

# Assessment of Environmental and Health Impacts of Management in Urban Kitwe

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## Abstract

Thousands of tons of waste are generated daily in Africa. Most of it ends up in open dumps and wetlands, containing surface and ground water posing major health and environmental hazards. Generation rates for waste ranges approximately from 0.5 kilograms per day per person to 0.8 kilograms per day per person. Kitwe being the second largest city in Zambia generates large amounts of waste, this poses challenges in the management of the generated waste. The greatest challenge is with the management of solid waste. The methods of management of these refuse is usually not improved thereby exposing the environment to negative impacts that may in turn affect health.

**Keywords:** Assessment • Health • Environment • Impacts • Management • Waste

## Introduction

Appropriate solid waste management of a city is crucial for public health and aesthetic surroundings. It is essential for a clean look and life support. Therefore, the removal of any scattered and littered waste is as important as effective street sweeping and drain cleaning. This also brings to focus the necessity of synergy in the design, construction and maintenance of roads, surface (storm water) drains and storage, collection and transport of solid waste.

Thousands of tons of waste are generated daily in Africa. Most of it ends up in open dumps and wetlands, containing surface and ground water posing major health and environmental hazards. Generation rates for waste ranges approximately from 0.5 kilograms per day per person to 0.8 kilograms per day per person. The majority of waste is managed by municipal- that is city councils, municipal councils and district councils.

"Most waste in Africa is not collected by municipal collection systems because of poor management, fiscal irresponsibility or malfeasance, equipment failure or inadequate waste management budgets". Due to its size and multiple activities, an average urban (city) area generates waste in the various forms namely; Municipal solid waste (from the domestic and commercial sectors and common areas such as street sweepings and drain silt), Construction and demolition debris, Bio-medical waste (waste generated by health-care and veterinary establishments), Slaughterhouse waste (organized as well, as un-organized activities), 'Special' waste (small quantities of toxic and hazardous waste generated by the household

and trade sectors) and Industrial waste generated within the city area. The presence of these different types of waste streams complicates the solid waste management scenario leading to deficiencies in planning and management.

Solid waste may be defined as all discarded solid materials resulting from households, industrial, healthcare, constructional, agricultural, commercial, and institutional sources. Solid waste when poorly managed leads to landfills. Gases and water produced as waste from industrial activities need proper management so that they are not allowed to escape freely into the environment: they can be hazardous. A variety of technical options applicable in the near and longer term can reduce the landfilling of wastes through source reduction and recycling of organic materials. Paper products, for example, comprise a significant portion of solid waste in developed countries (e.g., 40% in the U.S.) and a growing portion of solid waste in some urban centers in developing countries (typically 5 to 20%). Paper products can be recycled into a variety of products and the markets for the recycled products are, in most cases, identical to those for virgin paper products. Wastepaper-recycling processes range in technical complexity and include technologies as simple as hand-operated baling presses.

According to UNICEF, poor waste management leading to contamination of drinking water and poor sanitation led to the outbreak of cholera in Kanyama compound and Rufunsa district both of Lusaka province in Zambia. Kitwe city is sixty four kilometers from Ndola the provincial headquarters and it is the second largest city in Zambia, it is an industrial commercial area with activities ranging

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from copper mining, furniture manufacturing, and batteries, asbestos and cements production.

## Materials and Methods

### Study site/target population

This study will be done in urban Kitwe, the study area will be divided into three that is low cost, middle cost and high cost as characterized by high, medium and low density respectively. Each of the three areas will include a clinic then the Kitwe City Council will be used for secondary data.

### Study design

A descriptive cross-sectional observational study was used. Materials involved were individual questionnaires while preexisting municipal and hospital records ranging from 2016 to the actual time of conducting the study could not be used due to unavailability of the same. Assessment of environmental impacts will be through comparison of the situation in the study area and the ideal standard. Both qualitative and quantitative data was collected.

### Data collection

Collection of data was through questionnaires, and personal interviews for individuals unable to complete questionnaires. A pilot study will be done to test the effectiveness of the questionnaires. The Kitwe city council's data plus data from not less than two urban Kitwe health centers will be analyzed as secondary data to effectively meet the objectives of this research.

### Data analysis

In compiling and analyzing the data collected, Epi info software was used. Descriptive data were analyzed using frequency counts and percentages. These methods were selected because the research involves both qualitative and quantitative data analysis.

### Ethical consideration

Ethical approval was sought from the Tropical Disease and Research Centre (TDRC) ethics committee. Before enrolling any participant, consent was sought from them and adequate information about the study was given in order not to breach their right to accept or refuse participation. Respondents were treated with respect and confidentiality was highly observed.

### Limitation of study

The study focused on the assessment of health and environmental impacts of waste management in urban Kitwe and did not cover the fundamental mechanisms of the respective health impacts associated with waste management in Kitwe. The study did not also investigate the principles of the various methods used to manage waste in urban Kitwe. Other limitations included:

- Methods of waste management for industries could not be studied as they were beyond the scope of the study.

- Hospital records for diseases related to waste management were not included in the study because local hospitals do not have such records.
- Data was not collected in some high density places such as Kawama due to Covid-19 restrictions.

## Results and Discussion



**Figure 1:** Dumping of waste.



**Figure 2:** Waste packed in plastics awaiting collection by local company (COPWASTE).



**Figure 3:** Waste collection.

### Qualitative data

The analysis below represent information obtained from 230 participants who were identified in various areas and consented to take part in the study as outlined in the methodology. The expected sample was 230 hence the number that took part in the study represents a 100% response rate.

### Socio-demographic information

Table 1.1 shows that 230 participants took part in the study, 27 of them were below 21 years, 33 were between 21 and 25, 60 were between 26 and 35, 64 were between 36 and 40, while those between 41 and 45 were 6 the remaining 40 were above 46 years. In percentage, the participants were represented as 11.7, 14.3, 26.1, 27.8, 2.6 and 17.4 percent respectively. This shows that majority of the participants, 27.8%, were between 36 and 40 years. From these, 50.9% of the participants were females while the remaining 49.1% were males indicating a slight more female than male participation in the study. All the participants were Kitwe residents of which 3.5% attained primary level, 4.3 % basic level, 50.4 secondary, the remaining 41.7 % had gone up to tertiary level. In combination, 92.1% of the participants had gone beyond basic education level and the remaining 7.9 % were below secondary education level.

Distance from the central business district for each participant was estimated using google map. 62.2% of the participants lived within less than 5 kilometers, 34.3% within 7 to 15 kilometers, those that lived above 15 kilometers made up the remaining 3.5%. This shows that majority participants lived within less than 7 kilometers from Kitwe central business district.

Participants indicated the density of their residence- this was done with the aid of council labeling of these areas on various household goods and services bills. 55.7% of participants were from low density areas, 14.8 from medium while 29.6% was from high density areas. The information above is summarized in (Table 1).

| Parameter       | Frequency | Percent |
|-----------------|-----------|---------|
| 1. Age Below 21 |           |         |
| 21-25           |           |         |
| 26-35           | 27        | 11.7    |
| 36-40           | 33        | 14.3    |
| 41-45           | 60        | 26.1    |
| Above 46 Total  | 64        | 27.8    |

|                      |     |      |
|----------------------|-----|------|
|                      | 6   | 2.6  |
|                      | 40  | 17.4 |
|                      | 230 | 100  |
| Gender               |     |      |
| 1. Female            | 113 | 50.9 |
| 2. Male              | 117 | 49.1 |
| Total                | 230 | 100  |
| Residence            |     |      |
| 1. Kitwe             | 230 | 100  |
| 2. Others            | 0   | 0    |
| Total                | 230 | 100  |
| Level of Education   |     |      |
| 1. Primary           | 8   | 3.5  |
| 2. Basic             | 10  | 4.3  |
| 3. Secondary         | 116 | 50.4 |
| 4. Tertiary          | 96  | 41.7 |
| Total                | 230 | 100  |
| Distance from C.B.D  |     |      |
| 1. Less than 7km     | 143 | 62.2 |
| 2. 7-15km            | 79  | 34.3 |
| 3. greater than 15km | 8   | 3.5  |
| Total                | 230 | 100  |
| Density of Area      |     |      |
| 1. Low               | 128 | 55.7 |
| 2. Medium            | 34  | 14.8 |
| 3. High              | 68  | 29.6 |
| Total                | 230 | 100  |

**Table 1:** Shows that 230 participants took part in the study.

The various method of waste management indicated were dumping by 49.1% households, burning by 16.1% while 34.8% further indicated that they combined the two methods (Table 2).

| Method                         | Frequency | Percent |
|--------------------------------|-----------|---------|
| 1. Burning                     | 37        | 16.1    |
| 2. Dumping                     | 113       | 49.1    |
| 3. Burning + Dumping           | 80        | 34.8    |
| 4. Garbage collection          | 50        | 21.7    |
| +/- any of the above or other. |           |         |

**Table 2:** Methods of waste management in residential areas.

From the 230 participants, 85 indicated methods apart from the above. They indicated burying 1.3%, 2.6% dumped waste by the



roadside, 24.8% of these households had their waste collected and the rest had their waste collected plus other methods not indicated (Table 3).

| Uniformity | Frequency | Percent |
|------------|-----------|---------|
| Yes        | 84        | 36.5    |
| No         | 146       | 63.5    |
| Total      | 230       | 100     |
| Efficiency |           |         |
| Yes        | 230       | 100     |
| No         | 0         | 0       |
| Total      | 230       | 100     |

**Table 3:** Uniformity and efficiency of the methods of waste management.

This study sought to assess the health and environmental impacts of various methods of waste management in urban Kitwe. The participants were randomly sampled in various locations at both household and beyond household level. The main objective findings and recommendations are discussed in this chapter.

### Methods of waste management

In Kitwe, it was established that many households generate solid waste which is managed in different ways. According to the major models of disposal of solid waste in the United States suburbs are land filling or dumping and incineration, this is consistent with the findings for suburbs of Kitwe city. In other literature and jurisdictions solid waste may exclude sewage, dissolved solids in water, and industrial waste; this definition was mainly used for solid waste categorization because the methods used to manage industrial waste was found to be beyond the scope of this study.

In this study, at domestic level, dumping 49.1% was found to be the most practiced method with burning 16.1% being the least, others 34.8%, combined burning and dumping. From the 230 participants, 85 indicated methods apart from those mentioned above. In some instances those who practice the above methods still included other methods such as collection of these wastes by various institutions (24.8%). These findings were consistent with United Nations Environmental program publication which pointed out that the commonly used method of waste management in developing countries is dumping off on open places and open air burning. The waste collected by various institutions undergoes processing to complete the management.

In a similar study done, it was found that 97% of the households dumped waste while 2% burnt it, the remaining 1% engaged garbage collection companies. In this study it can be noticed that more people in other places, similar to Kitwe, use the same methods as Kitwe despite the differences in percentages in these studies.

### Environmental impact of waste management

The various methods of waste management were linked to having effects on water quality, composition or both. 60% of the participants indicated the methods have effects on water while the remaining 40%

indicated that the methods do not have any effect on water. The methods and their responses were cross-tabulated to establish association. The analysis was done without separating the methods because it was not possible to determine exactly the number that used only one method of waste management. Statistically; the various methods of waste management and their effects on water produced a p value of less than 0.001 with Chi-square value of 88.547. This indicates that there is strong association between the methods of waste management in urban Kitwe and some effects on water. The specific effects on water Changes takes 13%, garbage is carried along in rivers 1.3%, water spills in wells 15.7%, and water is spilt in wells, unspecified contamination 18.7%.

The above findings were consistent with literature, established that dumping of waste mainly affects ground water which is the main source of water in many countries. The composition of the water is usually changed as well as the quality compromised.

### Methods of waste management and their associated effect on land

Methods of waste management and effects on land showed an association (P value 0.004). This association was tabulated from the combined methods and not an isolated method. The study established that dumping which is the most practiced method affects land composition as well as quality.

In a study done, it was found that 32%, both near and far, indicated that their environment is dirty, while 52% near dumpsite and 46% far from dumpsite indicated that their environment is smelly, while only 18% near dumpsite and 22% far from dumpsite indicated that the environment is dirty.

In a similar study done in Rawalpindi city in Pakistan, it was found that discarded polythene bags in solid waste generated an aesthetic nuisance and may cause death to animals that graze those. In line with this finding, this study found that domestic animals such as dogs feed from anywhere and mostly the dump sites. Also established that mostly solid waste contains plastics that block drainages and lead to bleeding sites for micro-organisms.

### Method of waste management and associated effect on Air

With the already stated methods of waste management, the locals indicated that the air is affected. 16.1% of the participants, who burnt the waste complained that air gets polluted, P value <0.001. Participants who lives or works near dump sites complained that the air in the same areas is of unpleasant odor.

In a similar study done, it was observed during the field visit that solid waste collected at the communal bins is burnt. The local dwellers complained that burning of dumped solid waste creates drastic air pollution in the area.

## Conclusion

Most of the cities and towns of developing countries are not able to provide facilities for collection and processing of waste for the whole population. In urban Kitwe, solid waste is being dumped openly along roadsides. And like other cities, diverse solid waste management

systems are in practice. Open dumps are responsible for the blockage of drains, breeding of flies and spreading of epidemic diseases. Due to lack of proper equipment and funding, the present solid waste management system is insufficient for Kitwe city. High density areas are usually ignored in terms of solid waste collection and the methods practiced such as open dumping and open burning must be discouraged for they are hazardous

## Recommendations

The high numbers of people in the informal sector in the low cost and peri-urban areas means that there is a high potential for using solid waste management for employment creation in these areas. It is recommended that Kitwe City Council should encourage residents to form cooperatives and small and medium enterprises to be collecting solid waste.

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