

COMBINED WASTE CHARACTERIZATION AND PER CAPITA GENERATION RATE REPORT 2009

THE WESTERN, SOUTHERN & NORTHEASTERN WASTESHEDS



Prepared by

Planning & Research Department
National Solid Waste Management Authority (NSWMA)

TABLE OF CONTENTS

List of Tables.....	3
List of Figures	3
1.0 BACKGROUND.....	4
2.0 PROBLEM IDENTIFICATION	<u>3</u>
3.0 OBJECTIVES	4
4.0 RESOURCES UTILISED.....	4
5.0 METHODOLOGY	5
5.1 Sampling.....	5
5.2 Sorting	5
5.3 Data Analysis	6
6.0 FINDINGS AND RESULTS	6
6.1 Size of Samples	6
6.2 Household Waste Generation Rate.....	7
6.3 Comparison of Per Capita Generation 2008 & 2009	8
6.4 Household Waste Composition or Characterization	12
7.0 DISCUSSION	167
7.1 Decling Budget Allocation.....	17
7.2 Limited Storage Capacity	18
7.3 Residents Alternatives to SWM	18
7.1 NSWMA Shift Focus	18
7.2 Waste Diversion	18
7.3 Consumption Patterns.....	18
8.0 CONCLUSION	169
9.0 RECOMMENDATIONS CONCLUSION.....	19

LIST OF TABLES AND FIGURES

List of Tables

	Page
Table 1: The Average Daily Generation Rate Per Capita in the three Wastesheds	6
Table 2: The Variation of the Generation Rate across the Parishes	7
Table 3: Composition of Household Waste in the Retirement Wasteshed	11
Table 4: Composition of Household Waste in the Northeastern Wasteshed	11
Table 5: Composition of Household Waste in the Southern Wasteshed	12
Table 6: Composition of Household Waste in all three Wasteshed	13

List of Figures

Figure 1: A Comparison of the Per Capita Generation in the Retirement Wasteshed	8
Figure 2: A Comparison of the Per Capita Generation in the Northeastern Wasteshed	9
Figure 3: A comparison of the Per Capita Generation in the Southern Wasteshed	10
Figure 4: Composition of Household Waste in the Retirement Wasteshed	13
Figure 5: Composition of Household Waste in the Southern Wasteshed	14
Figure 6: Composition of Household Waste in the Northeastern Wasteshed	15

1.0 BACKGROUND

The National Solid Waste Management in an effort to manage solid waste effectively and efficiently continues to conduct relevant research in order to obtain data that is essential for planning and decision-making. Waste characterization and generation studies have been previously conducted in the Riverton (2000 & 2006), Retirement (2003/4, 2007 & 2008) and in the Southern and the Northeastern Wastesheds (2007 & 2008).

In previous reports the application of the data has been abundantly articulated, however for the benefit of those who have not been privy to those reports they include:

- Improvement to waste collection
- Improvement to transportation; and
- Diversion of some fractions of the waste stream

2.0 PROBLEM IDENTIFICATION

The Northeastern and Southern Wastesheds had the first ever generation and characterization surveys conducted in February/March 2007, which provided baseline data. However, the results were lower for the Retirement Wasteshed than in a previous exercise and those in NEPM and SPM were lower than anticipated based on previous work done in the other regions.

Despite acceptance that a survey of this nature satisfies a parameter critical to waste management and should be at least an annual exercise, the 2009 survey is intrinsic because of the need to obtain new rates as well as examining the trends since 2007. The fluctuation of the generation rate provides a clear indication of the organization's ability to perform its core function (notably domestic solid waste collection). Nevertheless, it also has implications for improper disposal practices.

3.0 OBJECTIVES

The principal aim of the exercise is to:

- Determine the average domestic waste generated daily by each person residing in the three Wastesheds
- Determine the composition or characterization of domestic waste generated in the three Wastesheds; and
- Highlight appropriate waste management options as indicated by the results.

4.0 RESOURCES UTILISED

The research was undertaken with the use of the following:

- Tipper truck (3.4 -7 cubic metres) with a crew of four for collecting the waste samples (one per wasteshed)
- Staff at disposal sites to sort, bag and weigh the waste fractions (four to six person wasteshed)
- Portable scales

- Tarpaulins
- Garbage bags
- Occupational safety gear (i.e. gloves, shovels, dust masks)
- Funds (i.e. labour cost for sorters, travel and accommodation costs for the research team)

5.0 METHODOLOGY

The procedures employed in computing the composition of the waste and the rate of generation required appropriate and representative sampling and data analysis. Listed below is the general sequence of procedures executed during the survey:

- Conducted consultations with key personnel associated with the use of the data and the implementation of the project (Directors of Landfill Operations, Directors of Operations, Regional Operations Managers, Public Cleansing Managers and Public Cleansing Inspectors and landfill supervisors)
- Identified sorters with years of experience on the disposal site and a trainable collection crew through the regional supervisors
- Briefed the collection crew in selection and identification of dwellings that were outside the scope of the study due to the presence of commercial activities and accounting for the number of dwellings serviced
- Briefed the sorters to identify the various categories of waste, sort, bag and weigh and the waste fractions
- The research team coordinated the daily operations
- Conducted required analyses and ensured the integrity of the reported data.

5.1 *Sampling*

The wastesheds of Southern, Northeastern and Retirement consisted of two, three and four different parishes respectively. A systematic sampling technique was chosen to satisfy the following criteria:

- Two communities from each parish
 - wealthy and urban, and
 - less wealthy and rural status
- Sample size of an average of 25 – 30 homes from each community
- Homes including a commercial activity was excluded from the sample
- One community sampled daily

5.2 *Sorting*

The sample was taken to the regional disposal site where the entire sample was tipped onto a tarpaulin and sorted into the following fractions:

- Compostable (Organic)
- Paper

- Plastics
- Glass
- Cardboard
- Wood/Board
- Metal/Tin
- Textile
- Electronic (E) Waste
- Hazardous; and
- Others

Each fraction was bagged, weighed and records made on the designed data recording sheet (Appendix 2).

5.3 *Data Analysis*

The method of handling the waste stream analysis was one established by the data analysis-working group of the European Recovery & Recycling Association (ERRA). A weighted average according to the composition and total weight of the sample was calculated for each category of waste. The average number of persons per household in each parish was obtained from the 2001 STATIN population census data and used in the determination of the per capita waste generation.

Three sets of weighted average computations were done for the data set as a means of verifying the waste analysis results. Weighted average was calculated according to the composition and total weight of:

1. All the community samples across the wasteshed, followed by the calculation of the per capita daily generation
2. The two samples within each parish, then of all the parishes in the wasteshed, followed by the calculation per capita daily generation
3. The two samples within each parish, followed by the calculation of the per capita daily generation within each parish. Weighted average was then calculated for the per capita daily generation rate according to composition across all the parishes in the wasteshed

The mean values from the three computations were calculated and accepted as final results (see Table 1)

6.0 FINDINGS AND RESULTS

6.1 *Size of Samples*

The actual size and mass of samples obtained were as follows:

1. The average number of homes sampled from each community per wasteshed was 25 homes (Retirement), 25.2 homes (Northeastern) & 25 homes (Southern).

2. The average mass of the waste sample sorted per community were 327 kg (Retirement), 278.92 kg (Northeastern) and 272.87 kg (Southern).
3. The range of the sample mass sorted was 198 – 430 kg (Retirement), 175.75 – 424 kg (Northeastern), and 145.5 – 468.70 kg (Southern).

6.2 *Household Waste Generation Rate*

The average rate at which each fraction or category of waste was generated daily by each person was calculated and displayed in Table 1. The rate of 0.31 kg was greatest for compostable waste and 0.13 kg for plastics. Wood/Board, E-waste, hazardous waste and the category of ‘Other’ were some of the fractions with the least generating rates.

The average daily waste generated by each person in each wasteshed was 0.56 kg for Retirement, 0.51 kg for Northeastern and 0.53 kg for Southern.

Table 1: The Average Generation Rate Per Capita in the Three Wasteshed

Waste Fractions	Retirement Wasteshed Average Generation Per Capita (kg/day)	Northeastern Wasteshed Average Generation Per Capita (kg/day)	Southern Wasteshed Average Generation Per Capita (kg/day)
Compostable	0.31	0.28	0.27
Paper	0.09	0.03	0.04
Plastics	0.07	0.12	0.13
Glass	0.03	0.02	0.03
Cardboard	0.01	0.02	0.02
Wood/Board	0.0	0.0	0.0
Metal/Tin	0.02	0.02	0.02
Textile	0.03	0.02	0.02
E-Waste	0.0	0.0	0.0
Hazardous	0.0	0.0	0.0
Other	0.0	0.0	0.00
Total Waste Stream	0.56	0.51	0.53

The variation of the generation rate per capita across the wastesheds and parishes is indicated in Table 2 (obtained from one of the computations done for verification of the results). Trelawney demonstrated the highest generation rate of 0.63 kg/ person daily and St. Mary the lowest of 0.31 kg/person daily.

Table 2: The Variation of the Per Capita Generation Rate across the Parishes

Wastesheds / Parishes	Average Generation Per Capita (kg/day)
<i>Retirement</i>	
St. James	0.62
Hanover	0.50
Westmoreland	0.48
Trelawny	0.63
<i>North-eastern</i>	
St. Ann	0.54
Portland	0.60
St. Mary	0.31
<i>Southern</i>	
Manchester	0.60
St. Elizabeth	0.51
Clarendon	0.33

The rate of domestic waste generation for St. James was marginally less than that of Trelawny. The gap between the two other parishes in the retirement wasteshed (Hanover and Westmoreland) was wider with daily generations of 0.5 kg and 0.48 kg respectively. In the Northeastern wasteshed Portland had the highest per capita daily generation of 0.6 kg. This trend is somewhat unusual since St. Ann is the more developed of the two parishes. Nevertheless, Portland has been experiencing more development projects than St. Ann in the past year. St. Ann and St. Mary had generations of 0.54 kg and 0.31 kg respectively. Manchester's per capita increase over the past year and had the highest of the tree parishes now in this wasteshed. The per capita generation for St. Elizabeth increased marginally over last year with 0.51 kg. Clarendon which was added to this wasteshed in the latter parts of 2008 experienced the lowest per capita of 0.33 kg. This was only slight above that of St. Mary.

6.3 Comparison of Per Capita Generation 2008 & 2009

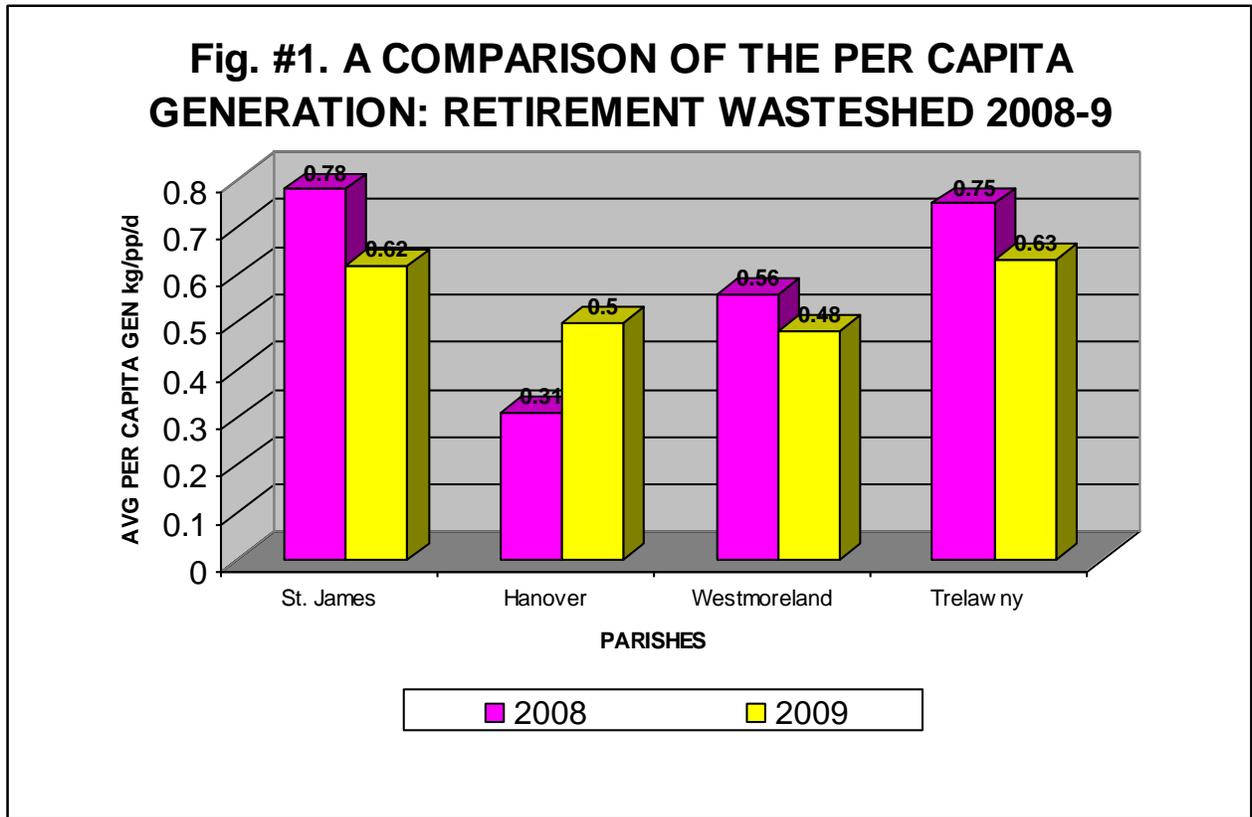
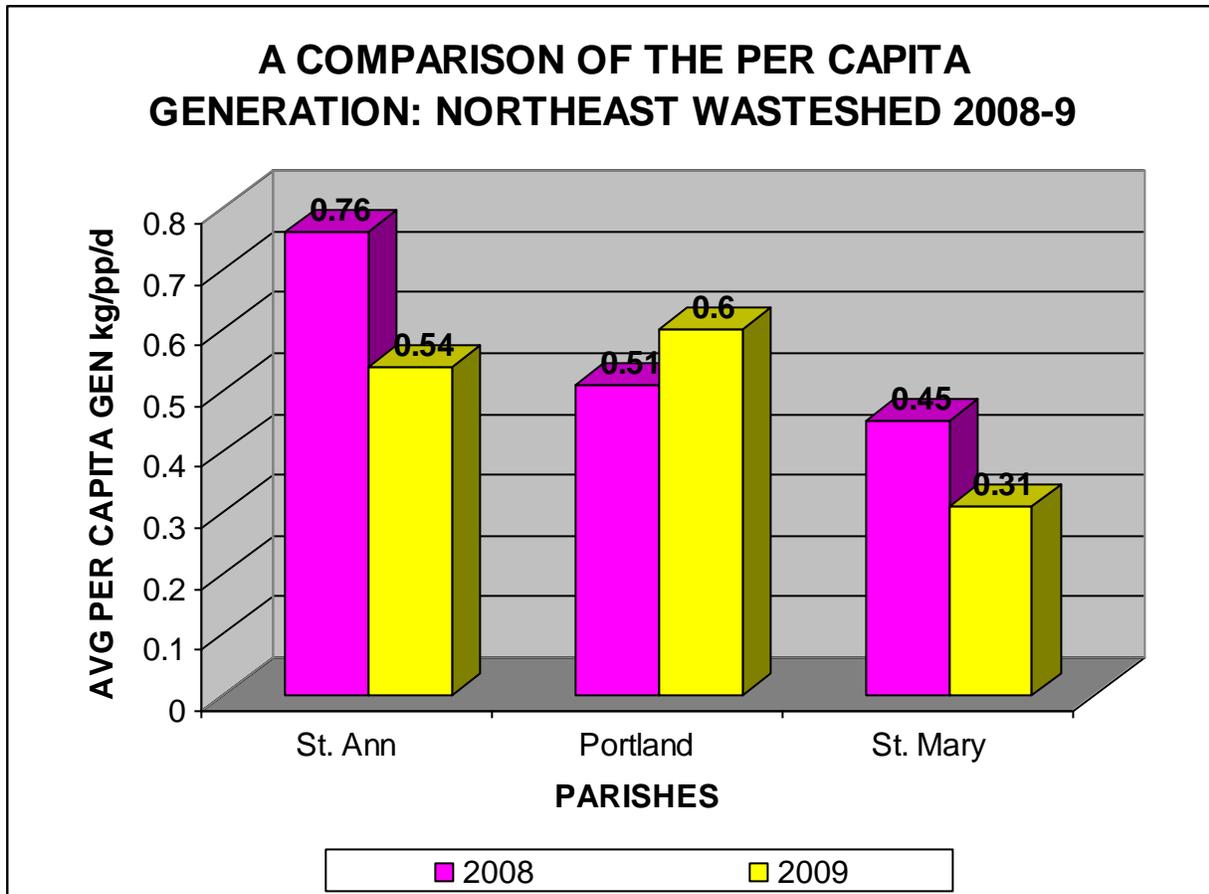
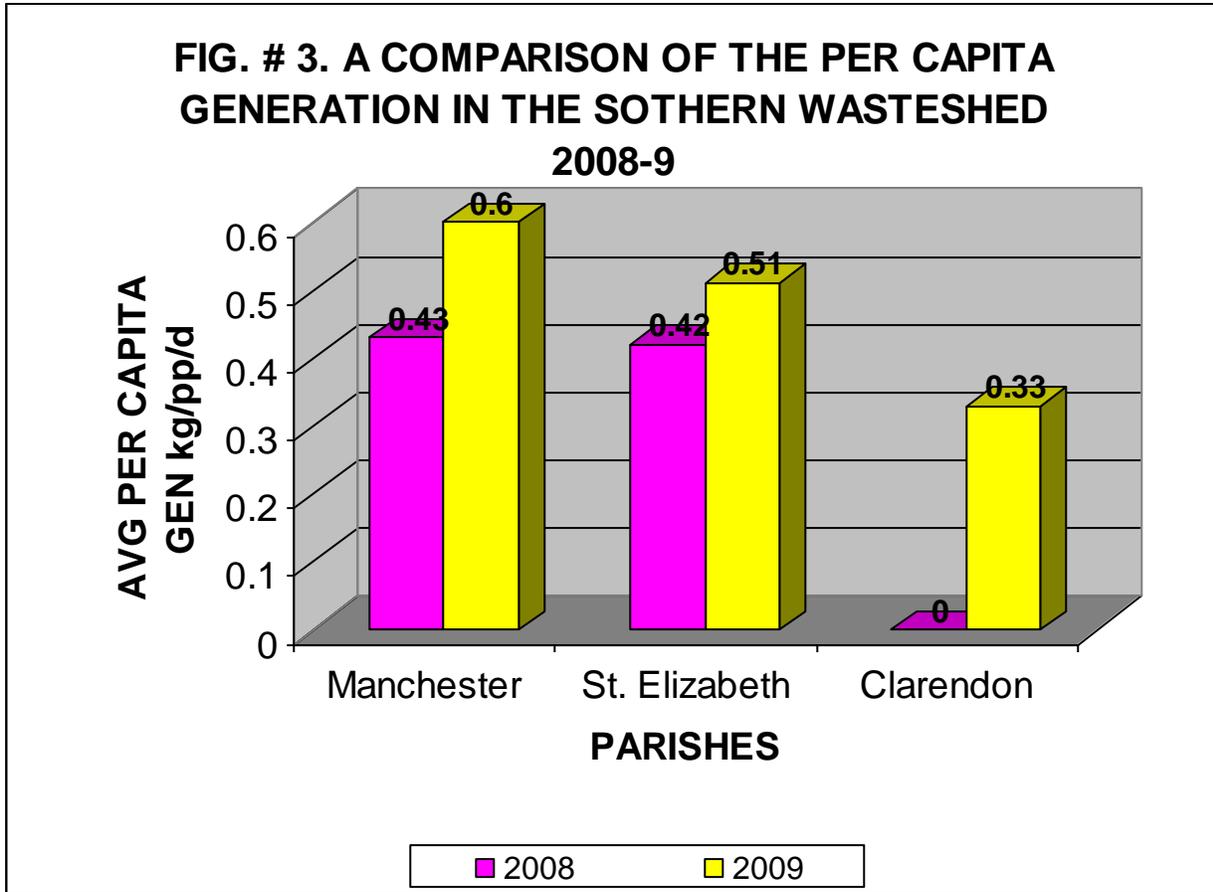


Fig.1 indicates that all the parishes in the Retirement Wasteshed, except for Hanover with an increase of 38%, experienced a decrease in the per capita generation. The region had an overall decline of 7%. At the parish level the declines were as followed Westmoreland 14%, St. James 20.5%, and Trelawny 16%.



With the exception of the parish of Portland all the other parishes in the Northeastern Wasteshed experienced decline in the per capita generation. Portland's increase amounted to just 17.6%. On the other hand the decrease in per capita generation was as follows; St. Ann - 29% and St. Mary - 31%.



The Southern Wasteshed had an increase in the per capita generation of 30.5% (Clarendon not included since it wasn't part of this wasteshed last year). Manchester's per capita generation increased by 39% while St. Elizabeth increased by 21.4%.

Table 3: Comparison of the Per Capita Generation of Household Waste in the Retirement Wasteshed

Waste Fractions	Avg. Daily Generation per capita (Kg/day) 2008	Avg. Daily Generation per capita (Kg/day) 2009	Percentage Change (%)
Compostable	0.35	0.31	-11.4%
Paper	0.11	0.09	-18.18%
Plastics	0.12	0.07	-41.67%
Glass	0.03	0.03	0.0%
Cardboard	0.01	0.01	0.0%
Wood/Board	0.0	0.0	0.0%
Metal/Tin	0.02	0.02	0.0%
Textile	0.02	0.03	50.0%
Electronic (E) Waste	0.0	0.0	0.0%
Hazardous	0.0	0.0	0.0%
Other	0.0	0.0	0.0%
Total Waste Stream	0.66	0.56	-15.15%

Textile was the only fraction of the wastestream that increased over the period (2008 – 2009). All other waste fractions reflected a decrease in generation. In the case of the categories wood/board, electronic, hazardous and other waste none were identified in the waste stream at the time of the sample.

Table 4: Comparison of the Per Capita Generation of Household Waste in the Northeast Wasteshed

Waste Fractions	Avg. Daily Generation per capita (Kg/day) 2008	Avg. Daily Generation per capita (Kg/day) 2009	Percentage Change (%)
Compostable	0.38	0.28	-26.31%
Paper	0.06	0.03	-50.0%
Plastics	0.1	0.12	20.0%
Glass	0.02	0.02	0%
Cardboard	0.03	0.02	-33.0%
Wood/Board	0.0	0.0	0.0%
Metal/Tin	0.02	0.02	0.0%
Textile	0.01	0.02	50.0%
Electronic (E) Waste	0.0	0.0	0.0%
Hazardous	0.0	0.0	0.0%
Other	0.0	0.0	0.0%
Total Waste Stream	0.62	0.51	-17.74%

A similar trend was recorded in the Northeastern Wasteshed. Plastics and textile increased 20% and 50% respectively. All other waste fractions reflected a decrease in generation. In the case of the categories wood/board, electronic, hazardous and other waste none were identified in the waste stream.

Table 5: Comparison of the Per Capita Generation of Household Waste in the Southern Wasteshed

Waste Fractions	Avg. Daily Generation per capita (Kg/day) 2008	Avg. Daily Generation per capita (Kg/day) 2009	Percentage Change (%)
Compostable	0.24	0.27	12.5%
Paper	0.02	0.04	50.0%
Plastics	0.07	0.13	85.71%
Glass	0.03	0.03	0.0%
Cardboard	0.03	0.02	-33.33%
Wood/Board	0.0	0.0	10.0%
Metal/Tin	0.01	0.02	50.0%
Textile	0.01	0.02	50.0%
Electronic (E) Waste	0.0	0.0	0.0%
Hazardous	0.0	0.0	0.0%
Other	0.0	0.00	0.0%
Total Waste Stream	0.41	0.53	29.27%

The glass fraction of the waste stream did not reflect a composition change, while cardboard experienced a decline. All the other waste fractions increased for the period between 2008 and 2009. Wood/board, electronic, hazardous and the category classified as 'other' were not identified in the waste stream.

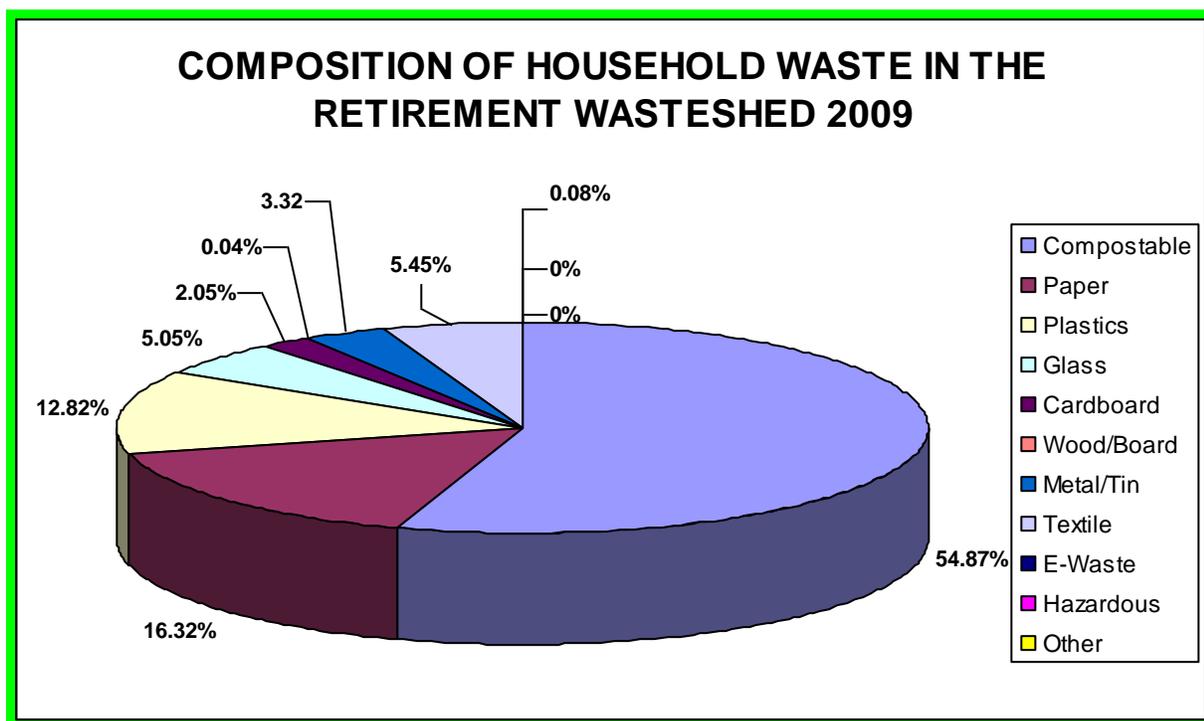
6.4 Household Waste Composition or Characterization

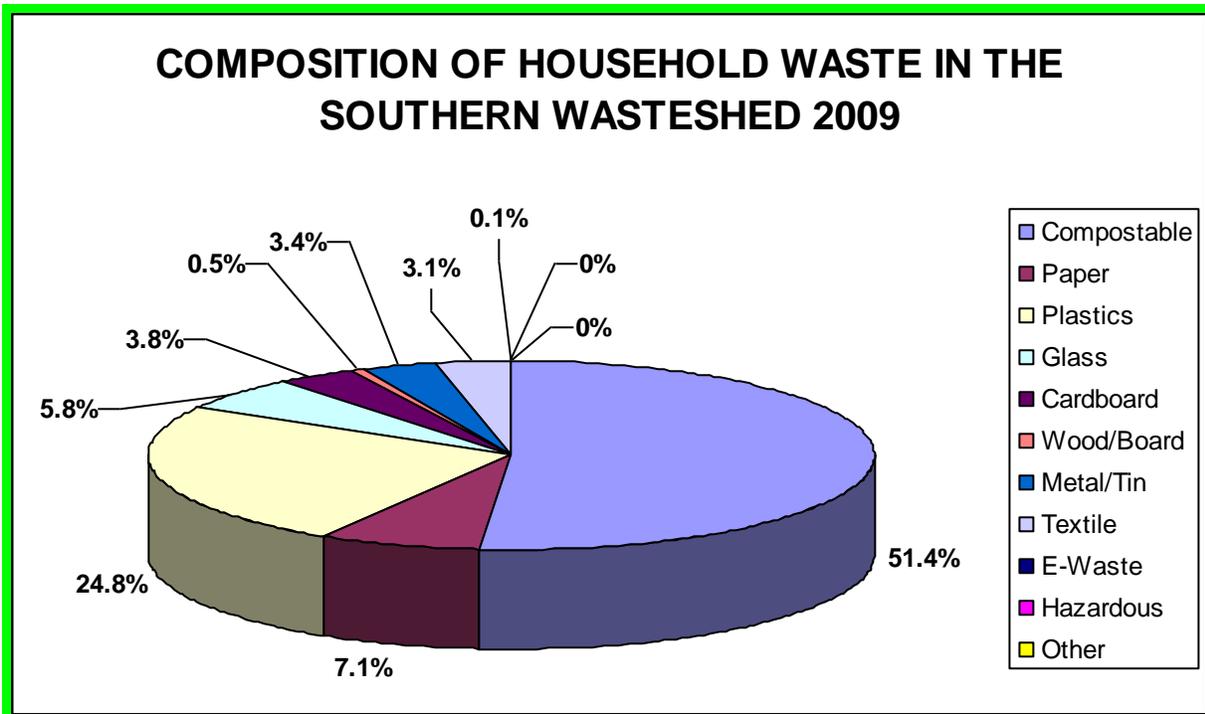
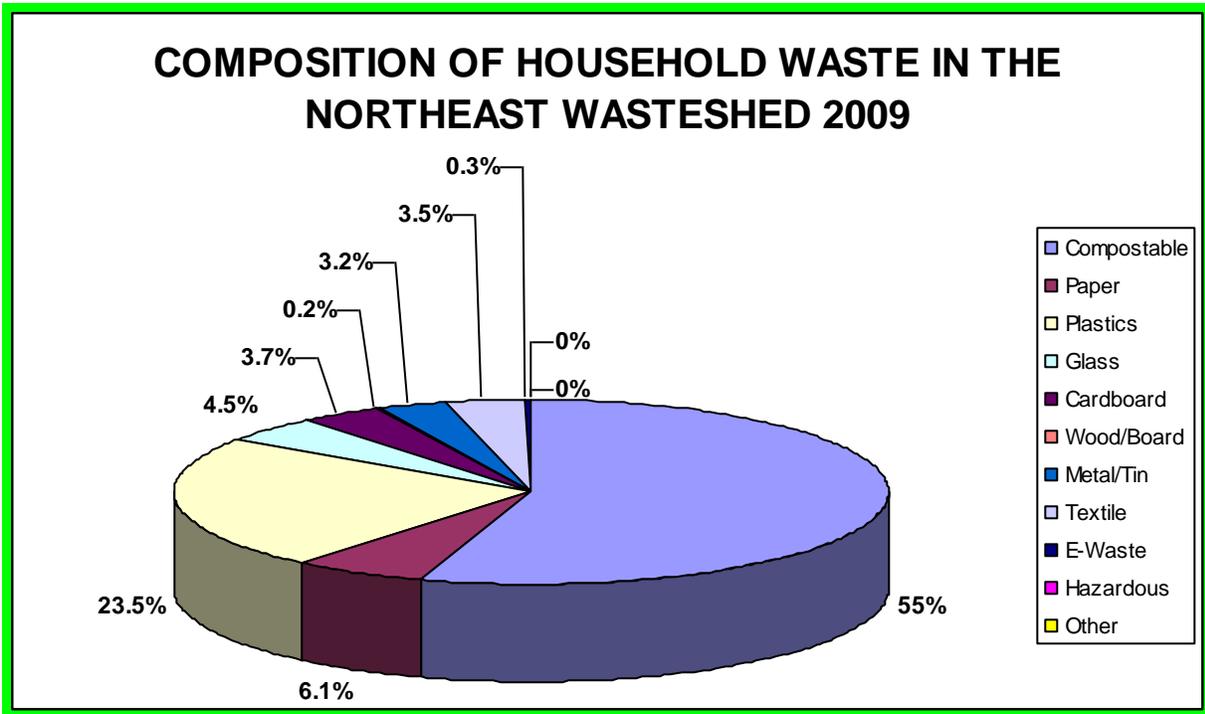
The composition of the domestic waste in all three wastesheds reflected greatly the rate at which the waste fractions were generated. Tabulated in Table 6, and displayed in Figures 4, 5 and 6, the organic or compostable fractions accounting for more than half of the waste stream (between 51.4% - 55.0 %). This was followed by plastics ranging between 12.82% - 24.8%. Paper, glass and textile reflected percentages ranging 6.1% - 16.32%, 4.5% - 5.8% and 3.1% - 5.45% respectively. Metal also reflected comparative figures similar to textile with percentages ranging from 3.2% - 3.45%.

Table 6: Composition of Household Waste in all three Wastesheds

Waste Fractions	Retirement Composition (%)	Northeastern Composition (%)	Southern Composition (%)
Compostable	54.87	55.0	51.4
Paper	16.32	6.1	7.1
Plastics	12.82	23.5	24.8
Glass	5.05	4.5	5.8
Cardboard	2.05	3.7	3.8
Wood/Board	0.04	0.2	0.5
Metal/Tin	3.32	3.2	3.4
Textile	5.45	3.5	3.1
E-Waste	0.08	0.3	0.1
Hazardous	0	0	0
Other	0	0	0
Total Waste Stream	100	100	100

The fraction of cardboard accounted for 2.05% - 3.8%, but this was usually contaminated and did not have a quality acceptable for recovery processes unless there was sorting at source. Wood/board and electronic waste both had minute percentages both under less than half of a percent. In all the wastesheds there were no data recorded for hazardous waste sand other material.





7.0 DISCUSSION

The data from this 2009 waste characterization and generation study continues to highlight the trends of per capita waste generation rates as well as the patterns of the composition of the waste being generated. It provides analysis from a comparative view point particularly since similar studies were done before. A closer examination of the per capita generation rate within the retirement waste indicates that not only has the rate decreased over the past year but continues to decline since 2004 when the first survey was done. The trend indicates that between these years the per capita generation declined from 1.2 kg in 2004 to 0.56 kg in 2009. So technically the per capita generation has been reduced by half (50%) over the past five years.

The comparative analysis for the other two wastesheds can only be done within the last three years since prior to this no data was available. The per capita generation rate for the Northeast wasteshed is similar to what it was in 2007 but this indicates a declining trend since it was 0.62 kg the previous year (2008). The trend in the Southern Wasteshed on the other hand also highlighted a declining trend but increased over the last year (2008). The per capita generation rate within all three wastesheds continues to indicate that they are significantly lower than that extrapolated nationally from a previous study performed in the Riverton Wasteshed which is estimated 1 kg/person /day.

The results of the 2009 waste characterization survey enable us to now validate the statements we made in last year's report as well as to make other justification why the per capita rates are as they are now. It also provides opportunities for the NSWMA to make adjustments to its modus operandi. Generation rates were thought to be lower than anticipated in 2008, and in 2009 there has been a further decrease in the rates for two of the three wastesheds assessed. The Southern Wasteshed was the only one to register an increased rate, reflective of an increased rate in all its parishes as well as the addition of a new parish to the wasteshed.

The decline in the per capita rate continues to be the underpinning question, and from a technical point of view could be attributed to:

- Declining budgetary allocation to the NSWMA.
- Limited storage capacity of residents to store solid waste.
- Residents at times are forced to develop their own means of disposing their waste
- NSWMA collection trucks used to collect both residential & commercial waste.
- Waste diversion.
- Changes in consumerism.

7.1 Declining Budget Allocation

Declining budgetary allocation to the NSWMA resulted in reduced collection frequency as well as unscheduled collection when there are backlogs. At times this results in residents not putting out their waste since it's not the regular collection day. Being unaware of the day the truck will come to collect results in less waste being collected.

7.2 Limited Storage Capacity

Limited storage capacity is also another factor which is related to the point above. This is particularly true as it relates to middle and lower income communities. The frequent backlogs and haphazard collection in some communities has resulted in storage containers being filled to its capacity. Domestic animals and stench from the waste only adds to the ills of the residents. Residents are therefore forced to find other storage areas within their own premises or find alternate means to dispose their waste. When the collection eventually goes in these communities less solid waste is collected than usual since the residents would have already disposed of some of or all that was generated.

7.3 Residence finds alternate means of disposing waste

Residents at times are forced to developed their own means of disposing their waste e.g. burning since reduce budgets means longer periods of storing the waste.

7.4 NSWMA collection trucks used to collect both residential & commercial waste

The NSWMA is both a service provider and a income generating entity since it collects both residential and commercial solid waste. Over the past year has resulted in major changes to the collection of solid waste in residential areas. Commercial entities are collected more frequently since they have become the new source of revenue for the NSWMA. This is further compounded in that there are no dedicated collection units to collect these commercial entities.

7.5 Waste Diversion

Waste diversion programs for recycling or export continues to be a major component of the waste stream. Fractions are sorted and removed at the level of the household; thus not being available for regular collection. The development of the scrap metal, paper and plastic recycling trade has only enhanced these activities at the household level.

7.6 Consumption Patterns

A more vigilant and environmental conscious consumer has resulted in lower levels of some fractions of waste generation at the household. This is particularly true amongst the more educated class and young people who usually get involved in recycling programs.

The character of the waste stream has highlighted a similar pattern sin 2004 however a new trend has emerged this year. While it was common to see compostibles, plastic and paper the predominant waste fractions, textiles have now become a major fraction. While the consumption pattern and methods of packaging can account for the former fractions, there is no clear explanation at this time why textiles are on the increase (50% in all three regions surveyed). This maybe a one off occurrence, but clearly highlights the need for further investigation and analysis. If this trend continues in the next waste characterization study (2010) then this matter will be examined in great detail.

8.0 CONCLUSION

Waste characterization exercises are conducted in order to improve solid waste management efficiency and the effectiveness of service delivery. In concurring, it is quite evident that the per capita generation has decline over the past year. This of course excludes the southern wasteshed which reflected an increase in per capita generation. The per capita generation was as followed;

- Retirement wastesheds 0.56 kg/person/day
- Northeastern wasteshed 0.51 kg/person/day
- Southern wasteshed and 0.53 kg/person/day

The nature of this decline suggest that the per capita waste generation might actually now tapering off, however further characterization exercises will have to be done to determine this.

The characteristics of the waste stream indicates the following;

- Compostables & plastics continue to dominate the composition throughout all wastesheds.
- Compostables makeup between 51.4% - 55.0 %
- Plastics makeup between 12.82% - 24.8% respectively.
- Textile fraction have increased over the previous year with fractions between 3.1% - 5.45% of the waste stream.

These conclusions have wider implications for the current management practices in that the organization for example must increase it efforts reuse and recycle these fractions of solid waste. Composting and the diversion plastics fraction to recycling facilities must be increased. In addition the way these fractions are collected must be further examined with a view to increasing efficiency. This suggests that efficiency surveys such as Time & Motion exercises must be conducted frequently and the results implemented also. This may also provide a avenue for increase revenue generation in the medium to long term.

9.0 RECOMMENDATIONS

Based on the findings revealed and the conclusion outlined, the following recommendations are therefore made;

1. A social impact analysis should be conducted to determine the extent of the effects on the global recession on the solid waste delivery in Jamaica. This should be done at both the macro and micro levels.
2. The frequency of these waste characterization surveys must be increased and the recommendation implemented.
3. The funding mechanism for solid waste management in this nation (the budget of the NSWMA) must be revolutionized. Both the source of funding and the method of payment must be changed. The intended use of the environmental levy must also be instituted.

4. The management practices of the NSWMA must also be reexamined as it also contributed to the declining per capita rate. Its inability to pay its public cleansing contractor which service residential communities (and the withdrawal of their service),
5. the organization's inability to retain highly trained operational staff, high staff turnovers particularly in the regional operations department, termination of some private contracts while not having the capacity to perform these functions are all contributing factors which need to be addressed at the organizational level.
6. The efforts of the Enforcement and Compliance Division should focus more on the organization's core responsibility (residential waste management) than the compliance of commercial entities and securing new commercial collection contracts. This too needs to be corrected.
7. The organization's recycling or recovery programs must be increased significantly.
8. Efforts to construct a 'waste to energy' facility in the island is commendable, but the collection mechanisms and revenue issues must be solved at all levels if this will work. An urgent fix is therefore intrinsic.
9. Greater opportunities for waste recovery from the domestic waste stream must also be capitalized on. Composting and the diversion of plastics fraction to recycling facilities must be increased. If the organization cannot undertake this by itself private sector interest must be invited to participate.
10. The policy for collection and disposal of the reusable waste fractions (compostables, plastics & textiles) must also be changed. A cost benefit analysis must be done to determine efficiencies as well as the viability of establishing these enterprises.
11. Efficiency surveys such as Time & Motion Exercises, waste audits and collection vehicle capability tests must be implemented and conducted at short frequencies as well.
12. Waste characterization surveys for commercial waste generators must also be conducted to determine efficiency and compare the non-commercial wastestream.