ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 8, Issue, 07, pp.33809-33814, July, 2016

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

MUNICIPAL SOLID WASTE CHARACTERIZATION AND QUANTIFICATION AS A MEASURE TOWARDS EFFECTIVE WASTE MANAGEMENT IN ALBANIA

[1]Ornela Çuçi, [1]Anila Kala, [2]Adem Meta, [3]Seit Shallari and *,[3]Fatbardh Sallaku

[1]PhD, student, Agricultural University of Tirana, Albania
[2]Lecturer, Faculty at Cuyahoga Community College, Cleveland, Ohio, USA
[3]Lecturer, Agricultural University of Tirana, Albania

ARTICLE INFO

Article History:
Received 21st April, 2016
Received in revised form
17th May, 2016
Accepted 10th June, 2016
Published online 16th July, 2016

Key words:

Waste sludge's,
Wastewater,
Solid waste.

ABSTRACT

The Prior to 1990, there was hardly any problem of solid waste management in Albania. The solid waste was locally managed in all the urban areas of Albania. Almost all the wastes was organic in nature and was used as manure. Traditionally, only a special caste was involved in waste management activities. In the past, these people collected the waste from settlements using primitive tools such as buffalo ribs to lift the waste and shoulder baskets to carry the wastes. The wastes collected were dumped on nearby river banks or in open fields. In those days, the flow of water in nearby rivers was capable in degrading the dumped organic wastes which were small in quantity. But these traditional practices could not continue due to the increasing population densities in urban areas. Increase in population density has lead to the increase in the volume of waste. This has created a massive threat to public health due to the lack of proper solid waste management. One of the key goals of the Albanian Government is to ensure sustainable provision of water and wastewater services, adapted to the needs of the population and industry, and approximation to the standards of the European Union. Albania is making progress towards accession to the EU, an important part of which is harmonizing environmental legislation with EU Acquis Communautaire. A number of important laws, strategies and plans are adopted or in draft, and these form the framework for environmental improvement in all sectors to be implemented over the next few years. While operationally sludge is an issue for the wastewater sector, from a legal perspective it is a component of the waste sector, which is still in development. To facilitate the development of sludge regulations, this study has prepared an outline of the standards that are considered appropriate for the conditions in Albania and which will harmonize with the EC Directive on sludge use in agriculture (86/278/EEC). There are a number of potential options for using sludge in land reclamation in Albania: abandoned mining sites (control of soil erosion and heavy metal pollution, undertaken by the local forestry offices); quarries (restoration is a legal obligation of owners); waste dump sites (to be restored when regional landfills are available); progressive restoration of the planned regional landfills; and possibly in land development (golf courses, etc. as tourism develops). Such sites could potentially use large quantities of sludge but the opportunities are few and periodic and currently there are no confirmed projects. The overall objective of the current study is to elaborate sludge management strategies for Albania. Since this is the first comprehensive strategic evaluation of sludge management options undertaken in Albania, the study inevitably raises issues of national importance.

Citation: Ornela Çuçi, Anila Kala, Adem Meta, Seit Shallari and Fatbardh Sallaku, 2016. "Municipal solid waste characterization and quantification as a measure towards effective waste management in Albania", *International Journal of Current Research*, 8, (07), 33809-33814.

INTRODUCTION

Solid waste management is also a non-excludable good as it is difficult to be protected by the general market forces. One way of managing non-excludable goods or services is either by the internalization of costs (by levying charges for the use of the services) or by following a command and control policy or a combination of both. Government intervention is necessary for this. The rationality of the government's intervention can be judged when the costs of producing the good or service decline as more of the good or service is produced and when production or use of the good or service results in "externalities" such as environmental pollution (Macauley and

Corresponding author: Fatbardh Sallaku,
Lecturer, Agricultural University of Tirana, Albania.

Walls, 1995. In the early days economists discussed about the socio-economic factors influencing waste generation by the households. Wertz (1976) discussed about the economic aspects of household's decisions to produce more or less refuse. He mainly analyzed the theoretical concept about household behavior on waste generation due to the changes in income, price of refuse service, frequency of service, site of refuse collection and packaging. He also discussed on resource implications of the local government policy, which refrains from the pricing of public refuse service to households. Economists also compared the composition and quantity of waste in terms of income level, household size and age structure of the household. The household size, household income and population were important factors affecting the quantity and composition of solid waste. The study shows that grass, yard wastes and newspaper were positively correlated to the level of income (Richardson et al. ,1978). As in many cities in the world, solid waste management in Albania is facing several problems of great importance that can directly affect the environment and health of the residents. Rapid increase in volume and types of solid and hazardous waste as a result of continuous economic growth, urbanization and industrialization, is becoming a burgeoning problem for Tirana Municipality to ensure effective and sustainable management of waste.

Although considerable efforts are being made by the Government of Republic of Albania and other entities in tackling waste-related problems, there are still major gaps to be filled in this area. Based on what mentioned above and on the targets sets by the national strategy, it was requested the technical cooperation to the Government of Japan to conduct the study for the Project for Tirana Thematic Urban Planning. The objectives of the study include the formulation of action plans under the short-term (5 year action plan) and the mid-term plan (10 year plan) for development of the urban infrastructures including solid waste management facilities. Municipality of Tirana faces uphill challenges to properly manage its waste with most efforts being made to reduce the final volumes and to generate sufficient funds for waste management. If most of the waste could be diverted for material and resource recovery, then a substantial reduction in final volumes of waste could be achieved and the recovered material and resources could be utilized to generate revenue to fund waste management. This forms the premise for Integrated Solid Waste Management (ISWM) system, based on 3R (reduce, reuse and recycle) principle. Developing and implementing ISWM requires comprehensive data on present and anticipated waste situations, supportive policy frameworks, knowledge and capacity to develop plans/systems, proper use of environmentally sound technologies, and appropriate financial instruments to support its implementation. In response to these data demands it was decided to undertake the Solid Waste Amount and Composition Survey (WACS), within the administrative boundary of Municipality of Tirana. This study attempted to harmonize the various approaches used, so that valid comparisons can be made within administrative boundary of the Municipality of Tirana. At the same time, this study consented for a wide diversity of approaches to address widely varying objectives and interests: public bins/or generators; city center/urban/suburban; high income/middle income/low income areas and informal settlements; etc.

To this effect, it was developed a consistent methodology for waste composition analysis and recommends locations for pilot demonstrations to verify it. The methodology developed in this study is based on direct waste analysis, as this method can provide data that is fairly detailed and accurate. The results from direct waste analysis studies can usually be extrapolated to similar jurisdictions using empirical analysis. Direct waste analysis studies are generally either landfill-based or generator-based. In landfill-based studies, waste arriving at the landfill is sampled whereas; in generator-based studies waste is collected from a selected sample of generators (e.g. households, institutions, industry). Generator-based studies generally provide greater flexibility in terms of dividing a sector into a number of sub-groups or strata with similar waste generation characteristics.

MATERIALS AND METHODS

The methodology of the WACS was drafted as a direct waste analysis, as this method can provide data that is fairly detailed and accurate. The methodology involved the actual quantification of waste, through collecting sample from the households, as domestic generators based, sampling by the trucks that enters in the Sharra's dumpsite, as dispose site based, and illegal dumping waste survey. Furthermore, conducting waste audits and studies where samples are sorted by waste type and weighed. The approach used in this survey was based on sampling of garbage at the point of generation (households). The survey used sample areas consisting of 4 areas, classified by income, High Income Residential Area, Middle Income Residential Area, Low Income Residential Area, and Informal Settlement Area. Waste sampling will be conducted for eight (8) days consecutively.

The first day sample will be used only for reference since the first day waste is probably mixed with waste generated before and the waste discharge amount is generally larger. Analysis will be carried out for 7 days samples gathered from the 2nd day survey. Prior to the survey, the surveyors visit the houses to ask for cooperation of the survey and conduct the interview survey to collect basic information of the waste generator including the number of family, monthly income/expenditure, status of recovery of recycling materials, complaints to the waste collection service, etc. The number of samples collected was of 25 samples per each income group, 100 samples per day, and for eight (8) days consecutively. In total the waste samples will be of 800 samples. Waste composition survey will be carried out for composite samples of each income group and the total number of samples will be come 32 sample. The waste amount discharged from each household will be weight and recorded.

RESULTS AND DISCUSSION

The data gathered during the sampling efforts was compiled, and statistical analyses were performed in order to extrapolate the findings to citywide estimates.

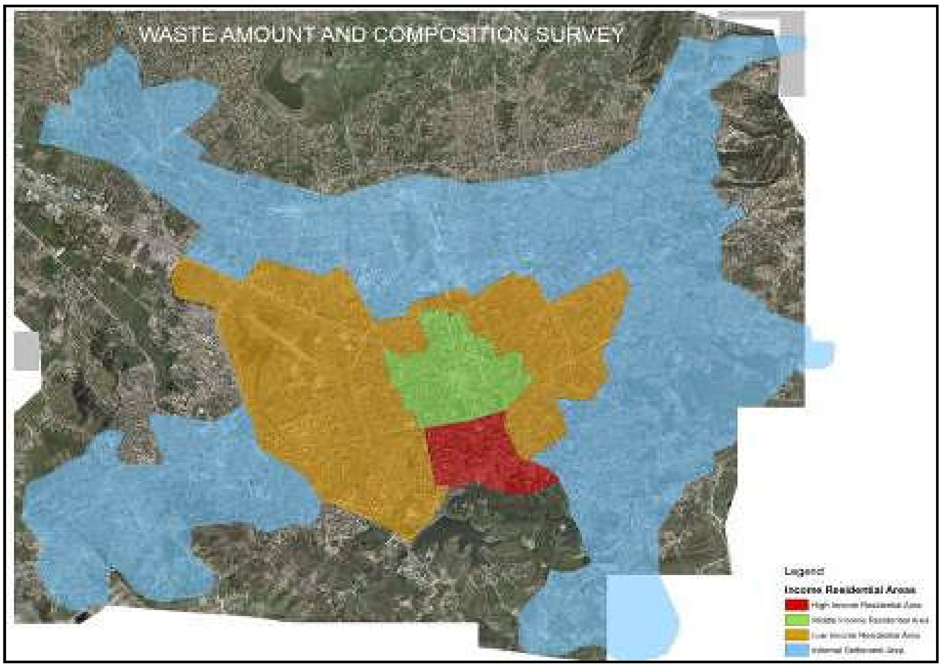

Figure 1. Four income areas for Tirana municipality

Table 1. Waste generation per capita per day for the domestic waste

Income Group	Minimum (kg/d/C)	Mean (kg/Cap/d)	Maximum (kg/Cap/d)
High Income Area	0.18	0.43	0.81
Middle Income	0.11	0.37	1.34
Low Income	0.06	0.35	0.67
Informal settlements	0.05	0.29	0.81
Total	**0.05**	**0.36**	**1.34**

Table 2. Average waste composition for the domestic waste

		Average Waste Composition-Domestic Waste (%)				
Waste Composition		High Income	Middle Income	Lower Income	Informal Settlements	Total
Food Waste		42.94%	45.65%	51.33%	44.86%	46.12%
Paper	Recyclable Paper	4.77%	5.31%	2.83%	1.35%	3.62%
	Recyclable Cardboard	6.07%	6.44%	4.43%	4.19%	5.32%
	Mixed Paper	6.68%	5.04%	5.36%	4.55%	5.43%
	Diapers	5.33%	6.39%	4.76%	4.93%	5.37%
	Subtotal-Paper	22.85%	23.19%	17.38%	15.03%	19.73%
Plastics	Plastic Sheet	1.37%	2.33%	1.40%	0.51%	1.42%
	Recyclable Plastics	4.13%	1.83%	4.30%	2.09%	3.08%
	PET Bottles	5.22%	6.93%	5.03%	2.91%	5.06%
	Other Plastics	9.19%	7.10%	6.63%	8.17%	7.79%
	Subtotal-Plastics	19.92%	18.19%	17.36%	13.67%	17.35%
Rubber & Leather		1.14%	1.95%	1.46%	1.08%	1.41%
Textiles		3.41%	3.24%	1.99%	3.91%	3.14%
Yard Waste		1.54%	0.30%	0.46%	8.19%	2.57%
Lumber & Logs		0.49%	0.31%	0.71%	0.83%	0.58%
Other Org. Waste		0.71%	0.29%	1.04%	1.40%	0.85%
Organic Waste - Subtotal		7.31%	6.09%	5.66%	15.41%	8.55%
Inorganic Waste						
Glass	Returnable Bottles	0.70%	1.16%	1.24%	0.72%	0.95%
	Other Live Bottles	2.15%	1.30%	1.73%	1.49%	1.67%
	Glass bins	0.00%	0.00%	0.05%	0.00%	0.01%
	Broken Glass	0.94%	0.58%	1.22%	0.39%	0.78%
	Glass-Subtotal	3.78%	3.04%	4.23%	2.60%	3.41%
Metals	Tin Cans (steel cans)	0.65%	1.15%	0.96%	0.72%	0.87%
	Aluminum cans	0.35%	0.54%	0.72%	0.33%	0.48%
	Copper	0.00%	0.00%	0.00%	0.00%	0.00%
	Other Metals	0.67%	0.33%	1.13%	1.10%	0.80%
	Metal-subtotal	1.66%	2.01%	2.81%	2.15%	2.15%
Dirt, Ash, Stone, Sand		0.88%	0.86%	0.89%	5.19%	1.92%
Inorganic Waste - Subtotal		0.00%	0.11%	0.00%	0.00%	0.03%
Unclassified residual waste		0.18%	0.38%	0.07%	0.67%	0.32%
Domestic Hazardous Waste		0.04%	0.05%	0.00%	0.00%	0.02%
Batteries - Dry Cells		0.27%	0.19%	0.10%	0.13%	0.18%
Other Domestic Hazardous Waste		0.16%	0.23%	0.17%	0.29%	0.21%
Total		100.00%	100.00%	100.00%	100.00%	100.00%

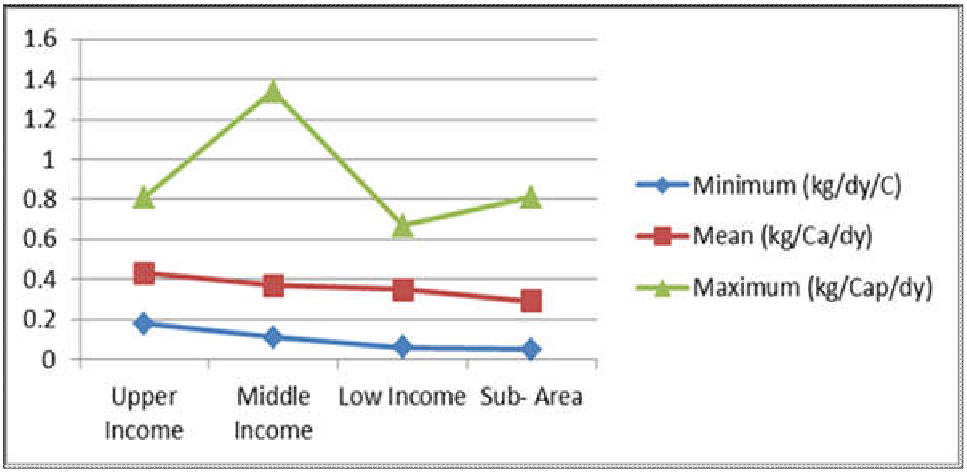

Figure 2. Waste generation per capita, per day for the domestic waste

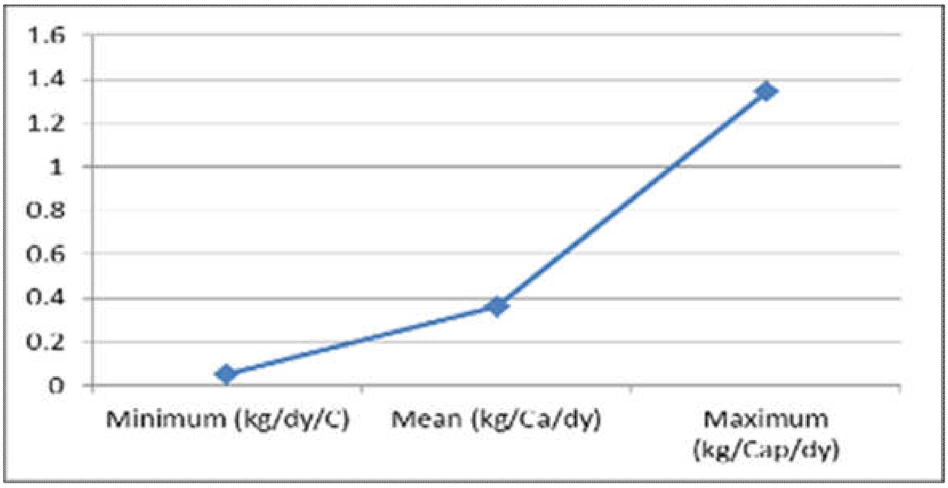

Figure 3.2 Total waste generation per capita, per day for the domestic waste

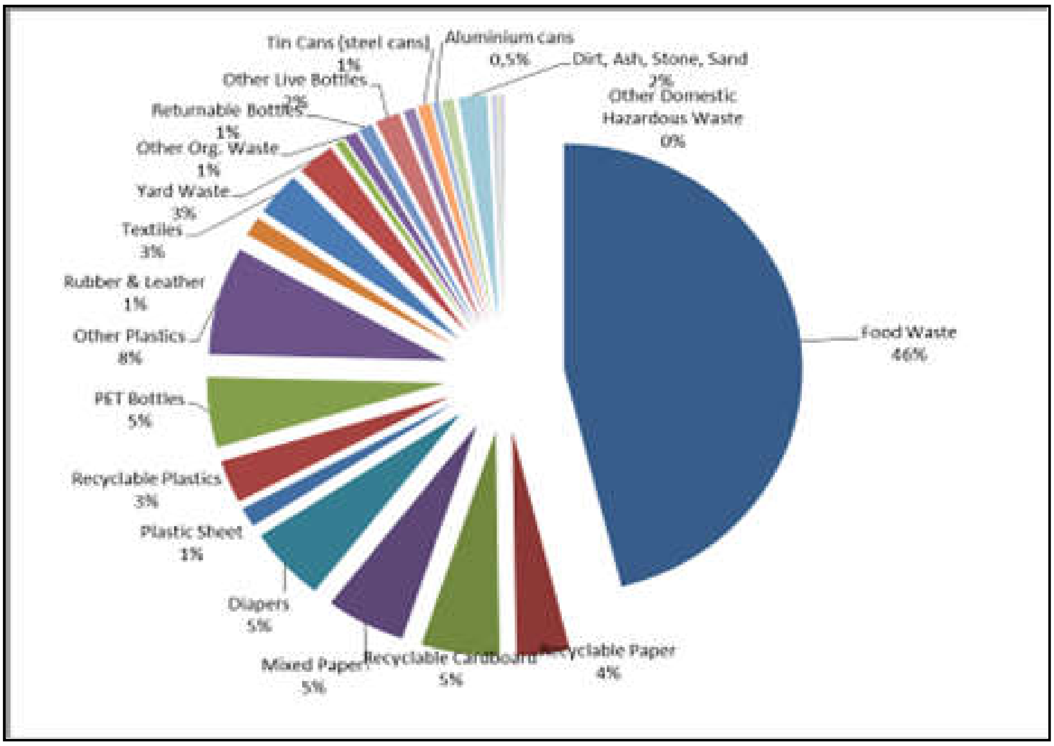

Figure 4. Average waste composition for the domestic waste

Table 3. Average waste composition of main components for the domestic waste

	Average Waste Composition-Domestic Waste (%)				
Waste Categories	High Income	Middle Income	Lower Income	Informal Settlements	Total
Food Waste	42.94%	45.65%	51.33%	44.86%	46.12%
Paper	22.85%	23.19%	17.38%	15.03%	19.73%
Plastics	19.92%	18.19%	17.36%	13.67%	17.35%
Glass	3.78%	3.04%	4.23%	2.60%	3.41%
Metal	1.66%	2.01%	2.81%	2.15%	2.15%
Others	8.85%	7.92%	6.89%	21.69%	11.24%
	100.00%	100.00%	100.00%	100.00%	100.00%

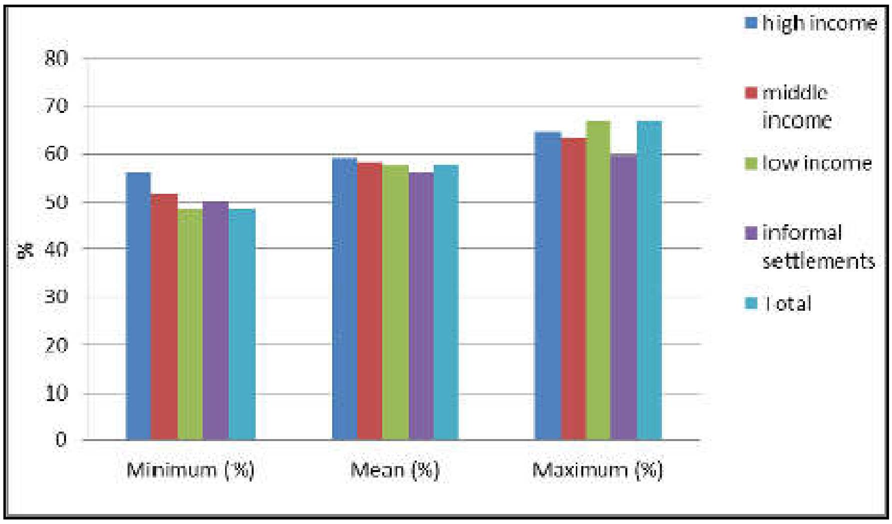

Figure 5. Average of the moisture content for each income area

Per Capita Waste Generation

The waste amount generation rate per capita in residential area for the survey is shown in Table 9. The generation ratio of solid waste per capita is in proportion to the number of members per household.

Waste Composition

The physical composition of the household waste for the survey is shown in *Table 10*. The following components are the highest according to the results of the two surveys: Food waste, paper and plastics.

Moisture content

The results of the moisture content analysis are shown in Table and Figure. The high income areas presented waste with the highest moisture content, whereas the low income areas and the informal settlements presented the lowest value. The quality of sludge is of fundamental importance in not only protecting the environment and health but also in determining the agronomic value of sludge so farmers can be advised appropriately. The parameters normally required in sludge are:• nutrient (N, P, K), organic matter (or volatile solids), pH, heavy metals (Zn, Cu, Ni, Cd, Pb, Cr, Hg). In addition, depending on the outcome of the current proposal for revision of EC Directive 86/278/EEC, microbial analysis to indicate the level of pathogens that may be present in sludge, may be required to classify sludge as 'conventional' or 'advance treated', as well as the analysis of a range of organic contaminants. Soil quality also requires monitoring, initially to determine natural background levels of heavy metals and pH and then at extended intervals to check that soil quality remains within the standards permitted where sludge is applied on a regular basis.

Conclusion

The key elements of the strategy are summarized based on the data discussed above. • The sludge's produced by air-drying and SRBs will be physically acceptable for any of the potential outlets. Agriculture has large potential capacity and there is high latent demand for organic manure but the outlet requires development through marketing activities in conjunction with the local agricultural offices. The chemical quality of sludge will require regular monitoring for compliance with the standards as elevated concentrations of nickel are evident, presumably arising from naturally high concentrations in the environment. Energy recovery options (cement factory) should be considered but this is unlikely to be feasible at the current time due to high transport costs and factories not adapted to using alternative fuels. Solid waste management depends on accurate data collection and resource-appropriate methods. This report outlines the results of statistical analysis of waste survey data collected from the households of 4 income areas and the income waste at the disposal site of Sharra. The study showed that the average amounts of waste generated per capita per day for domestic waste were 46,1% of food waste, 19, 7% of paper, 17,4% plastic, 2,2% of glass and 3, 41% of metal.

The biodegradable organic constitutes the largest category (about 54%) in the household waste stream. Waste from the high income areas represents the lowest percentage of organic and unlike the waste from the low income areas which have the highest percentage. The data analyses showed that per household generation of plastic and paper waste increase with increase in income level (Table. 12). This is explained by the relatively high consumption trends of higher income groups and the increased purchases of packaged products and reading material. The waste from the high income represents the highest recycling waste amount, only for paper is equal to Middle income. The bulk density is higher in the waste from the high income and low income areas represent the lowest bulk density. Though income matters on waste density; this means that lower income produce high bulky waste. There are no significant differences on moisture content between income groups.

REFERENCES

Headley, J. 1998. Article entitled: "An overview of Solid Waste management in Barbados" in text book entitled Solid Waste Management: critical issues for Developing Countries, edited by Thomas-Hope E. Published by Canoe Press, UWI.

Inter-American Development Bank. 2002. Solid Waste Management Project-Belize (Profile 11).

Macauley, Molly K.; Margaret A. Walls 1995. Solid Waste Reduction and resource Conservation: Assessment Policy, Resource for the Future Discussion Paper 95-32

Olexa, M., L. D'Isernia, L. Minton, D. Miller and S, Corbett. 2005. "Handbook of Florida Water Regulation (Solid Waste Management)." Florida University

Pan-American Health Organization, Pan American Centre for Sanitary Engineering and Environmental Sciences, and Department of the Environment. 2003. "Regional Evaluation of Municipal Solid Waste Management Services (Evaluation 2002) Belize Report."

Persall, J (Editor). 1999. The Concise Oxford Dictionary. Oxford University Press. 47

Richardson, Robert A. 1978. Economic Analysis of the Composition of Household Solid Wastes. *Journal of Environmental Economics and Management*, 5, 103-111, 1978

Simmons and Associates Inc. 2004. "Evaluation of Alternative technologies for the disposal of Solid Waste in Barbados." Consultants' Final Report commissioned by Government of Barbados.

Tchobanoglous, G, H. Theisen and S. Vigil. 1993. " Integrated Solid Waste Management". Published by Mc Graw Hill. Inc

UWI. 2005. Notes on Integrated Solid Waste planning and Management (ENVT 6143). Water, Engineering and Development Centre. 1998. "Micro-enterprises Development for Primary Collection of Solid Waste." Staff Conference Paper from University of Loughborough, published on the internet at www.gdrc.org/uem/waste/ swmconfpaper.htlm.

Wertz L. Kenneth, 1976. Economic Factors Influencing Household's Production of Refuse' *JEEM,* 2, 263-272.

****