

# HOUSEHOLD SOLID WASTE GENERATION IN THE PUBLIC HOUSING ESTATES IN AWKA

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## Abstract

This paper focuses on household solid waste generation in the public housing estates in Awka, Anambra state - Nigeria. It goes to determine the average quantity of solid waste generated per household per week and the category of solid waste that is mostly generated. A total of twenty percent representing one hundred and one of the entire household population of the estates were examined through a twelve item questionnaire. Solid waste generated in these households were collected once a week for three consecutive weeks, categorized into garbage, rubbish and refuse (being common wastes generated) and weighed. Data collected were statistically analyzed with the use of frequency distribution, percentages, and the use of student t - distribution. Results obtained reveal an average total of 16.51kg, 15.06kg, 15.70kg and 12.81kg of solid waste generated in Ahoel, Udoka, Iyigir and Real housing estates respectively per household per week with garbage being mostly generated. The household size and the level of income respectively have significant influence on the waste generated, in some estates while they do not in others. Major policy implications of the study include the need to recognize the amount of solid waste generated in our public housing estates and its relevance in planning.

## Introduction

In an apparent realization of the fast rate of degradation of our residential environments, federal and state governments accepted housing provision as a social commitment and decided to create "decent" living environment. In less than 10 years of active involvement by government in direct housing construction, it has become clear that the commitment "to ensure that every Nigerian has access to decent and affordable accommodation in clean environment" is being seriously questioned (Muoghalu, 1985). It is therefore clear that the public housing is directed more to the housing unit than the environment, when in actual sense housing environment cannot be separated from the housing unit.

Housing development goes beyond simple shelter. It includes utilities and services such as electricity, water supply, access roads, drainage systems, refuse disposal facilities as well as institutional and health facilities. All these, place housing as an important factor in general well being of the society. Since it has been realized that the quality of human life is generally dependent on the quality of residential accommodation and its environment especially in the urban areas, most of our public housing estates in this country have failed woefully in this area (Onibokun, 1977). These are evident in unplanned residential neighbourhoods and in the case where these neighbourhoods were initially planned, it is inadequate and lack basic infrastructural facilities and proper environmental maintenance. Provisions are not also made for refuse dumps, drainage channels and spaces for further growth.

The problem of solid waste generation in our public housing estates is a serious one. It constitutes one major cause of health hazards in our urban areas apart from creating an unpleasant environment. It has been observed that the majority of deaths which occur in our urban areas are as a result of diseases traceable to air pollution (Macpherson, 1989). Yet there is little or no literature on solid waste generation with respect to public housing estates.

A lot of works have been done on public housing environment, but most of these works focused on physical and social aspects of public housing (Macpherson, 1989; Onibokun, 1971; Muoghalu, 1985). These works gave attention to the nature of housing units, housing provision and social interactions in public housing. Also, the few works done on solid waste generation focused generally on urban and rural areas with no specific concentration on public housing estates (Arnold, 1995; Owadugu, 2003; Ogbounaya, 2001).

Public housing estates in Awka presently are generally experiencing various forms of waste management problems, which are now creating unpleasant sites. Various forms of solid wastes are found in open streets and around residential homes. The situation is worse after every rainfall as the inhabitants throw their refuse into the few existing flood drains. The result is that the streets are littered with wastes after rainfall, while the drains are blocked with wastes thus encouraging urban flooding.

In an attempt to provide solution to the problem of solid waste management in our public housing estates in Awka - Anambra State with a focus on generation, this paper intends to provide answers to the following questions:

- a. What is the average quantity of solid waste generated per household per week in public housing estates in Awka.?

- b. What category of solid waste is highest in the quantity generated?
- c. Do the household sizes and income level have any effect on the solid waste generated?

### **Research Aim and Objectives**

The aim of the research is to study household solid-waste generation in public housing estates in Awka with a view to providing adequate information for planners and designers to improve the provision of public housing. The objectives are as follows:

1. To determine the average quantity of solid waste generated per household per week in the public housing estates in Awka.
2. To determine the category of solid waste that is mostly generated in these estates.
3. To determine the relationship between the income level of the household heads and the quantity of solid waste generated.
4. To determine the relationship between the household sizes and the quantity of solid waste generated.

### **Research Design**

The research conducted in May, 2004, covered four public housing estates in Awka, capital of Anambra State - Nigeria. These estates were Udoka, Ahocol, Iyiagu and Real housing estates occupied by civil servants. Figure 1, identifies the location of the four public housing estates under study.

Data for the study were collected by questionnaire and field measurements. A 20 percent systematic sampling of 501 housing units occupied in the four estates was made which reflected 32 at Udoka, 28 at Ahocol, 23 at Iyiagu and 18 at Real housing estate. Every fifth house in all the streets in the housing estates was examined. Where it is a semi-detached housing unit, comprising more than one household, only one household was studied. The male household heads were interviewed except in a case where such is absent. The sampled households were assigned field survey numbers which were also used during the weekly measurement of solid waste generated. A pilot survey carried out showed that the categories of solid waste common in the estates are garbage, rubbish and refuse following Cheremisonoff and Morres (2001), solid waste classification.

The questionnaire was categorized into two sections. Section A was on personal data which elicited responses on estate of residence, gender, age, educational background, occupation, income level and household size. The household sizes were grouped into five: 0-2, 3-5, 6-8, 9-11, and 12 while the income level adopted was from the new harmonised public service salary structure, office of the head of service, Anambra State of Nigeria. This gave an income level categories of junior workers (01-06), senior workers (07-12) and Senior - Management workers (13-17). Field assistants were trained and equipped with measuring instruments to collect and weigh solid waste generated from the sampled households per week (every Saturday) for a duration of three weeks. This provided answers to questions raised in section B of the questionnaire which was based on household solid waste generation.

### **Data Analysis**

Data were presented and analyzed using the frequency distribution, averages and percentages of all respondents. The student's t-distribution was used to test the difference between the average quantity of solid waste generated by households per week in relation to their household sizes and levels of income in each of the estates. The student's F-distribution has a mean and a mode both equal to zero and a variance of  $r/(r-2)$ , ( $r > 2$ ) which is generally greater than one but approaches one as  $r$  becomes very large.

### **Discussion**

#### **Solid Waste Generation in Ahocol, Udoka, Iyiagu and Real Housing Estates Based on Household level of Income**

Data collected through the questionnaire on respondents' occupation, level of income, household size revealed the particulars of the sampled households. Measurements of solid waste collected were based on the data.

Table 1 : shows the average quantity of solid waste generated per household per week in the four housing estates - Ahocol, Udoka, Iyiagu and Real estate. The table shows that an average of 13.46kg, 14.62kg, and 13.1 kg respectively of solid waste were generated by the low income earners while an average of 15.91 kg, 13.70kg, 19.38kg and 15.36kg respectively were generated by middle income earners. For the high income earners the table shows an average of 19.40kg, 19.02kg, 22.38kg and 16.84kg respectively of solid waste. It was observed that some households though belonging to the middle income group generated as much solid waste as those in high income group. This may be attributed to 'availability of other sources of income apart from the monthly Government pay. It was also observed that some households in high income

group generated almost the same quantity of solid waste with the low income households. This may be as a result of investment in other projects apart from just food consumption.

**Table 1: Summary of Average Quantity of Solid Waste Generated Per Household Per Level of Income in Ahocol, Udoka, Iyiagu and Real housing estates (kg).**

Household income level	Average Quantity of solid Waste generated per week (kg)			
	Ahocol	Udoka	Iyiagu	Real
Low income (₦5,000 – ₦10,000)	13.46	-	14.62	13.11
Middle income (₦10,001 – ₦25,000)	15.91	13.70	19.38	15.36
High Income (₦25,001 +)	19.40	19.02	22.38	16.84

Source: field survey, 2004.

### Solid Waste Generated in Ahocol, Udoka, Iyiagu and Real Housing Estate Based on Household Size

Table 2 shows the average quantity of solid waste generated by the estates for the period of three weeks based on the household sizes. For household size 0-2, the result showed an average generation of 13.01kg (Ahocol); 13.39kg (Udoka), 14.81kg (Iyiagu) and 13.41kg (Real) per household per week. For household size 3 - 5, an average of 16.23kg, 17.22kg, 17.32kg and 14.13kg were obtained respectively. An average of 14.80kg, 19.14kg, 20.50kg of 17.97kg were also obtained respectively from the household size 6-8. The table shows, a slight difference between the average quantities of solid waste generated and their household sizes. Household size though a factor in solid waste generation may be silenced by the emergence of other intervening factors such as income level. The result in the table seems not to agree with the common belief that the higher the household size, -the higher the expected solid waste to be generated.

**Table 2: Summary of Average Quantity of Solid Waste Generated Per Household Size in Ahocol, Udoka, Iyiagu and Real housing estates (kg).**

Household income level	Average Quantity of solid Waste generated per week (kg)			
	Ahocol	Udoka	Iyiagu	Real
0-2	13.01	13.39	14.81	13.41
3—5	16.23	17.22	17.32	14.13
6-8	14.80	19.14	20.50	17.97
9 - 11	18.87	20.44	-	14-98
12 +	-	-	-	-

Source: Field survey, 2004.

### Categorization of Solid Waste Generated

Table 3, shows the categories of solid waste generated in Ahocol, Udoka, Iyiagu and Real housing estates based on the sampled 20% of the household population. Based on the pilot survey, solid waste generated were categorized into garbage, rubbish and refuse. The result shows that garbage is the most generated solid waste in the estates followed by rubbish and refuse. This may be attributed to the households' understanding that provision of edible goods should be a priority in keeping life moving. It was observed that much vegetable and animal wastes resulting from cooking and serving of foods were seen in the households waste bins. Refuse was not seen much probably because each household was mindful of its environment. The result shows that some of the households were without refuse in some weeks. Garbage took up to 61.80% in Ahocol, 62.2% in Udoka, 56.2% in Iyiagu and 48.5% in Real housing estate.

**Table 3: Summary of Categories of Solid Waste Generated in the Estates (Kg)**

Category	Estates							
	Ahocol		Udoka		Iyiagu		Real	
Garbage	855.18kg	61.80%	1079.03	62.2%	725.93kg	56.2%	335.78	48.5%
Rubbish	353.42kg	25.6%	431.46kg	24.9%	355.97kg	27.6%	246.19	35.6%
Refuse	175.19kg	12.6%	223.56kg	12.9%	208.62kg	16.2%	110.60kg	15.9%

Source: Field Survey, 2004

**Implications of Household Size and Level of Income on Solid Waste Generation in Estates**

The research tested two hypotheses which were stated in null form. Hypothesis one states that there is no significant difference between the household sizes and the average quantity of solid waste generated per week in the estates. The intention is to see if the household size has any effect on the quantity of solid waste generated. Statistical instrument used was the student t - test. The predetermined alpha level at which any of the null hypothesis could be rejected was 0.05 (ie 5% significance level).

Results obtained shown in table 4 indicated that there is no significant difference between household size; 0 - 2/3 - 5, 0 - 2/6 - 8, 3 - 5/6 - 8 and 3 - 5 / 9 - 11 in Ahocol; 3 - 5/6 - 8 and 3 -5/9-11 in Udoka; 0-2/3-5 in Iyagu; 0 - 2/3 - 5, 0 - 2/6 - 8, 0 - 2/9 - 11, 3 - 5/6 - 8, 3 - 5/9 - 11 and 6-8/9-11 in Real and the quantity of solid waste generated. The rest household sizes have significant difference. This implies that household size is not the only determinant of the quantity of solid waste to be generated in a household.

**Table 4: Summary of Statistical Analysis on Solid Waste Generated by Households Based on Household Sizes in the Estates**

1 Housing Estates	Household size	Result	Inference
Ahocol	0-2/3-5	Itl=0.98<to.95,10=2.23	NSD
	0-2/6-8	111 =0.40X0.95,14=2.14	NSD
	0-2/9-11	itl =5.30X0.95,10=2.23	SD
	3-5/6-8	Itl = 0.79<to.95, 14=2,14	NSD
	3-5-9-11	Itl = 1.48<to.95,10=2.23	NSD
	6-8/-9-11	Itl = 7.58X0.95, 14=2. 14	NSD
Udoka	0-2/3-5	Itl -2.96X0.95,10=2.23	SD
	0-2/6-8	Itl =3.00X0.95,14=2.14	SD
	0-2/9-11	Itl =3.91X0.95,10-2.23	SD
	3-5/6-8	Itl = 1.40<to.95,18=2.09	NSD
	3-5/9-11	Itl =2.01<to.95,14=2.14	NSD
	6-8/9-11	Itl =3.91X0.95,10-2.23	SD
Iyagu	0-2/3-5	HI =0.56<to.95,8=2.31	NSD"
	0-2/6-8	Itl -3.07X0.95,14=2.14	SD
	3-5/6-8	Itl =2.12X0.95,18=2.10	SD
Real	0-2/3-5	Itl = 0.28<to.95,7=2.36	NSD
	0-2/6-8	Itl = 1.28<to.95,6=2.45	NSD
	0-2/9-11	111 = 1.38<to.95,5=2.57	NSD
	3-5/6-8	Itl = 1.52<to.95,9=2.26	NSD
	3-5/9-11	Itl = 0.38<to.95,8=2.31	NSD
	6-8/9-11	Itl=0.97<to.95,7=2.36	

NSD - No significant Difference; SD - significant Difference.

Hypothesis two tests the significant difference between the income level of household heads and the quantity of solid waste generated in the estates. The intention is to see if the income level of household heads has any effect on the quantity of solid waste generated.

Table 5 shows the summary of statistical analysis on solid waste generated by households based on household level of income in the estates. The table reveals that the quantity of solid waste generated in some households is affected by household level of income while others are not. The table shows that in Udoka and Ahocol estates there is a significant difference between the levels of income and the quantity of solid waste generated in households while Real estate shows no significant difference. Household level of income cannot also be taken as a determinant factor in solid waste generation.

**Table 5: Summary of Statistical Analysis on Solid waste Generated by Households Based on Household Level of Income in the Estates**

Housing Estate	Household in levels	Result	Inference
Ahocol ^ _ _ _ _ J	Low income and middle income	$I_{ti} = 3.4 \times 0.95, 20 = 2.09$	SD
	Low income and high Income	$= 5.72 \times 0.95, 12 = 2.1-8$	SD
	Middle income and high Income	$= 3.77 \times 0.95, 18 = 2.10$	SD
Udoka	Middle income and high income	$I_{tl} = 10.02 \times 0.95, 30 = 2.04$	SD
lyiagu	Low income and middle income	$I_{tl} = 3.21 \times 0.95, 15 = 2.13$	SD
	Low income and high income	$I_{tl} = 11.17 \times 0.95, 11 = 2.20$	SD
	Middle income and high income	$I_{tl} = 2.06 \times 0.95, 11 = 2.14$	NSD
Real	Low income & Middle income	$I_{tl} = 1.28 < 0.95, 11 = 2.20$	NSD
	Low income and high income	$I_{tl} = 0.46 < 0.95, 7 = 2.36$	NSD
	Middle income and high income	$= 0.61 < 0.95, 12 = 2.18$	NSD

**NSD - NO significant difference; SD = Significant Difference**

The increasing rate of solid waste generation and its problem of disposal call for great concern in the management of our urban centres. The category of solid waste determines the kind of disposal techniques to be adopted. According to Arnold (1995); Owadugu (2003) and Nigeria (1984), greater percentage of solid waste generated in our residential urban centres is made up of leaves and food remnants. This kind of solid waste is easily managed through the method of composting. The findings of this research agree with their discovery. This paper has also identified refuse as the next category of solid waste mostly generated in our urban residential areas after garbage. This implies that greater percentage of the population income is spent on food items (edible foods). Even though food is a major essential need of man, it shows a factor common in most developing countries where people are still striving to survive the menace of hunger. When households spend more on items apart from food; it shows an improved economy.

An average solid waste generated per capita/day in Nigeria as reported by PAI and Associates in Nigeria (1984), was 0.39kg (which can be estimated as 2.73kg per week) differs much from the findings of this research. Also it differs from the discovery of Otto, (1990), which gave an average solid waste generation per capita/day in Enugu urban as between 1.15 - 1.50kg estimated to be 8.05 -10.50kg per week) the findings of this research which has an average solid waste generation of 16.51kg, 18.06kg, 18.70kg and 12.83kg per week in the four housing estates notes an increase in the amount of solid waste generation following previous research records. This paper therefore observes that the country's rate of technological advancement and increase in income level per capita which affect the purchasing power may have contributed to the increasing rate of solid waste generation. This suggests the need for advancement in the disposal techniques to avert the menace.

According to a study which reviewed the broad trends related to solid waste management in Asia by the Urban development Sector Unit (1999), which presented a current urban municipal solid-waste generation per capita/day of low, middle and high-income countries as 0.64kg, 0.73kg and 1.64kg respectively, it can be inferred that the level of income affects the quantity of solid waste generated. The findings of this research work do not only look at the effects of household level of income on the waste generated but also consider that of the household size. While there is significant difference in the quantity of solid waste generated based on household income level and household size in some estates, others showed no significant difference. It can be deduced that it is not in all cases that the income level or household size can determine the quantity of waste to be generated. While a household income or size may be increased, other household needs that require much expenditure like need for a dwelling unit, means of transport (car), educational training of children, etc, may not allow a clear change in household consumption rate; thereby not affecting the waste generated. Also the household income may be increased but the household size still remains small. In this case the category of waste mostly generated in that particular household may change.

An understanding of the above findings regarding our public housing estates will therefore enhance the future quality of the environment and assist in preparing a better public housing design and management scheme.

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