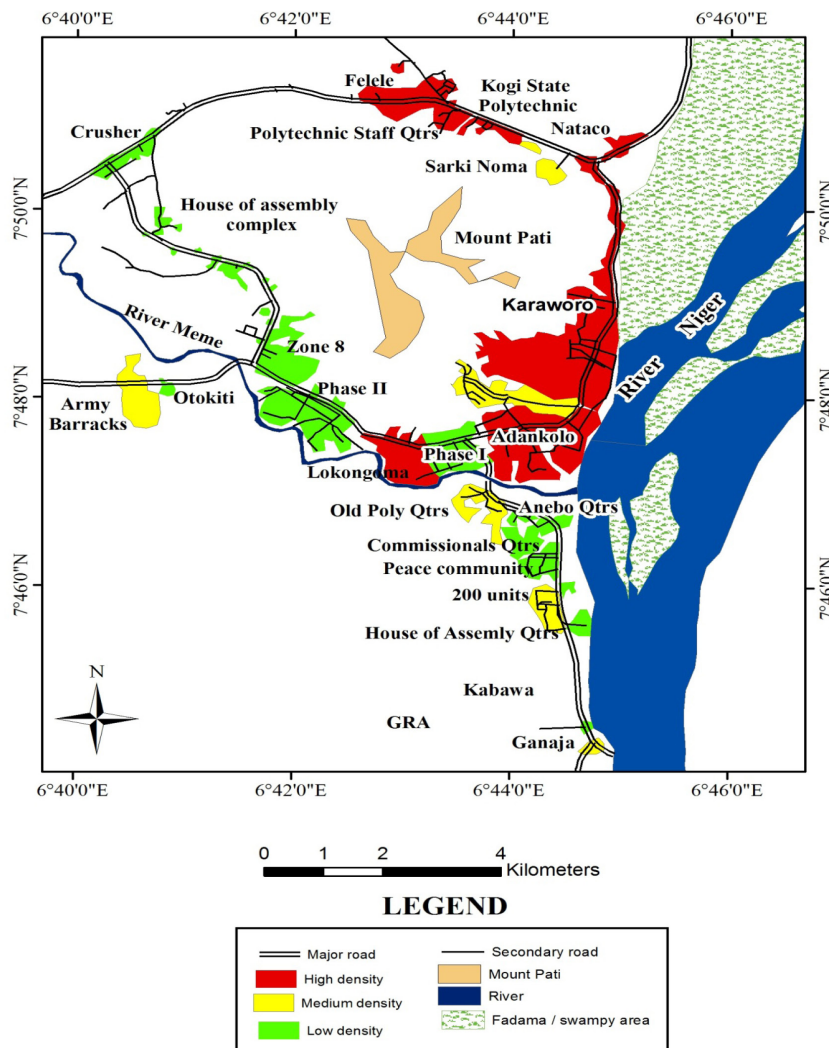


Figure 1. Map of the Study Area

3. Methodology

A primary data source was basically used for the present study. The study area was grouped into three residential densities based on land use characteristics and population densities. These three residential densities identified in Lokoja Metropolis are high, medium and low residential densities. The high density areas include the old residential areas such as Karaworo, Kabawa, Adankolo and Felele. Among the medium density areas are Old Poly Quarters, Gadumo, Zango, Phase One and Two Housing Estates, while the low density areas include Commissioners' Quarters, Zone Eight, Two Hundred and Five Hundred Housing Estates. In each of the residential densities, an average of forty structured questionnaires was distributed to the head of households on how waste is being managed. A systematic random sampling technique was adopted on the principle of one in every ten buildings along selected major streets within the Metropolis. In each of the selected building, one household head was chosen for questionnaire administration. The data obtained include waste disposal methods by residents, distance of dumping sites to residential units and as well as residents' awareness of the risks involved in keeping solid waste for a long period of time in their neighborhoods. Descriptive statistics such as tables of percentages and analyses of variance was employed to analyze the results of the findings. Besides, principal component analysis was used to examine the factors affecting environmental health in the study area. These factors include, residential location, household size, educational background, distance to public waste collection site, awareness of risk involved in keeping waste in the residence for a long period of time, type of waste generated, among others.

4. Results of the Findings

4.1. Types of Waste Generated

Some of the urban centers in Nigeria are littered with solid waste in all nook and cranny which pollute our natural environment, and this consequently has a negative externality effect on human health. Table 1 reveals that agricultural waste and different types of polythene bags constituted the largest proportion of the solid waste generated in Lokoja Metropolis and this accounted for about 19.2% and 48.5% of agricultural residues and polythene bags respectively. A bulk of the agricultural waste (73.7%) emanates from the high density area of Lokoja Metropolis. The reason for this could be the local markets located at the high density area of city, where the majority of the agricultural products produce in the rural communities of the state and other adjoining states are brought for sale as a result of the large population size in the town. Also, the findings reveal that waste generated from paper of different kinds was ranked third (26.3%) as a type of the solid waste generated in the city. In the last three decades, urbanization trends in Nigerian cities have led to a high demand for the manufactured goods such as electronics, computer and many others. These manufactured goods are packed with cartons, leathers of different types and polythene bags which constitute in no small measure to waste generated in the city. Industrial waste is the lowest volume of waste generated in Lokoja and this accounts for only 3% of the waste generated. These include electronic waste and others.

Beside the solid waste generated in the city, excreta constitutes a significant proportion of the waste which are dumped in open spaces, uncompleted buildings and sometimes in drainages and along river channels. This constitutes serious environmental threat to urban residents in the city. As high as 66.7% of the excreta generated come principally from the high density areas of Lokoja, most especially at Kabawa, Adankolo and Karaworo where the early settlers reside.

Table 1. Waste Generated by Household Members Across Residential Density (in Percentage)

Residential Zone	Type of waste generated				
	Agricultural waste (Organic waste)	Industrial waste	Paper waste	Leather/ nylon bag/ carton	Excreta
High Density Area	73.7	0.0	19.2	39.6	66.7
Medium Density Area	26.3	66.7	38.5	41.7	0.0
Low Density Area	0.0	33.3	42.3	18.7	33.3
Total	100%	100%	100%	100%	100%

Source: Authors' Field Survey, 2014.

4.2. Waste Collection Points

Inadequate and non-existence of accredited waste collection points in the neighborhoods of many urban centers in Nigeria has resulted to indiscriminate dumping of solid waste in different parts of the city. This constitutes negative externality effects on human health. Table 2 shows that 55.6% of the respondents in the study area claim that there is no accredited waste collection points in their neighborhoods. Approximately 44.4% of the residents indicate that they have waste collection points close to their residences in Lokoja Metropolis.

Table 2. Accessibility to Dump Site around the Neighborhoods

Possession of waste collection points	Percentage
Yes	44.4
No	55.6
Total	100.0

Source: Authors' Field Survey, 2014

4.3. Waste Management Practices in Lokoja

Solid waste is not properly disposed in some of the ancient cities in Nigeria. Indiscriminate dumping of refuse in all nook and cranny of the urban centers has become the order of the day in Nigeria. Table 3 reveals that 64.6% of the residents in Lokoja burn their refuse in their neighborhood. This is considered to be an unhealthy way of waste disposal method as the smoke emanating from burning pollutes the air in the immediate environment. Further analysis reveals that 20.8% of residents in Lokoja indicate that they dispose their waste at the accredited road intersections where the public waste disposal vehicles come to collect the waste deposited. The uncoordinated way of dumping waste along the road sides affect the free movement of pedestrians as well as motorists in the city. Similarly, an approximately 16.8% of the sampled population in Lokoja Metropolis who live close to the trenches of streams and erosion channels dispose their waste in to water bodies for onward transmission to bigger water bodies like Meme River and River Niger. This practice makes it difficult for the people to make use of the water from these two rivers for domestic purposes without proper treatment.

Table 3. Waste Management Practices in Lokoja

Management Practices	Percentage (%)
Burning of Solid Waste	63.6
Dumping of Waste in Public Waste Bin (Along road intersections)	19.8
Dumping of Waste in Drainages/Water Channels)	16.6
Total	100.0

Source: Authors' Field work, 2014

4.4. Modal Considerations for Waste Disposal in Lokoja Metropolis

The geographical locations of accredited waste collection sites in Lokoja are along the major road intersections where they are conveyed by public waste disposal vehicles to the approved dumped site at the outskirts of the city. Table 4 reveals that an overwhelming (84.1%) proportion of urban residents in Lokoja claim that they use different types of polythene bags to convey their waste to the waste collection sites. Some of the residents in this category claim that they pack their refuse in the polythene bags for days until they are filled before taking them to the waste collection points. Another unpalatable method of waste disposal among some residents in Lokoja is the conveyance of solid waste with the aid of motorcycles to the accredited dump sites. These types of waste disposal techniques are unhygienic for any country striving to achieve sustainable environmental development by the year 2025.

Table 4. Means of Conveying Waste to Public Waste Bin

Methods	Percent
Transporting solid waste by nylon bags to public waste bin	84.1
Motorcycles	9.1
Personal vehicles	6.8
Total	100.0

Source: Authors' Field Survey, 2014.

4.5. Periods of Keeping Waste in the Residence

For a better hygiene of the residents in any community, a prompt disposal of the waste is the most important factor to be considered. However, in some of the urban centers of Nigeria, solid waste is kept for a couple of days before disposal to the appropriate waste dump sites. The non-availability of waste collection points in some of the neighborhoods, coupled with the inadequacy of waste disposal vehicles in Lokoja can be responsible for keeping the wastes for a long period of time in their residential areas. Table 5 reveals that 82.5% of the households interviewed in Lokoja indicate that they keep their waste for less than three days. A significant (13.4%) proportion of the respondents keep their waste between 3-6 days while 6.1% of the residents keep their solid waste generated in their premises for more than six days before disposing of them. This method of keeping waste for a long period of time in residential units constitutes great threat to the health of urban dwellers because waste deposition serves as breeding grounds for disease vectors.

Table 5. Period of Keeping Solid Waste in the Neighborhoods

Time of Keeping waste	Percentage
Less than 3 days	82.5
3-6 days	13.4
More than 6days	4.1
Total	100.0

Source: Authors' Field Survey, 2014

4.6. Health Challenges of Waste Management in Lokoja Metropolis

Different types of health challenges are experienced by inhabitants of Lokoja. Table 6 reveals that 54.5% of the residents indicate that they have experienced malaria infections within the last six months. This can be attributed to the fact that the blockage of drainage channels impedes the free flow of water thereby serving as breeding grounds for mosquitoes (malaria carrying agents) and other vector diseases which are harmful to human health. Further analysis reveals that 40.7% of the inhabitants of Lokoja Metropolis indicated that they had dysentery within the last six months, while 4.8% of the residents indicated that they had Cholera. These diseases are peculiar characteristics of unhygienic environment.

Table 6. Households Health Challenges within the Neighborhoods

Diseases	Percentages
Malaria	54.5
Dysentery	40.7
Cholera	4.8
Total	100.0

Source: Authors' Field Survey, 2014

4.7. The Results of Principal Component Analysis on the Environmental Impact of Waste Disposal Methods in Lokoja

The result of principal component analysis also confirmed that the nonchalant attitude of the urban residents toward prompt solid waste disposal as well as a number of household sizes constitutes about 21.93% from a total 84.89% of the variance of factors affecting environmental health of the inhabitants of the city. Table 7 indicates that the type of residential unit occupied by the residents and the type of waste generated accounted for approximately 17.05% of the

factors threatening human health in Lokoja. Also, Table 8 shows that the waste disposal methods (0.579) is the variable loaded on the factor 3 and accounts for about 13.30% of the variance of the factors threatening human health in the city. The level of awareness of the risk involved in keeping waste in the residence for long period of time accounted for 10.93% of the variance of the factors militating against human health in the city.

Table 7. Result of the Variance Explained by Environmental Health Challenges Emanating from Solid Waste Disposal Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	%Variance	Cumulative %	Total	% of variance	Cumulative %
1	3.728	21.931	21.931	3.728	21.931	21.931
2	2.899	17.053	38.984	2.899	17.053	38.984
3	2.260	13.295	52.279	2.260	13.295	52.279
4	1.858	10.295	63.208	1.858	10.929	63.208
5	1.451	8.535	71.743	1.451	8.535	71.743
6	1.217	7.160	78.902	1.217	7.160	78.902
7	1.018	5.991	84.893	1.018	5.991	84.893
8	.735	4.322	89.215			
9	.521	3.064	92.279			
10	.482	2.836	95.115			
11	.298	1.755	96.870			
12	.227	1.335	98.205			
13	.141	.830	99.035			
14	.093	.546	99.581			
15	.054	.316	99.987			
16	.014	.083	99.980			
17	.003	.020	100.000			

Extracted Method: Principal Component Analysis - Source: Authors' Field Work, 2014

Table 8. Result of Component Matrix on Environmental Health Challenges Emanating from Solid Waste Disposal Component Matrix ^a

Parameter	Component						
	1	2	3	4	5	6	7
Residential Zone	-.630	.528	-.092	.380	.265	-.179	-.020
Household Size	.492	.117	.018	-.208	-.507	-.453	-.190
Educational background of respondents	-.661	.156	-.079	-.408	-.053	.395	-.341
Types of residential unit occupied	.146	.783	.432	.151	-.129	-.018	.138
Do you have drainage channels in your house?	.478	-.330	-.567	.317	.298	-.167	.081
What is the average distance of your building from the next house?	-.231	.363	-.640	-.224	-.180	-.105	.432
Frequency of clearing of drainage channel Specify the waste receptacle type	.716	.195	-.360	-.337	.108	.140	.284
Do you have waste receptacle in your house?	-.604	.459	.148	.333	-.357	-.061	-.019
How often do you get rid of the waste from your House?	.439	.268	.187	-.021	.667	-.015	-.205
Period of keeping waste generated in your house before disposing it to the dumping site	-.046	.105	.579	-.533	.421	-.271	.107
Do you have dump site around your neighborhood?	.507	.509	.558	-.095	-.068	.108	.257
Health challenges of the residents within the last six months?	.346	.467	-.357	.226	.130	.490	-.295
Awareness of the risk involved in keeping waste in residential units for long period of time too long in your residence?	-.550	-.100	-.054	-.534	.081	.388	.350
If the dump site is more than 100 meter to your residence, how do you convey the solid waste generated to the dump site?	-.108	-.518	.186	.464	.005	.049	.427
How do you dispose the solid waste from your neighborhood?	-.528	.463	-.164	.263	.395	-.170	.179
State the types of waste generated by members of your household	.150	-.343	.517	.414	-.051	.448	.121
	.534	.557	-.200	.142	-.186	.231	.119

Extracted Method: Principal Component Analysis. - 7 components extracted

5. Conclusions and Recommendation

Disposal of solid waste has constituted a serious environmental threat to human existence in urban centers in the developing countries of the world. But this is more pronounced in some of the urban centers in Nigeria due to the high rate of urbanization trends within the last 25 years. It is on this background that the present study was designed to assess the environmental impact of solid waste disposal methods on the inhabitants of Lokoja so that appropriate modern methods of solid waste techniques could be recommended for the city and other urban centers in Nigeria at large. The findings reveal that majority of Lokoja residents burn the waste generated in their households which constitutes serious environmental risk to human health as the smoke emanating from the burnings pollute the natural environment. Similarly, nonchalant attitudes toward prompt disposal of the solid waste also accounted for the significant proportion of the variance of the factors affecting environmental health in the city.

The present study recommends that the waste recovery, re-use and recycling techniques should be embraced as this method is practiced in some of the advanced countries of the world. The study concludes that more research needs to be carried out on waste management techniques in some of the urban centres in Nigeria and other African countries at large.

References

- [1] Adeoye, N. O. (2012): Spatio-Temporal Analysis of Land Use/Cover Change of Lokoja: A Confluence Town. *Journal of Geography and Geology*, Vol. 4, No. 4. Pp 40-51.
- [2] Afangideh, A.I., Joseph, K. U. and Atu, J. E (2012): Attitude of Urban Dwellers to Waste Disposal and Management in Calabar, Nigeria. *European Journal of Sustainable Development*, Vol 1, No. 1. Pp 22-34.
- [3] Dong Qing Zhang et al (2010): Municipal Solid Waste Management in China: Status, Problems and Challenges. *Journal of Environmental Management* Vol. 91, Issue 8. Pp 1623–1633.
- [4] Herbert, L. (2007): Centenary History of Waste and Waste Managers in London and South East England". Chartered Institution of Wastes Management. Available online at http://www.ciwm.co.uk/web/files/about_ciwm/100_yrs_london_and_se_centre.pdf
- [5] Mansoor, A., Andrew, C., and Ken, W., (2005): Waste Disposal in Developing Countries. Quality Assurance: Sandy Cairncross. Available Online at <http://www.lboro.ac.uk/well/resources/fact-sheets/fact-sheets-htm/waste.htm>.
- [6] Nwigwe, N. (2008): Problems and Prospects of Refuse Disposal in Nigerian Urban Centres. *International Journal of Natural and Applied Sciences*, Vol 4, No 3. Available online at <http://dx.doi.org/10.4314/ijonas.v4i3.49880>.
- [7] Olawepo, R. A. (2009): Evaluating Housing Problems through Participatory Rural Appraisal in Lokoja, Nigeria. *African Research Review: An International Multi-Disciplinary Journal* Vol. 3 (1). Pp 77-96.