





















checklist to take stock of information not covered in the questionnaire. This procedure was closely followed with a direct personal observation of people's attitude towards domestic waste collection and disposal methods. Information was obtained from interviews obtained from different classes of people on issues centered on the objectives of the study. Secondary sources of information included publications such as text books, journals and other useful documentation on wastes health and sanitation.

### **Data Collection:**

Data was collected for this study through the use of structured questionnaires administered to thirty (30) respondents between January 2018 – April 2018 before embarking on a full scale data collection, a feasibility study of the research area was done. This enabled the researcher to examine the waste disposal sites for container with some of the guards attached to the container stations selected for this study. The researcher introduced himself to the senior Ministry of Health and Sanitation staff attached to the study area and informed them on the purpose of the research. Most of the questionnaires were administered by the researcher. Some were however self administered by respondents who were guided on how to fill in the details. Creole and Mende languages were the medium of communication used in the interview but all relevant information were written in English Language.

### **Research Instrument:**

This research involved the use of two sets of structured questionnaires administered to two categories of respondents. This first set of questionnaire was administered to fifteen (15) household heads and twenty (20) Ministry of Health and Sanitation workers of different houses engaged in commercial activities. This questionnaire was divided thus:

- Section 'A' - Identification of Respondents
- Section 'B' - Waste Accumulation
- Section 'C' - Container Station Distribution
- Section 'D' - Ways of Improving Methods of Waste Management

**Section 'A'** of both sets of questionnaire was meant to solicit information on the general and demographic profile of each of the respondents interviewed.

**Section 'B'** of the first set of questionnaire focused essentially on information on the rate of waste generation, including the types o waste must frequently generated.

**Section 'C'** of the questionnaire solicited information on the distribution of containers among the various container sites. It also investigated the causes of the gradual reduction of container sites and the ways in which waste from the homes and offices finally enters into the containers.

**Section 'D'** was centered on finding out about the attitude of people towards the use wastes and waste sites. Alternative methods of waste treatment by the people were also identified in this section. In the second set of questionnaire section 'B' asked questions covering the main activities adopted by Ministry of Health and Sanitation and Bo City Council in the collection and disposal of wastes. It also focused on the materials used in the waste collection exercise, their allocation and degree of availability for use. Section 'C' and 'D' were primarily entered on identifying the main impediments to the current methods used in waste collection and how to overcome such problems.

This section provided for possible suggestions on alternative waste collection methods, assuming the problems associated with the present waste collection method are not overcome.

#### **Data Analysis:**

The analysis of the responses entailed in the questionnaire was both descriptive and mathematical. The information was tabulated accordingly from which the frequencies were determined and converted to percentages. These percentages were then interpreted into the results and findings.

## **RESULTS AND DISCUSSION**

The main thrust of this chapter is an analysis of information obtained on the current waste collection and disposal methods in central Bo City. Most of the data including the characteristics of the respondents are tabulated. Frequencies and percentages are also used to represent the findings which form the hub of the ensuing discussions. It no doubt forms the basis of the results reached at the end of this work.

#### **Waste Site Distribution and Characteristics of respondents:**

The collection and disposal of public wastes in central Bo City is coordinated by the Ministry of Health and Sanitation and the Bo City Council through the establishment of various waste sites. These wastes which are mostly domestic in nature are often collected in containers which are unevenly distributed in the Bo central area. The container stations distributed in 2017 were 60% in central I and 40% in central II respectively. This indicates a higher stationing of the existing containers in Bo central 1. The users of these containers were categorized into household heads who are mostly downtown office workers and

commercial house workers amongst whom are petty traders, business house workers and middle – level workers like craftsmen as explained in chapter 3.3 like the other categories of container users, the sanitary workers were classified into field workers and office workers as shown in table 4.1 This table shows a greater proportion of sanitary.

**TABLE 1: Classification of Sanitary Workers According to Job Type:**

| Job Type     | Frequency (F)    | Percentage (%) |
|--------------|------------------|----------------|
|              | Sanitary Workers |                |
| Field        | 13               | 90             |
| Office       | 2                | 10             |
| <b>Total</b> | <b>15</b>        | <b>100</b>     |

According to table 1 above, (90%) of the workers directly engaged in the Field Work either as Supervisor or Guards. It is only the Zonal Managers are retained in the office.

**TABLE 2: Marital Status of Respondents:**

| Marital Status | Sanitary Workers | Frequency (F)    |                         | Percentage (%) |
|----------------|------------------|------------------|-------------------------|----------------|
|                |                  | House Hold Heads | Commercial House Worker |                |
| Married        | 12               | 10               | 9                       | 83             |
| Single         | 2                | 4                | 1                       | 13.2           |
| Divorced       | 1                | -                | -                       | 1.9            |
| Widowed        | -                | 1                | -                       | 1.9            |
| <b>Total</b>   | <b>15</b>        | <b>15</b>        | <b>10</b>               | <b>100</b>     |

**SOURCE: (City Council, 2017 Survey)**

In table 2, 83% of the respondents are married while 13.2% are single of whom 1.9% are either divorced or widowed. This preponderance of marriage among the various categories of container users. (83%) are indicative of a higher tendency to generate waste.

**TABLE 3: Distribution of the Respondents:**

|  |  | Frequency (F) |  |  |
|--|--|---------------|--|--|
|  |  | House Hold    |  |  |
|  |  |               |  |  |

| <b>Age Group</b> | <b>Sanitary Workers</b> | <b>Heads</b> | <b>Commercial House Worker</b> | <b>Percentage (%)</b> |
|------------------|-------------------------|--------------|--------------------------------|-----------------------|
| 0 -19 yrs        | -                       | -            | -                              | -                     |
| 20- 29yrs        | 4                       | 6            | 4                              | 32                    |
| 40-59yrs         | 7                       | 6            | 6                              | 49                    |
| 60-79yrs         | 4                       | 3            | -                              | 19                    |
| <b>Total</b>     | <b>15</b>               | <b>15</b>    | <b>10</b>                      | <b>100</b>            |

**SOURCE: (City Council, 2012)**

**Age Distribution of Respondents:** Some respondents in the active age bracket (20-60 years) of the population; however a total of 7.54% of the sanitary workers who are mostly container guards fall above the working age group of the country. This number, though not very significant, contributes to the inadequacies in the waste disposal drive of the Ministry of health and sanitation (MOHS).

In terms of educational achievement, table 4a shows a high level of educational attainment among the commercial house workers with 56% having gone through tertiary institutions and another 44% having secondary education. This figure contrast sharply with the sanitary staff (table 4a), with just 10% of their workers having tertiary education, another 30% having attained a secondary school education while the bulk of the staff have either primary education (20%) or non-formal education (40%). This present level of education attainment among the sanitary staff may not be unconnected with.

**TABLE 4a: Educational Attainment among Household Heads:**

| <b>Educational Level</b> | <b>Frequency (F)</b>    |                       |
|--------------------------|-------------------------|-----------------------|
|                          | <b>Sanitary Workers</b> | <b>Percentage (%)</b> |
| Tertiary                 | 2                       | 10                    |
| Secondary                | 3                       | 30                    |
| Primary                  | 4                       | 20                    |
| Non-formal               | 6                       | 40                    |
| <b>Total</b>             | <b>15</b>               | <b>100</b>            |

**TABLE 4b:**

| <b>Educational Level</b> | <b>Frequency (F)<br/>Household Heads</b> | <b>Percentage (%)</b> |
|--------------------------|--|-----------------------|
| Tertiary                 | 6  | 38                    |
| Secondary                | 5  | 33                    |
| Primary                  | -  | -                     |
| Non-formal               | 4  | 29                    |
| <b>Total</b>             | <b>15</b>                                | <b>100</b>            |

**TABLE 4c:**

| <b>Educational Level</b> | <b>Frequency (F)<br/>Commercial House Workers</b> | <b>Percentage (%)</b> |
|--------------------------|---|-----------------------|
| Tertiary                 | 6   | 60                    |
| Secondary                | 4   | 40                    |
| Primary                  | -   | -                     |
| Non-formal               | -   | -                     |
| <b>Total</b>             | <b>15</b>   | <b>100</b>            |

24.

**Educational Attainment among Commercial House Workers in Table 4c:** The inadequate funding of the Ministry of Health and Sanitation (MOHS) to enhance workers education and training and hence the drawbacks of the current waste disposal method. The household heads as shown in table 4b are mostly educated with a total of 38% and 33% having obtained tertiary and secondary education respectively. A much smaller percentage of 29 attested to have acquired a non-formal type of education. With regards to length of services only sanitary workers and commercial house workers were interviewed as shown in table 4.5(i). Both categories of workers had worked for 1-29 years.

**TABLE 5a: Length of Service of Sanitary and Commercial House Workers:**

| <b>Length of Services</b> | <b>Sanitary Workers</b> | <b>Commercial House Workers</b> | <b>Percentage (%)</b> |
|---------------------------|-------------------------|---------------------------------|-----------------------|
| 0-9 yrs                   | 8                       | 8                               | 66                    |
| 10-19yrs                  | 6                       | 2                               | 31                    |
| 20-29yrs                  | 1                       | -                               | 3                     |
| 30-39yrs                  | -                       | -                               | -                     |
| 40-49yrs                  | -                       | -                               | -                     |
| <b>Total</b>              | <b>15</b>               | <b>10</b>                       | <b>100</b>            |

There appeared to be a greater concentration of workers within the first nine (9) years which reduces as the length of service increases. Amongst the sanitary staff for example, a total of 60%, 30% and 31% were registered respectively for the age group 0-9yrs, 10-19yrs and 20-29yrs. The trend may indicate that more people have entered the job recently even-though the possibility equally exist that some people over the years have left. Like the length of service, there was a gradual decrease in the length of residence among the households with a higher number registered for a period 0-9 years. This trend, as shown in table 5b is consistent with the residential pattern of most urban centres in less developed countries where tenancy is highly practiced.

**TABLE 5b: Length of Service of Sanitary Workers:**

| <b>Length of Services</b> | <b>Sanitary Workers</b> | <b>Percentage (%)</b> |
|---------------------------|-------------------------|-----------------------|
| 0-9 yrs                   | 8                       | 60                    |
| 10-19yrs                  | 6                       | 35                    |
| 20-29yrs                  | 1                       | 5                     |
| 30-39yrs                  | -                       | -                     |
| 40-49yrs                  | -                       | -                     |
| <b>Total</b>              | <b>15</b>               | <b>100</b>            |

It could be seen in table 5c, where as the respondents from amongst the household and commercial houses included both sexes that for the sanitary worker consisted of only males. A greater percentage of this staff were 40 years and above, a good number of whom were field workers directly attached to the containers. It was therefore apparent that most of these workers were aged and these were often assigned to collecting and disposing of the wastes.

**TABLE 5c: Length of Residence of Household Heads:**

| <b>Length of Services</b> | <b>Sanitary Workers</b> | <b>Percentage (%)</b> |
|---------------------------|-------------------------|-----------------------|
| 0-9 yrs                   | 6                       | 38                    |
| 10-19yrs                  | 4                       | 24                    |
| 20-29yrs                  | 3                       | 25                    |
| 30-39yrs                  | 1                       | 4                     |
| 40-49yrs                  | 1                       | 4                     |
| <b>Total</b>              | <b>15</b>               | <b>100</b>            |

**TABLE 5d: Sex Composition of Respondents:**

| <b>Sex</b>   | <b>Sanitary Workers</b> | <b>Frequency (F)</b>   | <b>Commercial</b>   | <b>Percentage (%)</b> |
|--------------|-------------------------|------------------------|---------------------|-----------------------|
|              |                         | <b>Household Heads</b> | <b>House Worker</b> |                       |
| Male         | 15                      | 6                      | 8                   | 69.8                  |
| Female       | -                       | 9                      | 2                   | 30.2                  |
| <b>Total</b> | <b>15</b>               | <b>15</b>              | <b>10</b>           | <b>100</b>            |

**Waste Matter and Method of Collection**

**TABLE 6: Container Stations Distribution in 2015 Compared with Figures for 2012:**

| <b>Area</b>     | <b>No. of Stations in 2012</b> | <b>No. Of Stations in 2015</b> | <b>Difference</b> | <b>Percentages (%)</b> |
|-----------------|--------------------------------|--------------------------------|-------------------|------------------------|
| Central 1       | 12                             | 6                              | 6                 | 25                     |
| Central 2       | 8                              | 4                              | 4                 | 25                     |
| Central Bo City | 20                             | 10                             | 10                | 25                     |



**SOURCE: EHD, 2012 AND Author’s 2015 Survey Data**

In table 4.6 the total number of container stations in the entire central Freetown area in 2012 compared with that for 2015 shows a reduction of 25%. It seems very likely that given the bad practices of accumulating huge quantities of wastes at waste sites which have created a climate of opinion that have led land owners to oppose the location of any kind of waste disposal site in their vicinity, more stations will close down. This development coincides with a seemingly Luke worm attitude of the Ministry of Health and Sanitation (MOHS) in replacing worn out container possibly due to lack of adequate funds. In terms of machinery, table 4.7 shows the variety of equipment’s used by the Ministry of health and Sanitation (MOHS) in the disposal of wastes.

**TABLE 7: Quantity of Machines Used by Ministry of Health and Sanitation (MOHS) in the Disposal of Wastes in 2011/12 Compared with Figures for 2015:**

| Type of Machine            | Quantity in 2011/12 | Quantity in 2015 | Difference | Percentage (%) |
|----------------------------|---------------------|------------------|------------|----------------|
| Skip trucks                | 9                   | 3                | 6          | 66.60          |
| Dump trucks                | 2                   | 1                | 1          | 50.00          |
| Loaders                    | 2                   | -                | 2          | 100.00         |
| Bull dozers                | 1                   | -                | 1          | 100.00         |
| Other vehicle (light Vans) | 10                  | 2                | 8          | 80.00          |

**SOURCE: MOHS, 2012 and Author’s Survey Data**

As shown in table 7, there has been a drastic decline in the available machines for work since 2011/12. Loaders and bull dozers for example, are no longer available, while other vehicles, skip trucks and dump trucks respectively showed a decline of 80%, 66.6% and 50% in terms of availability. Considering that these are the only machines serving the entire Bo City, it may not be uncommon for waste disposal sites to be prioritized in the use of these machines. In addition to the machine, a variety of tools, equipments and materials were used especially by the container and guards and sweepers in the course of collecting and disposing of wastes. It is worth noting however that these implements were mostly crude and

grossly inadequate. The main wastes generated are classified according to their rate of decay of shown in table 8.

**TABLE 8: Classification of Wastes According to Rate of Decay:**

| <b>ORGANIC WASTES</b>               | <b>INORGANIC WASTES</b>      |
|-------------------------------------|------------------------------|
| Papers                              | Broken bottles/glass         |
| Vegetables                          | Plastics                     |
| Dust                                | Empty tins/cans              |
| Fruit peels                         | Gauges                       |
| Empty boxes/cartons                 | Needles                      |
| Kitchen wastes                      | Syringes                     |
| Leaves and flowers                  | Rubbers                      |
| Clothing materials                  | Oil wastes                   |
| Timber/wood/ stick                  | Rod (Iron)                   |
| Saw dust                            | Metal (Scrapped)             |
| Coal wastes and ashes               | Hair (human and animal)      |
| Fish entrails                       | Chemical wastes              |
| Meat bones                          | Nylons                       |
| Plasters                            | Worn out zincs               |
| Worn out shoe and heals leather     |                              |
| Bags of worn – out paper or leather |                              |
| Soap wastes                         |                              |
| Food wastes                         |                              |
| Dead animals                        |                              |
| Total Organic wastes x – 20         | Total Inorganic waste x = 15 |

**SOURCE: Author’s Survey, 2015**

As could be seen the wastes are mostly vegetative and food matter which often generate very offensive odor. Much of the factories and enterprises in this area operate on a small scale and their wastes are normally caught in the net of the overall municipal wastes. The predominance of vegetative and food wastes among the main wastes constituents signifies the importance of households in generating waste.

**TABLE 9: Type of Wastes in Relation to Main Waste Source:**

| Source of Waste                                  | Type of Waste    | Percentage (%) |
|--|------------------|----------------|
| Households                                       | Organic          | 16             |
|  | Inorganic        | 5              |
| Market Centers                                   | Organic          | 14             |
|  | Inorganic        | 8              |
| Offices and Institutions<br>(Public and Private) | Organic          | 6              |
|  | Inorganic        | 14             |
| Street Side Wastes or Gutter<br>Wastes           | Inorganic        | 14             |
|  | Inorganic        | 12             |
| Shop and Business Houses                         | Organic          | 9              |
|  | Inorganic        | 12             |
| <b>Total Wastes</b>                              | <b>Organic</b>   | <b>57</b>      |
|  | <b>Inorganic</b> | <b>43</b>      |

**SOURCE: Author's 2015 Field Survey**

Table 8 shows the contribution to the total wastes by the main waste source in central Bo. Although the wastes are not separated into types at the time of disposal into the containers, it is evident from this table that a greater quantity of wastes from households, market centers and street sides can easily decay when compared with wastes from offices and institutions as well as wastes from shop and business houses. The contribution by these latter sources of wastes which were highly inorganic results in the rising need to flood the market with different kinds of commodities to meet the demands of the growing population. This rise in the proportion of inorganic wastes might continue for a long time to come and hence further intensifying the pressures on the current waste disposal facilities. There is therefore an urgent need for the adoption of treatment methods that could reduce the volumes of wastes that can be accommodated in the scarce containers. When asked about the forms of waste treatment adopted besides the disposal of wastes into containers, over 70% of the respondents admitted using none. However, a significant number totaling 15% admitted using the bio-degradable waste constituent as manure while another 10% claimed to either burn the wastes or throw them into streams. A significant amount of recycling was also observed among households in keeping rice bags, bottles, etc separate and selling them to collectors.

Containers and land fill sites are also searched by scavengers and the process is continued by refuse collectors and disposal site scavengers.

## **SUMMARY, CONCLUSION AND RECOMMENDATION**

### **Summary of Findings:**

Domestic waste collection and disposal in Bo City began at the end of First World War. In 1960, the public health act empowered the Department of Health and Social Services (DOHSS) the responsibility to collect and dispose of waste in Bo City. This mandate was fully exercised by the Department of Health and Social Service (DOHSS) until 1991 when it delegated to the Bo Town Council (BTC) the responsibility for providing sanitary wastes services. Another sector dealing with waste collection and disposal is the Environmental Health Division (EHD) of the Ministry of Health and Sanitation. This waste disposal drive in Bo City has been faced with a series of setbacks which has led to the accumulation of large quantities of wastes which must be safely and adequately collected. This study is an investigation into the adequacy of present method of collecting and disposing wastes in Bo City. The research was carried out in central Bo City which forms one of the sectoral divisions of Bo in which can be found the city's main central business district, administrative offices and diplomatic missions. In the course of this work both primary and secondary data were used. The study population comprised of household heads, commercial house workers and sanitary officers of the Environmental Health Division (EHD) attached to the central Bo area. A 40% sample of container stations in both Bo central I and central II were randomly selected and this was considered to be manageable for the purpose of this work. In determining the population sample a 40% sample of the number of streets served by each container station was selected from which two dwellings close to the container were examined. Seven (7) of the streets selected for this study were found to have commercial houses. One of such houses were selected at random from each street to form the sample. Eight (8) senior sanitary officials attached by the Environmental Health Division (EHD) central Bo including one guard at each of the eight container stations were also randomly selected to form the sample population.

This work was intended to identify the problems of the present method of collecting and disposing wastes and to suggest alternative methods which will enhance a sustained and a more efficient waste handling mechanism. In pursuance of this intention, two sets of questionnaires were administered to fifteen (15) household heads and ten (10) commercial house workers to determine the main waste components frequency of waste generation. The waste sites dwellers were not happy with the disposing waste site and comment on the present method of collecting and disposing wastes. The second set was administered to fifteen (15) sanitary officials to identify waste sites, main wastes generated, number of

times the containers are emptied, instruments and materials used in waste collection and to suggest possible alternatives that could solve the problems associated with the current waste collection and disposal drives of the Environmental Health Division.

An over age of twenty-five (25) minutes was spent in administering each questionnaire. Apart from the relevance of a house hold heads to respond to interviews, the overall exercise was very successful with very little interference. The relevant information obtained were tabulated and the frequencies of respondents determined. In most of the tables, the frequencies of the interviewees were converted to percentages. The analysis was both descriptive and mathematical. The study revealed that while the population of central Bo City is on the increase and hence the rates of waste generation, the number of container stations have seen a dramatic decrease over the years. In addition, it was found that capital equipment (Vehicles and Machines) used in the collection of waste have declined drastically both in number and availability for work. It is not surprising therefore to find a large accumulation of wastes at the container stations for most of the time. There was a popular rejection of the container land fill method of collecting wastes. A few people admitted using alternative methods of waste management. These included burning of wastes, throwing wastes into streams and streets. Composting and recycling etc these were therefore the must wide spread methods. These practices suggests the desire of the public for instituting a more efficient and reliable method of waste collection and disposal.

### **Conclusion:**

This research aimed at examining the method(s) used by both the Bo Town Council and the Environmental Health Division (EHD) of the Ministry of Health and Sanitation in Collecting and disposing domestic wastes in central Bo City. The following are the conclusions drawn from the findings of the study.

- ✓ There is a rapid increase in the population of central Bo City with an average annual growth rate of 40% over the next twenty (20) years. The result is that there has been an increase in the number of households with a corresponding expansion in the rate of waste generation.
- ✓ There is a decline of about 25% in the number of containers sites in central Bo City between the periods 2009 to 2012. The closure of these sites can partly be attributed to the growing demand by land owners for their land areas which were used as container sites. Also, the seeming lack of maintenance of the containers by the Environmental Health Division (EHD) of the Ministry of health and Sanitation (MOHS) has led to a reduction of containers available to cover all the previous sites.

- ✓ The same materials which were provided by the German Cooperation unto 1994 (when the German Embassy closed down in Sierra Leone). Continues to serve as the main items or instruments used by the Bo City Council in the collection and disposal of wastes. This study reported that large quantities of these machines and vehicles now show a considerable decline in terms of availability for work.
- ✓ There is a narrow level of educational attainment particularly among the sanitary staff attached to the container stations. Also, a total of 7.54% of the sanitary guards fall far above the retirement age (60 years). Owing to the absence of worker – incentive and poor salary conditions due to inadequate funding of the Environmental Health Division (EHD), it is apparent that the efficiency of workers has declined over the years.
- ✓ The volume of wastes generated at any given waste site exceeds the existing facility (containers) and materials for collecting and disposing of wastes. As a result, there is nearly always an excess accumulation of waste of different degrees of decay which poses a threat to both the environment and human health.
- ✓ Household heads and sanitary workers are aware of the inadequacies of the container land fill method of collecting and disposing wastes. Regrettably, there is yet no decisive method to be adopted on a broader scale for replacement.
- ✓ A small number of container users have adopted alternative methods of treating wastes such methods like burning and the act of throwing wastes into streams and streets degrades both the quality of the environment and human life.

### **Recommendations:**

In view of the conclusions, the following recommendations are made:

- ❖ Households, shopkeepers and office workers should be encouraged to provide and maintain storage containers. These are particularly important in very busy areas where certain streets are too narrow to admit sanitary vehicles. Containers should be made available for emptying by Environmental Health Division employees at prescribed times as such a practice helps to reduce the pressure on the public waste collection sites.
- ❖ Government should make substantial allocation of staff or mobilize other agencies, organizations to provide efficient support to Environmental Health Division for an efficient collection and disposal of wastes from the city.

- ❖ There is need to establish institutions for training with the objective of increasing the efficiency of the workers. This should include vocational or professional training for middle and top management.
- ❖ There is need to establish a skilled and efficient management structure with a specialized back ground in waste management. This should include civil and mechanical engineers, chemical engineers transport organizers and economists.
- ❖ Environmental Health Division (EHD) should employ motor vehicles for the achieve high productivity.
- ❖ Environmental Health Division (ED) together with the councils should design container sizes that can adequately collect large quantities of wastes over a long period.
- ❖ Environmental Health Division (EHD) should ensure the enclosure of waste at all stages of storage and collection to produce health risks to residents and workers management should improve productivity by motivating workers by providing some measures of creative satisfaction.

There should be regular consultations and outer change of views at all levels in order to accommodate complaints, suggestions and also to inform workers and users on management problems and policies.

- ❖ Management should work relentlessly towards providing maximum protective gears for workers against the risk of accidents contracting and the spread of diseases.
- ❖ Effort should be made by management to educate the public on the more responsible use of the containers provided and to solicit their co-operation for sustained and efficient methods of collecting and disposing wastes.
- ❖ Management should ensure that container sites are cleared daily or preferably three (3) times daily.

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