



EMA
environmental
management
authority

2011 ANNUAL REPORT





Mission Statement

The Environmental Management Authority is committed to protecting and conserving the natural environment to enhance the quality of life by promoting:

- *Environmentally responsible behaviour*
- *Development and enforcement of environmental legislation*
 - *Encouragement of voluntary compliance*
 - *The use of economic and other incentives*

This is to be achieved in an atmosphere of mutual respect, professionalism, accountability, transparency, collaboration and social responsibility.

QUICK FACTS ON THE ENVIRONMENTAL MANAGEMENT AUTHORITY

- ✓ The Environmental Management Authority (EMA) was established by the Trinidad and Tobago Parliament in 1995 through the enactment of the Environmental Management Act, 1995. It was later repealed and re-enacted by the Environmental Management Act, Chapter 35:05.

- ✓ Major functions of the EMA include:
 - ❖ Promoting a better understanding and appreciation of the environment.
 - ❖ Encouraging the integration of environmental concerns into private and public decision-making.
 - ❖ Co-ordinating efforts among the various institutions with responsibility for the environment to establish an integrated environmental management system designed to protect, enhance and conserve the environment.
 - ❖ Developing and implementing laws, policies and programmes to promote sustainable development, achieve economic growth and meet international obligations.
 - ❖ Enhancing the legal, regulatory and institutional framework for environmental management.

- ✓ The EMA prepares an annual report containing an assessment of the state of the environment, which is intended to:
 - ❖ Provide a foundation for improved decision-making at all levels;
 - ❖ Increase awareness and understanding of environmental trends and conditions;
 - ❖ Facilitate the measurement of key indicators that monitor progress of the pace and direction towards enhancing positive, or mitigating negative, observed conditions and trends.

MESSAGE FROM THE CHAIRMAN



Dr. Allan Bachan
Chairman

During the 2011 reporting period, the Board of Directors of the Environmental Management Authority (EMA) operated under the Chairmanship of the late Mr. Kelvin Ramnath, On behalf of the current Board of Directors I am pleased to present this 2011 Annual Report as part of the EMA's ongoing commitment towards meeting its mandate as outlined in the Environmental Management Act, Chapter 35:05.

This 2011 annual report includes: the Assessment of the State of the Environment Report which focuses on solid and hazardous waste in Trinidad and Tobago; the EMA's accomplishments for 2011 and plans for 2012; financials for the fiscal year 2011 and any other financial support.

Based on the data gathered from the solid and hazardous waste report, the EMA was able to contribute significant data towards the research and development of our waste management system in Trinidad and Tobago. Strengthening the EMA's legislation is a critical aspect that will be looked at with a focus on improving existing legislation such as the Draft Waste Management Rules. Additionally collaborating with various bodies such as: state agencies, Non-Governmental Organisations and Community Based-Organisations, will be on going as the EMA seeks to collectively inform waste management plans in Trinidad and Tobago.

The year 2011 was also internationally recognised as the International Year of Forests with the United Nations adopting the theme '*Forests for People*'. The EMA adopted this theme for most of its public education awareness initiatives this year. In addition to this, pertinent aspects of the work of the EMA continued. The EMA continued its work in Source Registration (SR) and issuing Water Pollution Permits with several facilities being prioritized for permit notification. The EMA also received over 340 Certificates of Environmental Clearance applications and processed over 300 Noise Variation applications. Additionally, the EMA completed lead remediation works at Food Crop Trace, Guayaguayare.

The EMA also successfully completed a project proposal in August 2011 which was aimed at strengthening the capacity of Small Island Developing States (SIDS) in the Caribbean by implementing obligations under the Basel Convention, and as appropriate, the Stockholm and Rotterdam Conventions.

The EMA also facilitated community-based fire management training within the Aripo community as fire was identified as an on-going threat to the Aripo Savannas Environmentally Sensitive Area (ASESA). The University of the West Indies (UWI) and the Trinidad and Tobago Orchid Society (TTOS) also conducted significant research within the Aripo Savannas.

The EMA is continuously working towards achieving its strategic goals while contributing towards a holistic approach to environmental management. The EMA remains dedicated to fulfilling its mandate and will continue to work towards improving and developing further its human resources, legislation and other technical expertise in addressing environmental matters in Trinidad and Tobago.

Dr. Allan Bachan
Chairman, EMA

ACKNOWLEDGEMENTS

The 2011 Assessment of the State of the Environment (ASOE) report has been written and edited by the following team: Wayne Rajkumar, Nicole Bachan, Candice Clarence, Xiomara Chin, Karisse Montano, Lorraine Maharaj, Shivanna Sam and Ryan Assiu. The Environmental Management Authority is also grateful for the guidance provided by Dr. Joth Singh and for the contributions made by the Ministry of the Environment, the Trinidad and Tobago Solid Waste Management Company Limited and all of the recycling industries who upon contact willingly provided the required information needed to compile the final report.

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ACRONYMS

| | |
|-------|--|
| ADR | Alternative Dispute Resolution |
| ASOE | Assessment of the State of the Environment report |
| BC | Beverage Containers |
| BFR | Brominated Flame Retardants |
| BOD | Biological Oxygen Demand |
| CD | Compact Disk |
| CEC | Certificate of Environmental Clearance |
| CEHI | Caribbean Environmental Health Institute |
| CEO | Chief Executive Officer |
| CEPEP | Community-Based Environmental Protection and Enhancement Programme |
| CFC | Chlorofluorocarbons |
| COD | Chemical Oxygen Demand |
| CPU | Central Processing Unit |
| CRT | Cathode-Ray Tube |
| CR/PE | Corporate Relations and Public Education |
| CSO | Central Statistical Office |
| DRS | Deposit Refund System |
| DVD | Digital Versatile Disc |
| EMA | Environmental Management Authority |
| EPU | Environmental Police Unit |
| ESAR | Environmentally Sensitive Areas Rule |
| ESSR | Environmentally Sensitive species Rule |
| GDP | Gross Domestic Product |
| GEF | Global Environment Facility |
| GHG | Greenhouse Gas |
| GoRTT | Government of the Republic of Trinidad and Tobago |
| GWP | Global Warming Potential |
| ICC | International Coastal Clean-up |
| ICI | Institutional, Commercial and Industrial |
| IPC | Infection Prevention and Control |

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|-----------|--|
| ISIC | International Standard Industry Classification |
| Kg | Kilograms |
| LCD | Liquid-Crystal Display |
| LFG | Landfill Gas |
| LNG | Liquefied Natural Gas |
| MOLG | Ministry of Local Government |
| MoU | Memorandum of Understanding |
| MS | Microsoft |
| n.d. | No Date |
| n.e.c. | Not Elsewhere Classified |
| NEP | National Environmental Policy |
| NGOs | Non-governmental Organizations |
| NOV | Notice of Violation |
| NPCR | Noise Pollution Control Rules |
| PAH | Polycyclic Aromatic Hydrocarbons |
| PC | Personal Computer |
| PCB | Polychlorinated Biphenyls |
| PETROTRIN | Petroleum Company of Trinidad and Tobago |
| POPs | Persistent Organic Pollutants |
| PPE | Personal Protective Equipment |
| ppm | Parts per Million |
| PVC | Polyvinyl Chloride |
| SAICM | Strategic Approach to International Chemicals Management |
| SEA | Secondary Entrance Assessment |
| SIDS | Small Island Developing States |
| SME | Small and Medium Enterprises |
| SR | Source Registration |
| SRC | Source Registration Certificate |
| SRL | Secure Recycling Limited |
| SWMCOL | The Trinidad and Tobago Solid Waste Management Company Limited |
| THA | Tobago House of Assembly |
| TTSIDA | Trinidad and Tobago Scrap Iron Dealers Association |

| | |
|-------|--|
| UBVA | United Bottles Vendors Association |
| UNDP | United Nations Development Programme |
| UNEP | United Nations Environmental Programme |
| UNIDO | United Nations Industrial and Development Organization |
| USA | United States of America |
| USEPA | United States Environmental Protection Agency |
| VAT | Value Added Tax |
| VOC | Volatile Organic Compound |
| WASA | Water and Sewage Authority |
| WED | World Environment Day |
| WEEE | Waste Electrical and Electronic Equipment |
| WPR | Water Pollution Rules |
| WTE | Waste-to-Energy |

**PART A: ASSESSMENT OF THE STATE OF THE ENVIRONMENT
REPORT**

EXECUTIVE SUMMARY

The theme of this year's Assessment of the State of the Environment Report is "Solid and Hazardous Waste in Trinidad and Tobago." This topic was chosen in light of the rapid economic growth and commercialization which has been occurring within the country and the inability of local waste management infrastructure to adequately deal with the volume and type of waste being generated. Such a situation threatens both public and ecosystem health in the form of various types of pollution thus necessitating the need for the development of cohesive waste management strategy. There has also been an increase in urbanization within the country and this has influenced the rate of waste generation within urban areas.

Within recent years, the country has witnessed a significant alteration to the type of waste being generated, with the emergence of special waste types such as electronic and biomedical waste, which have posed serious challenges to the conventional method of waste management being currently utilised. The evolution of the global market has also brought with it changes in lifestyles which have further facilitated the preponderance of packaging products, especially in the form of non-biodegradable plastics.

In a similar manner, economic expansion especially within the petrochemical and hotels and restaurant sectors have resulted in increased hazardous waste production. This situation represents part of the larger paradox of development whereby factors which create the most obdurate problems currently facing developing countries, such as Trinidad and Tobago, are the very same problems which are ironically derived from development itself. As such, in order to fill this growing gap between changing patterns of growth and modernisation and the capacity to effectively plan and manage waste, it is of paramount importance that a national sustainable waste management system be aggressively pursued in order to curb the growing waste volumes within the country.

This report provides both quantitative and qualitative data related to solid and hazardous waste generation; waste collection and storage and waste disposal. Solid waste generation rates were reported based on the Solid Waste Management Program Waste Characterization and Centroid Study conducted for Trinidad in 2010 while hazardous waste generation rates were derived from the National Hazardous Waste Inventory conducted for the period 2004-2008. The key findings emanating from the data analysed are as follows:

Hazardous Waste

- An estimated total of 171,978 metric tonnes of hazardous waste was reported as being generated within Trinidad and Tobago for the period 2004-2008, with Trinidad reporting

149,327 metric tonnes (87 %) of the total amount of hazardous waste for the five year inventory period while Tobago only accounted for 22,651 tonnes (13%).

- In Trinidad, waste oils/water; hydrocarbons /water mixtures and emulsions generated the greatest volume of hazardous waste (138,821 tonnes), while waste lead-acid batteries: whole or crushed, was seen to be the second largest generator of hazardous waste (6,422 tonnes) for the five year inventory period. Waste oils/water; hydrocarbons /water mixtures and emulsions was also seen to be the greatest contributor to hazardous waste on the island of Tobago, with basic solutions or bases in solid form and organic phosphorous compounds being the second and third largest contributors respectively.
- The three major sectors contributing to hazardous waste generation within Trinidad and Tobago were the oil and natural gas sector including support services; the power generation sector and the hotels and restaurants sector.

Solid Waste

- Organics were seen to comprise the highest proportion of household waste whilst construction and demolition waste were least prevalent. Plastics and paper were the second and third most common respectively and contributed similar amounts to the overall waste composition.
- Organics, plastics and glass were most prevalent in areas of low population density. However, paper was seen to be most generated in areas of high population density.
- A significantly high proportion of organics was seen to originate from high income households. Paper was also most prevalent in households of high income. On the other hand, glass was most prevalent in low income households whilst plastics from very low income households.
- The Beetham Landfill contained a higher proportion of organics and paper as compared to the other landfills. Plastics, on the other hand, were most prevalent at the Forres Park landfill whilst an exceedingly high proportion of glass was observed at the Guapo landfill.
- Waste samples characterised during the study exhibited a very high proportion of plastics and packaging materials. Proportions of old corrugated cardboard, metals and beverage containers were found to be very low. This may have been a reflection of the vigorous entrepreneurial activities already evident in Trinidad, at least in the major centres of the country, by which these materials are collected in considerable quantities prior to disposal at landfills.
- Institutional, Commercial and Industrial sources (ICI) were seen to generate a total of 233, 333 tonnes of waste in 2010, an approximate one third of the total waste generated within the country.
- Based on data derived from the annual Ocean Conservancy's International Coastal Clean-up (ICC) for the period 2002-2011, it was seen that shoreline and recreational activities

served as the two major contributors to coastal pollution, with the most abundant materials being plastic bottles, glass bottles, containers, bags, plates and cutlery.

Electronic Waste

- Discarded electrical and electronic assemblies (E-waste) generated within the country mainly comprised end of life computers, computer parts and peripherals, cell phones and batteries and other discarded electronic appliances and electronic parts. The activities generating this type of waste included the repairing of electronic equipment and appliances and the retirement of computers and other electronic appliances.
- The amount of electronic waste generated was seen to almost double between 2004 and 2005, while a significant reduction occurred between 2005 and 2006. However, the figure increased slightly in 2007 with the largest amount of waste (71, 070kg) being reported in 2008.
- Based only on those entities sampled during the study period, the three sectors making the most significant contributions to the total e-waste generated within the country was seen to consist of the power generation sector; the computer sales and services sector and financial institutions.
- At present, there is no disposal system in place for hazardous waste, inclusive of e-waste, within Trinidad and Tobago. Two of the three major landfills within the country are not lined and although the disposal of e-waste is prohibited at landfill sites, this special waste type still continues to be disposed of as part of the general municipal solid waste stream.

Biomedical Waste

- Clinical wastes from medical care in hospitals; medical centres and clinics generated within the country, consisted mainly of animal and human body parts, body fluids including blood and urine samples, needles, syringes, special garbage bags, reagent bottles, sharps, oils, chemicals including used chemicals and those consisting of or containing dangerous substances, wash water, gloves, bandages, spent vials, radioactive and amalgam waste.
- For the period 2004-2008, a total of 539, 402 kg of Y1 waste was generated within the country. Trinidad accounted for the majority of this type of waste i.e. 331, 050 kg whilst Tobago only accounted for 208, 352 kg.
- In Trinidad, based on the industries which were sampled for this study, the major generators were seen to originate from the vicinity of Chaguanas and San Fernando while in the case of Tobago, the largest generator was seen to be within the Scarborough area.

Waste Disposal Sites

There are presently nine (9) solid waste disposal sites within Trinidad and Tobago. Comprising these nine sites are the public landfills, where the majority of solid waste generated in the

country is disposed of. There are three (3) public landfills in Trinidad and one (1) in Tobago. Of these nine solid waste disposal sites, only the Forres Park Landfill (Trinidad) and Studley Park Landfill (Tobago) are engineered landfills. As it relates to hazardous waste disposal, there is currently no dedicated hazardous waste landfill or disposal facility within the country to accommodate this type of waste. As such, a substantial percentage of the hazardous waste which is generated is usually disposed of either as part of the general municipal solid waste stream or indiscriminately dumped.

Need for a Modern and Effective Waste Management System

Several factors affect the effectiveness and efficiency at which waste management services are executed and these include institutional, legislative, technical and financial aspects. As such, in order to overcome the present challenges facing waste management within the country, an integrated approach is needed which consists of a hierarchical and coordinated set of actions aimed at reducing pollution, maximising the recovery of reusable and recyclable materials whilst protecting human health and the environment. This report therefore provides a summary of the strengths and weaknesses of the current waste management system followed by a brief synopsis of the state of recycling activities within the country.

Lastly, the recommendations made are centred on the concept of an Integrated Waste Management System which once adapted to local conditions should be socially desirable, economically viable and environmentally sound. Bearing in mind the above, this assessment thus serves as a starting point in establishing an understanding of the state of waste management within Trinidad and Tobago. The report draws upon the information of past studies such that there is a clear understanding of what is currently occurring within the country, which is necessary in order to inform and guide the pathway for future waste management decisions. The report is therefore aimed towards engendering general awareness of and collective responsibility for waste generation within the country and to inform and assist in the public response to curbing this significant environmental issue.

1.0 INTRODUCTION

1.1 Rationale

Waste management is a major social, environmental and economic issue which traverses and impacts on all areas of public and private activities. In recent years, rapidly growing populations and increased urbanisation have led to increased waste generation, thus intensifying the resulting impacts of waste on the environment¹. It has also become evident that the increasing volume and complexity of waste associated with economic growth is posing serious risks to global ecosystems and public health². On a global scale, approximately 11.2 billion tonnes of solid waste is collected annually, with the decaying organic proportion of such waste contributing to an estimated five (5) percent of global greenhouse gas (GHG) emissions³. However, although the waste sector makes a relatively minor contribution to GHG emissions, it should be noted that the prevention and recovery of wastes has the ability to reduce emissions in all other sectors of the economy. As such, this gives the waste sector the unique ability to move from being a minor source of global emissions to becoming a major reducer of emissions.

Within the last 20 years, Trinidad and Tobago has seen a shift in the type of waste being generated as a result of an increase in the standard of living, commercialisation, residential development and industrialisation within the country⁴. In addition, increased manufacturing and extensive built development has led to an increase in the volume of post-consumer items, construction materials and packaging materials requiring disposal, with plastics superseding paper and glass as the main packaging material in many industries, thus increasing its prevalence as a waste product. Undoubtedly, waste management has therefore presented itself as a major environmental challenge, being further reinforced by the limited land resources and fragile ecosystems characteristic of a small island developing state like that of Trinidad and Tobago. As such, the effect of improperly disposed waste is amplified by the reduced availability of land to site waste disposal facilities, limited human and institutional capacity and increased risks to public and environmental health. Furthermore, as it regards the economy, efficient waste management is critical in ensuring the optimal functioning of major local industries such as tourism, agriculture and fisheries.

It is estimated that for Trinidad and Tobago, an average of one kilogram (kg) of waste is generated per capita per day, with a range of 0.55kg/capita/day in rural areas to

¹ Achankeng, E. (2003). Globalization, Urbanization and Municipal Solid Waste Management in Africa. *African on a Global Stage*. African Studies Association of Australasia and the Pacific.

² Intergovernmental Panel on Climate Change (IPCC). (2007). *Climate Change 2007: Working Group III: Mitigation of Climate Change*. Retrieved June 27, 2011, from http://www.ipcc.ch/publications_and_data/ar4/wg3/en/tssts-10.htm.

³ United Nations Environment Programme (UNEP). (2011). *Waste: Investing in Energy and Resource Efficiency*.

⁴ Ministry of the Environment and Water Resources. (2011). The Environmental Policy and Planning Division.

1.75kg/capita/day in highly commercialised and industrialised areas such as Port of Spain⁵. In addition, the generation rate of garbage for the city of Port of Spain is estimated at 1.54kg per inhabitant per day⁶. At present, there is little/no segregation of waste prior to disposal, minimal reuse and recycling, unsanitary and limited number of landfills, inadequate legislative and management systems and a general lack of public awareness as it relates to waste management activities.

Thus, with the understanding that waste and its management strongly influences economic activity, consumption, resource conservation and environmental protection, all of which are firmly entrenched in sustainable development, this assessment seeks to provide an in-depth analysis of the current state of waste generation within Trinidad and Tobago and assess the level at which waste is being treated and disposed. With particular emphasis on the main factors affecting waste generation as well as the adverse effects of improperly treated waste on the country's ecosystems, the report also serves to provide recommendations through which sustainable waste management can be achieved within the country.

The following summarises the major objectives of the 2011 Assessment of the State of the Environment Report:

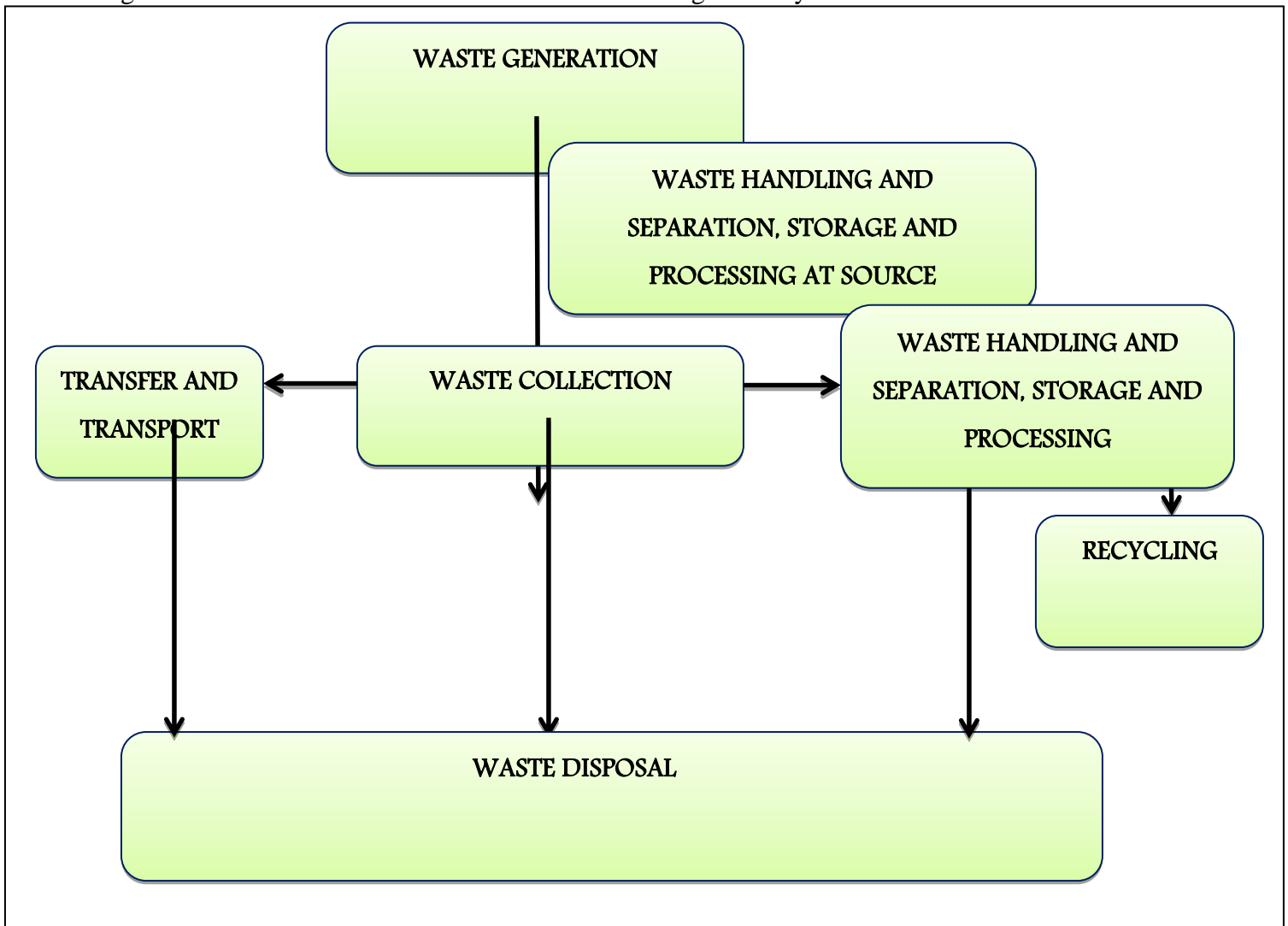
- ❖ To establish the current functional operational structure of the waste management sector.
- ❖ To determine existing waste conditions as it pertains to waste generation, collection, storage and disposal.
- ❖ To examine the main consequences of improper waste disposal and to provide recommendations aimed at promoting sustainable waste management within Trinidad and Tobago.

In order to achieve the above objectives, the report will focus on assessing several aspects of the waste management process as illustrated in Figure 1.

⁵ Binger, A. (2011). Economic Opportunities in Waste Management in Small Island Developing States (SIDS). *CSD Intercessional Conference on Building Partnerships for moving towards Zero Waste*. Tokyo.

⁶ Binger, A. (2011). Economic Opportunities in Waste Management in Small Island Developing States (SIDS). *CSD Intercessional Conference on Building Partnerships for moving towards Zero Waste*. Tokyo.

Figure 1: Functional Elements within the Waste Management System



Adapted from the Indian Institute of Science, Centre for Ecological Sciences, 2011

1.2 Context for Analysis

The following terms used throughout the report are defined as follows:

Competent Authority - The entity responsible for receiving and responding to notifications of transboundary movements of hazardous and other wastes. The Competent Authority in Trinidad and Tobago is the Environmental Management Authority (EMA).⁷

⁷ Environmental Management Authority. (n.d.). *Basil Convention: Public Guide for Transboundary Movements of Hazardous Waste*. Port of Spain

Landfarming - Also known as land treatment or land application, is an above-ground remediation technology for soils that reduces concentrations of petroleum constituents through biodegradation.⁸

Transboundary Movement - Any movement of hazardous waste or other waste from an area of national jurisdiction of one state to or through an area under the national jurisdiction of another state provided at least two states are involved in the movement.⁹

Waste - Any material discarded or intended to be discarded which: (1) constitutes garbage, refuse, sludge or other solid, liquid, semi-solid or gaseous material resulting from any residential, community, commercial, industrial, manufacturing, mining, petroleum or natural gas exploration, extraction or processing, agricultural, healthcare or scientific research activities; or (2) is otherwise identified by the Environmental Management Authority as waste under Section 55 of the Environmental Management Act, Chapter 35:05.¹⁰

Waste Generation – The amount (weight or volume) of waste originating from a given source(s) that enter into a waste stream before waste diversion takes place. The main sources considered in this study fall under the broad categories of (i) residential and (ii) institutional, commercial and industrial (ICI) sources.¹¹

Waste Disposal – The process of collecting and removing waste which is no longer of value to the owner and relocating to an official or unofficial dump site. The various waste disposal methods referred to in this report include composting, incineration, landfilling, illegal dumping and waste exportation.¹²

Waste Stream – The total flow of solid waste from homes, businesses, institutions and manufacturing plants that must be recycled, burned, or disposed of in landfills; or any segment thereof such as “residential waste stream” or “recyclable waste stream”.¹³

Waste Management – The management of all elements, resources and processes involved in the waste management process such that there is proper handling of waste at each step of the waste process, i.e. from waste collection to disposal, in accordance with specific laws and regulations.¹⁴

Waste Diversion – The process of diverting waste away from landfills through the prevention and/or reduction of waste via source reduction initiatives, recycling, reuse or composting.¹⁵

⁸ United States Environmental Protection Agency (US EPA). (1994). Landfarming

⁹ Environmental Management Authority. (n.d.). *Basil Convention: Public Guide for Transboundary Movements of Hazardous Waste*. Port of Spain

¹⁰ Government of Trinidad and Tobago. (2000) *Environmental Management Act*

¹¹ **Adapted from:** Columbia Analytical Services Inc. (2011). *Waste Generation Meaning*. Retrieved from ALS Environmental: http://www.caslab.com/Waste_Generation_Meaning

¹² **Adapted from:** The National University of Malaysia. (2011). *Solid Waste Disposal*. Retrieved from <http://www.ukm.my/ahmadukm/images/stories/data/kuliah/manusia/artikel/solid.html>

¹³ United States Environmental Protection Agency. (1995). *Decision Maker's Guide to Solid Waste Management: Volume II*. Municipal and Industrial Solid Waste Division

¹⁴ **Adapted from:** BusinessDictionary.com. (2011). *Definition of Waste Management*. Retrieved from BusinessDictionary.com: <http://www.businessdictionary.com/definition/waste-management.html>

¹⁵ **Adapted from:** United States Environmental Protection Agency. (2011). *Waste Diversion*. Retrieved from Greening EPA: <http://www.epa.gov/greeningepa/waste>

2.0 FACTORS AFFECTING WASTE GENERATION

The volume and type of solid and hazardous waste generated within the country are affected by a variety of socio-demographic and economic factors. Accelerated industrialisation, increased commercialism and increased residential development may be regarded as some of the factors which have directly influenced changes in waste generation rates and type within Trinidad and Tobago¹⁶. The following chapter serves to highlight some of the main factors affecting waste generation.

2.1 Socio-demographic Factors

2.1.1 Population Size and Urbanisation

Past research^{17,18,19} has shown that the amount of waste generated is proportional to population size whereby increased population growth usually results in a simultaneous increase in the amount of waste generated. Based on the Solid Waste Characterisation and Centroid Study (2010)²⁰ which was carried out for Trinidad, it was illustrated that most waste generation occurred in the densely populated areas located along the western side of the island. Such a relationship can be explained by the fact that as population increases so does consumption, therefore resulting in greater volumes of waste being produced.

Another key factor influencing waste generation is the level of urbanisation. According to UN-HABITAT (2010)²¹, 50% of the world's population had already been urbanised by 2010. Over the last 30 years, the largest share of urban growth was seen to occur in developing countries, with the expectation that by 2017, the developing world would have a larger proportion of urban population as compared to rural²². While the overall population within Trinidad and Tobago has been increasing, most of the growth in Trinidad has been concentrated in urban areas along the western coast of the country and at the foothills of the northern mountain range. Tobago's population on the other hand, has been concentrated in the south-western side of the island, with

¹⁶ Ministry of the Environment and Water Resources. (2011). The Environmental Policy and Planning Division.

¹⁷ Omolulu, O.O & Lawal, S.A. (n.d.). *Population Growth and Waste Management in an African City*. Retrieved June 06, 2011, from <http://bit.ly/1bVjtFu>

¹⁸ Memon, M. A. (2011, June 30). *Challenges and Opportunities in Waste Management*. Retrieved July 11, 2011, from United Nations Environment Programme, Division of Technology Industry and Economics, International Environmental Technology Centre: <http://www.unescap.org/apuf-5/bazaar/presentations/Bazaar1-and-2/5-SWM-ESCAP-DONE/SWM-UNEP-Mushtaq.pdf>.

¹⁹ Sivakumar, K., & Sugirtharan, M. (2010). Impact of family income and size on per capita solid waste generation: A case study in Manmunai North Divisional Secretariat Division of Batticaloa. *Journal of Science, University of Kelaniya*, 13-23.

²⁰ CBCL Limited. (2010). *Trinidad Solid Waste Management Program Waste Characterization and Centroid Study*. Ministry of Local Government.

²¹ UN UN HABITAT. (2010, March 18). *State of the World's Cities 2010/2011: Bridging the urban divide*. Nairobi.

²² Cohen, B. (2006). Urbanization in developing countries: Current trends, future projections and key challenges for sustainability. *Elsevier*.

southwest Tobago experiencing rapid growth and development in the tourism and related services sectors²³.

Cities have long been focal points for economic growth, innovation and employment and with such expansion and development comes increased waste generation. Capital cities in particular, like that of Port of Spain, are where the vast majority of production activities tend to be concentrated. Rapid urban development on a local scale has impeded the ability of urban areas to provide adequate services to citizens. However, despite this, city and municipal areas continue to attract new migrants thereby expanding the number of squatter settlements and so exacerbating the problem of urban congestion and sprawl. The latter further impedes the efforts of local authorities to deliver essential services inclusive of waste collection, especially in inaccessible and/or difficult areas.

Over the years, urban sprawl within Trinidad has tended to focus on the east-west corridor, stretching from Chaguaramas west of Port-of-Spain to Arima in the east²⁴. Such urban sprawl often includes settlements constructed in such a way that makes access by garbage trucks difficult. For example, several areas within the city of Port of Spain have been identified as being inaccessible or difficult areas to service by waste collection vehicles²⁵. These areas include the Belmont, St.Clair, Woodbrook, Cocorite and Sealots areas. As such, waste collection in such hard-to-serve urbanised areas tends to occur much less frequently, thus resulting in a build-up of waste in these communities which usually results in the dumping of waste by residents into empty lots, drains and alleys. To add to this issue, waste awaiting collection is often strewn by animals and humans or transported by wind and rain into nearby waterways. In this way, rivers and coastal waters become polluted by solid waste.

The differences in physical, social and economic infrastructure between rural and urban areas are easily discernible throughout the country. However, as cities grow and evolve, the task of managing them becomes increasingly complex. As a result, a large number of urban residents suffer to some extent from severe environmental health challenges associated with inadequate sewerage facilities and solid waste disposal mechanisms²⁶. Frequency and failure of garbage collection as well as inefficient waste management and recycling practices consequently results in cities being inundated in their own waste.

²³ Water Resources Agency. (2001). *National Report on Integrating the Management of Watersheds and Coastal Areas in Trinidad and Tobago*. Ministry of the Environment.

²⁴ Fritz, A. (2008). *Trincity Millenium Vision, Trinidad and Tobago*. 44th ISOCARP Congress.

²⁵ CBCL Limited. (2010). *Trinidad Solid Waste Management Program Waste Characterization and Centroid Study*. Ministry of Local Government.

²⁶ Water Resources Agency. (2001). *National Report on Integrating the Management of Watersheds and Coastal Areas in Trinidad and Tobago*. Ministry of the Environment.

2.1.2 Level of Income

In general, a positive correlation tends to exist between individuals' income and the amount of waste generated. Past studies^{27,28} have shown that higher income households/individuals consume more than lower-income ones, thus resulting in a higher waste generation rate for wealthier households. The same can be said for societies on a whole whereby richer societies are characterized by higher waste generation rates per capita whilst less affluent societies generate less waste and tend to practise informal recycling/re-use initiatives which aid in reducing the amount of waste per capita at a municipal level²⁹.

A difference in income levels also tends to affect the composition of wastes generated. For example, in the case of Trinidad, wealthier households are seen to generate higher proportions of organic and paper material as compared to lower income households which generate higher proportions of plastic and glass material³⁰.

2.1.3 Globalisation, Consumption Patterns and Lifestyles

Private consumption is shaped by an array of complex and interrelated factors, including demographics; income and prices; trade, globalisation and technologies; supply of goods and services and how they are marketed; information and transparency on products and services; policies; housing and infrastructure as well as social and psychological factors such as habits, culture and taste³¹. Globalisation has played an integral role in influencing consumption patterns and lifestyles through the creation of open markets. Society itself has also changed into one which is fast-paced and this has impacted on personal lifestyles as individuals have adapted through changes in consumption patterns which facilitate more 'on-the-go' convenience products, including increased fast food purchasing which can result in increased solid waste generation.

2.2 Economic Factors

2.2.1 Technological Advancements

Rapid developments in technology not only drive the demand for technology-based products but also increase the rate of obsolescence of existing technology. This results in an increase in the amount of waste generated especially with regard to e-waste. Data from the Central Statistical

²⁷ Sivakumar, K., & Sugirtharan, M. (2010). Impact of family income and size on per capita solid waste generation: A case study in Manmunai North Divisional Secretariat Division of Batticaloa. *Journal of Science, University of Kelaniya*, 13-23.

²⁸ Rafia Afroz, K. H. (2010). The Role of Socio-Economic Factors on Household Waste Generation: A Study in a Waste Management Program in Dhaka City, Bangladesh. *Research Journal of Applied Sciences*, 183-190.

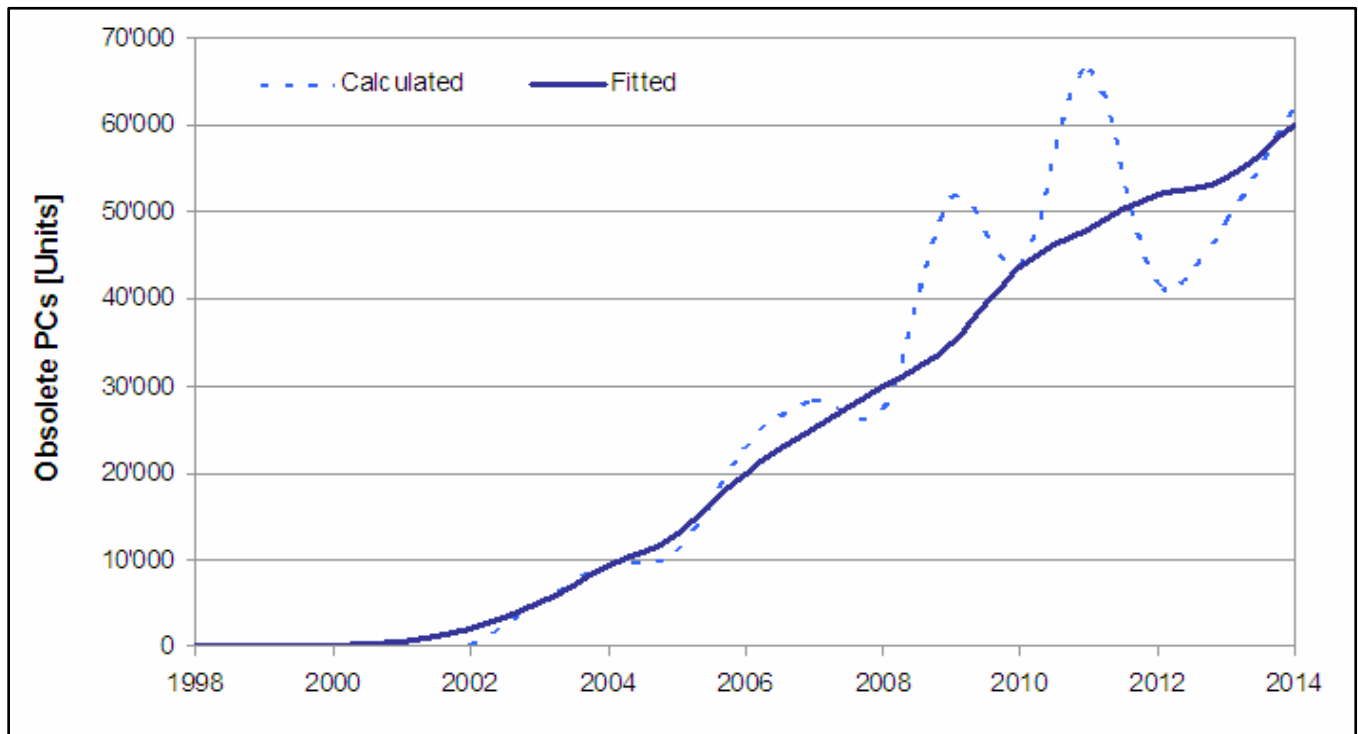
²⁹ Intergovernmental Panel on Climate Change (IPCC). (2007). *Status of the Waste Management Sector: Waste Generation*. Retrieved June 06, 2011, from http://www.ipcc.ch/publications_and_data/ar4/wg3/en/ch10s10-2.html.

³⁰ CBCL Limited. (2010). *Trinidad Solid Waste Management Program Waste Characterization and Centroid Study*. Ministry of Local Government.

³¹ Mont, O. & Power, K. (2010). The role of formal and informal forces in shaping consumption and implications for a sustainable society. *Sustainability 2 (5)*, 2232-2252.

Office (CSO)³² indicated an importation figure of 33,536 computer units for Trinidad and Tobago for the year 2008, excluding computers brought into the country by individuals during travel. In addition, World Bank figures also indicated that for the same year, a total of 238,500 computers were installed within the country³³. The consumption rate of new, updated technology (inclusive of computers) is expected to increase, bringing with it a simultaneous increase in the amount of obsolete equipment. Figure 2 illustrates the estimated and projected generation of obsolete computers within the country for the period 1996 - 2014.

Figure 2: Estimated and projected generation of obsolete computers (PCs per year) in Trinidad and Tobago, 1996 - 2014



Source: EMPA, 2010

From the figure above, an estimated 45,000 computers were calculated to be obsolete in 2010 with that figure expected to increase to 60,000 by 2014.

At present, there are very limited establishments or facilities in place to deal with the disposal of e-waste, leading to the majority of this type of waste being disposed of as part of the municipal

³² Central Statistical Office (CSO), Trade Section: Imports and Exports on Selected Items. (2008). Republic of Trinidad and Tobago.

³³ Egarr & Associates and EMPA. (2010). *E-waste Assessment in Trinidad and Tobago*. A situational analysis of e-waste management and generation with special emphasis on personal computers.

waste stream. As such, in most cases electrical appliances are illegally dumped at unofficial dump sites or within local waterways, so posing a risk to environmental and public health.

2.2.2 Economic Growth and Expansion

In general, the quantity of solid waste generated is known to increase with economic growth. In that, the higher the Gross Domestic Product (GDP) of a country, the greater the amount of waste generated per capita³⁴. This is so since a higher GDP usually means an improved standard of living, which generally results in increased demand and consumption of products. In Trinidad, industrial development, which is largely driven by the petrochemical sector, has resulted in the development and expansion of industrial estates within the country which has affected the amount of waste being generated, particularly that of hazardous waste. In Tobago, on the other hand, expansion in the tourism industry has led to increased urban development, including the construction of new hotels, which is likely to impact significantly on the rate of solid waste generation. As such, it is expected that as the local economy continues to grow and expand, so will the amount of waste generated.

On the social side, overall economic growth accompanied by increased levels of urbanisation and consumption not only results in increased waste generation but also leads to diversification of the waste stream. In particular, special waste types such as e-waste, hazardous waste and biomedical waste have emerged as growing challenges within the realm of waste management.

3.0 CHARACTERISATION OF THE WASTE MANAGEMENT SECTOR IN TRINIDAD AND TOBAGO

3.1 Waste Legislation and Policy Framework

Solid waste management was first recognised as a national issue in 1979 with the development of a Solid Waste Master Plan which gave rise to the establishment of the Trinidad and Tobago Solid Waste Management Company Limited (SWMCOL) in 1980. SWMCOL was mandated as the primary state agency with the specific responsibility to manage the collection, handling, treatment and disposal of solid waste in Trinidad and Tobago. The master plan allowed the country to move towards a more organised and sanitary manner of dealing with waste. In that, the practice of burning waste as well as open dumping was reduced considerably with the introduction of new engineering and management techniques. In addition, technological advancements became evident as significant improvements in collection systems allowed for the

³⁴ European Commission. (2010, July 08). *Breaking the link between economic growth and waste generation*. Retrieved June 07, 2011, from Science for Environment Policy: <http://ec.europa.eu/environment/integration/research/newsalert/pdf/203na2.pdf>.

efficient transport of larger volumes of waste to disposal sites³⁵. In 1983, SWMCOL was given responsibility for the three major landfill sites in Trinidad which consisted of the Beetham Landfill located in the north, the Forres Park Landfill located in the south and the Guanapo Landfill located in the east. All other smaller regional sites continued to be managed by local government bodies.

At present, there exist several pieces of legislation governing the management of waste in Trinidad and Tobago. As a result, the implementation and enforcement of waste legislation has become fragmented across different ministries, statutory bodies and agencies, within which the respective legislation falls under. Table 1 below outlines the varying legislation, policies, plans, programmes and projects relevant to waste management in Trinidad and Tobago as well as the responsible entities for each.

³⁵ Pan American Health Organization (PAHO). (2003). *Regional Evaluation Municipal Solid Waste Management Services*. Country Analytical Report Trinidad and Tobago - Evaluation 2002.

Table 1: Legislation, Policies, Plans, Programmes and Projects related to Waste Management in Trinidad and Tobago

| LEGISLATION, POLICIES, PLANS, PROGRAMMES AND PROJECTS | SYNOPSIS | RESPONSIBLE ENTITY |
|--|---|---------------------------|
| The Environmental Management Act, Chapter 35:05 | Provides a legal regime for the proper management of solid and hazardous waste and handling of hazardous substances. | EMA |
| Certificate of Environmental Clearance Rules, 2001 | Defines the process for the application of a CEC for activities requiring one as outlined in the CEC (Designated Activities) Order (as amended). The CEC Rules stipulate that the quantity and destination of any waste that may be generated from a respective activity must be accounted and appropriately accommodated for. | EMA |
| National Environmental Policy (2006) | Makes provisions for waste management which is to be based on the principles of reduction, reuse and recycling. It also highlights the Government's commitment to addressing hazardous waste by enabling the necessary legislation to give effect to the Basel Convention and, inter alia, establishing requirements for handling and disposal and establishment of standards and design criteria for hazardous waste handling and disposal facilities. | EMA |

| LEGISLATION, POLICIES, PLANS, PROGRAMMES AND PROJECTS | SYNOPSIS | RESPONSIBLE ENTITY |
|--|--|--|
| Public Health Ordinance Chapter 12 No.4 (amended, 1976) | Addresses the effects of waste activities on human health. Control is placed mainly over domestic waste. | Ministry of Health |
| Pesticides and Toxic Chemicals Control Act, Chapter 30:03 | Regulates the importation, storage, manufacture, packaging, sale, use, transportation and disposal of pesticides and toxic chemicals. | Pesticides and Toxic Chemicals Control Board |
| The Town and Country Planning Act, Chapter 35:01 | Provides for the orderly and progressive development of land in both urban and rural areas, inclusive of permission for developers of industrial undertakings to provide for the deposit of waste material. | Town and Country Planning Division |
| Municipal Corporations Act, Chapter 25:04 | Assigns responsibility of municipal waste to corporations. Under this act corporations have the responsibility for the disposal of garbage, the development and maintenance of sanitary landfills and the abatement of public nuisances. | Municipal Corporations |
| Litter Act, Chapter 30:52 | Deals with the littering of public places and premises, including water courses and drains. | Local Authority |

| LEGISLATION, POLICIES, PLANS, PROGRAMMES AND PROJECTS | SYNOPSIS | RESPONSIBLE ENTITY |
|--|--|--|
| Trade Ordinance No.19 of 1958 | Provides legal authority to ban importation of waste materials | Ministry of Trade |
| Minerals Act, Chapter 61:03 | Provides for precautionary action during drilling, production, storage and pumping operations so as to prevent the pollution of watercourses, foreshore and sea by oil/fluid/substance. | Ministry of Energy and Energy Industries |
| Petroleum Regulations | Requires a licensee to take all reasonable precautions and safety measures to prevent waste from petroleum or other material generated during the course of operations. | Ministry of Energy and Energy Industries |
| Water and Sewerage Act, Chapter 54:40 | Provides for the development and control of water supply, promotion of conservation and proper use of water resources and powers to make by-laws to prevent pollution of surface and ground water. | Water and Sewerage Authority (WASA) |

| LEGISLATION, POLICIES, PLANS, PROGRAMMES AND PROJECTS | SYNOPSIS | RESPONSIBLE ENTITY |
|--|--|---|
| Summary Offences Act, Chapter 11:02 | Addresses the pollution of rivers, streams and ponds flowing through state or private lands. | Commissioner of Police |
| Draft Waste Management Rules (2008) | Prepared in 2008 pursuant to Section 26 of the Environmental Management Act to regulate waste in Trinidad and Tobago. The rules make provision for the storage and disposal of hazardous waste and the regulation of landfill sites and incinerators through a permitting process. | EMA |
| Draft Beverage Container Bill, 1999 (amended, 2011) | Makes provisions for the reuse, recycling and subsequent reduction in disposal of beverage containers into the environment, through the establishment of a deposit-refund system, where upon payment of a deposit on prescribed classes of beverage containers, the return of such containers after use results in refund of the deposit. The bill also incorporates other administrative and fiscal measures to encourage the reuse and recycling of beverage containers. | Ministry of the Environment and Water Resources |

| LEGISLATION, POLICIES, PLANS, PROGRAMMES AND PROJECTS | SYNOPSIS | RESPONSIBLE ENTITY |
|--|--|------------------------------|
| Draft Municipal Solid Waste Management Policy (2008) | Provides the necessary framework for developing and implementing a sustainable solid waste management system. The policy advocates increased private sector involvement and outlines the procedure for identifying, collecting, contracting, monitoring and evaluating private service providers in solid waste management. | Ministry of Local Government |
| The Code of Practice for Biomedical Waste Management in Trinidad and Tobago (2005) | This document was prepared by the Pan American Health Organization in collaboration with the World Health organization and adopted by the Government of Trinidad and Tobago in 2005. The Code provides for the disposal of bio-medical waste in an environmentally sound manner through the review and development of existing disposal techniques. It also encourages the continual improvement and application of existing procedures and guidelines to be implemented alongside the Code. | Ministry of Health |

| LEGISLATION, POLICIES, PLANS, PROGRAMMES AND PROJECTS | SYNOPSIS | RESPONSIBLE ENTITY |
|---|---|---------------------------|
| Infection Prevention and Control (IPC) Policies and Guidelines for Health Care Services (Revised June 2011) | The primary objective of the infection prevention and control policy is to prevent the spread of infection in health care facilities and settings. This manual therefore, inter alia, outlines standard precautions for safe waste disposal and environment control. Section IX of the manual also specifically addresses waste management within health care facilities. | Ministry of Health |

3.2 International Initiatives

Trinidad and Tobago has acceded to several international protocols and conventions as it regards waste *management*. Table 2 describes these conventions and summarizes the obligations Trinidad and Tobago has made in acceding to them.

Table 2: International protocols Trinidad and Tobago has acceded to that regards waste management

| Convention | Description | Year Acceded | Summary Description of Commitments made by Trinidad and Tobago |
|--|--|--------------|---|
| Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and Disposal | Addresses the transboundary movement of hazardous wastes between nations as well as its disposal. The convention is focused on reducing hazardous waste generation whilst simultaneously promoting the environmentally sound management of hazardous wastes; restricting the transboundary movement of hazardous waste with the exception of cases where environmentally sound management is employed and ensuring that a regulatory system exists in cases where transboundary movements are permissible. | 1994 | <ol style="list-style-type: none"> 1. Should not permit the export of hazardous waste for disposal within the area of 60°S latitude or any waste to developing countries if there is reason to believe that it will not be managed in an environmentally responsible manner; 2. Prohibit the importation/exportation of waste from/to non-member parties unless waste is subject to another convention that does not detract from the Basel Convention; 3. Honour the importation bans of other countries, consider illegal trafficking of waste to be illegal and take appropriate measures to ensure that this convention is not circumvented; 4. Ensure that transboundary movement of waste is conducted in a safe, transparent and responsible manner; 5. Cooperate in activities with other parties and interested organizations in order to improve responsible management of hazardous waste and prevent illegal trafficking; 6. Review periodically the possibility of the reduction of the amount and/or pollution potential of waste exported to other states. |

| Convention | Description | Year Acceded | Summary Description of Obligations of Trinidad and Tobago |
|--|--|-----------------|--|
| Framework Agreement with the Basel Convention Secretariat | Enactment of legislation facilitating the establishment of the Caribbean Basel Regional Centre for Technology Transfer and Training. This centre comprises a critical part of the institutional framework of the Basel Convention | 2004 | 1. Permit the physical and legal establishment of a Basel Convention Regional Centre for Training and Technology Transfer for the Caribbean Region (BCRC – Trinidad and Tobago) in Trinidad and Tobago as an autonomous institution with its own legal personality. |
| Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade | Addresses the importation of hazardous chemicals. This convention compliments other international agreements such as the Strategic Approach to International Chemicals Management (SAICM) grant which is geared towards using Trinidad and Tobago as a pilot country to design model legislation aimed at strengthening the legislative, regulatory and enforcement capability of Trinidad and Tobago to ensure compliance with other international conventions and obligations. | 2009 | <ol style="list-style-type: none"> 1. Use proper labelling, include directions on safe handling, and inform purchasers of any known restrictions or bans when exporting hazardous chemicals; 2. Take appropriate steps to ensure that chemical producers within Trinidad and Tobago honour importation bans set by other countries; 3. Adopt national legislation and strengthen infrastructure to support the implementation of this convention; 4. Facilitate the exchange of information among parties and to the public of Trinidad and Tobago concerning chemicals listed in the convention; 5. Ban the import of chemicals in this convention as the GoTT sees fit. |

| Convention | Description | Year Acceded | Summary Description of Obligations of Trinidad and Tobago |
|-------------------------|--|-----------------|---|
| Marpol Convention | Addresses pollution originating from ships by ensuring the safe shipping of oils, chemicals and harmful substances transported in bulk or packaged form. The convention also makes provisions for the prevention of discharge of ballast water, wastewater and waste. | 2003 | <ol style="list-style-type: none"> 1. Provide facilities at ports and terminals to for the reception of garbage without causing undue delay of ships and according to the needs of the ships using them; 2. Ensure that foreign merchant ships visiting the country's ports comply with standards laid out in relevant conventions through document and ship inspection; 3. Ensure that vessels with Trinidad and Tobago as its listed Flag State certify the ship's compliance with MARPOL's pollution prevention standards. |
| Stockholm Convention | Aimed at eliminating and/or restricting the production and use of persistent organic pollutants (POPs) which can persist in the environment for long periods of time, become widely distributed geographically and bio-accumulate in human and wildlife. The convention therefore encourages parties to manage and dispose of POPs in an environmentally sound manner. | 2002 | <ol style="list-style-type: none"> 1. Develop and implement a national action plan to evaluate current and projected releases (including development and maintenance of inventories of existing stocks of POPs and unintentional POPs sources and loads), minimize/eliminate POP releases from stockpiles and wastes, and conduct additional research; 2. Take necessary legal measures to prohibit the import of chemicals listed in Annex A for which Trinidad and Tobago has not listed an exemption; 3. Facilitate and undertake the exchange of information relevant to the reduction and elimination of POPs as well as the cost and use of alternatives to POPs; 4. Promote awareness and education on POPs and its associated issues to the public and policy makers. |

| Convention | Description | Year Acceded | Summary Description of Obligations of Trinidad and Tobago |
|---|---|-----------------|---|
| Memorandum of Understanding (MoU) with the Province of Nova Scotia; Implementation Agreement with the Province of Nova Scotia and Nova Scotia Environment | Advocates a series of co-operative ventures between the Government of Nova Scotia and the Government of the Republic of Trinidad and Tobago (GoRTT). The MoU serves to assist the GoRTT with the development and enforcement of an Integrated Solid Waste/Resource Management System. | 1996; 2008 | 1. Through various state agencies (Ministry of the Environment and Water Resources, SWMCOL, the EMA and other relevant agencies) partner with the province of Nova Scotia and Nova Scotia Environment to perform a solid waste management gap analysis, develop a work plan, and implement a work plan (including the establishment of a material recovery facility). |

3.3 Organisation of Waste Management Responsibilities within the Government

The country's public landfill sites (REF. Section 4.6.1) are currently managed by SWMCOL while Municipal Borough and City Corporations retain the responsibility of collecting wastes within each of their individual municipalities. The Ministry of Local Government (MOLG) being the central coordinating agency for the 14 municipal corporations in Trinidad is therefore in charge of the collection and disposal of solid waste. The 14 municipal corporations in Trinidad are divided as follows:

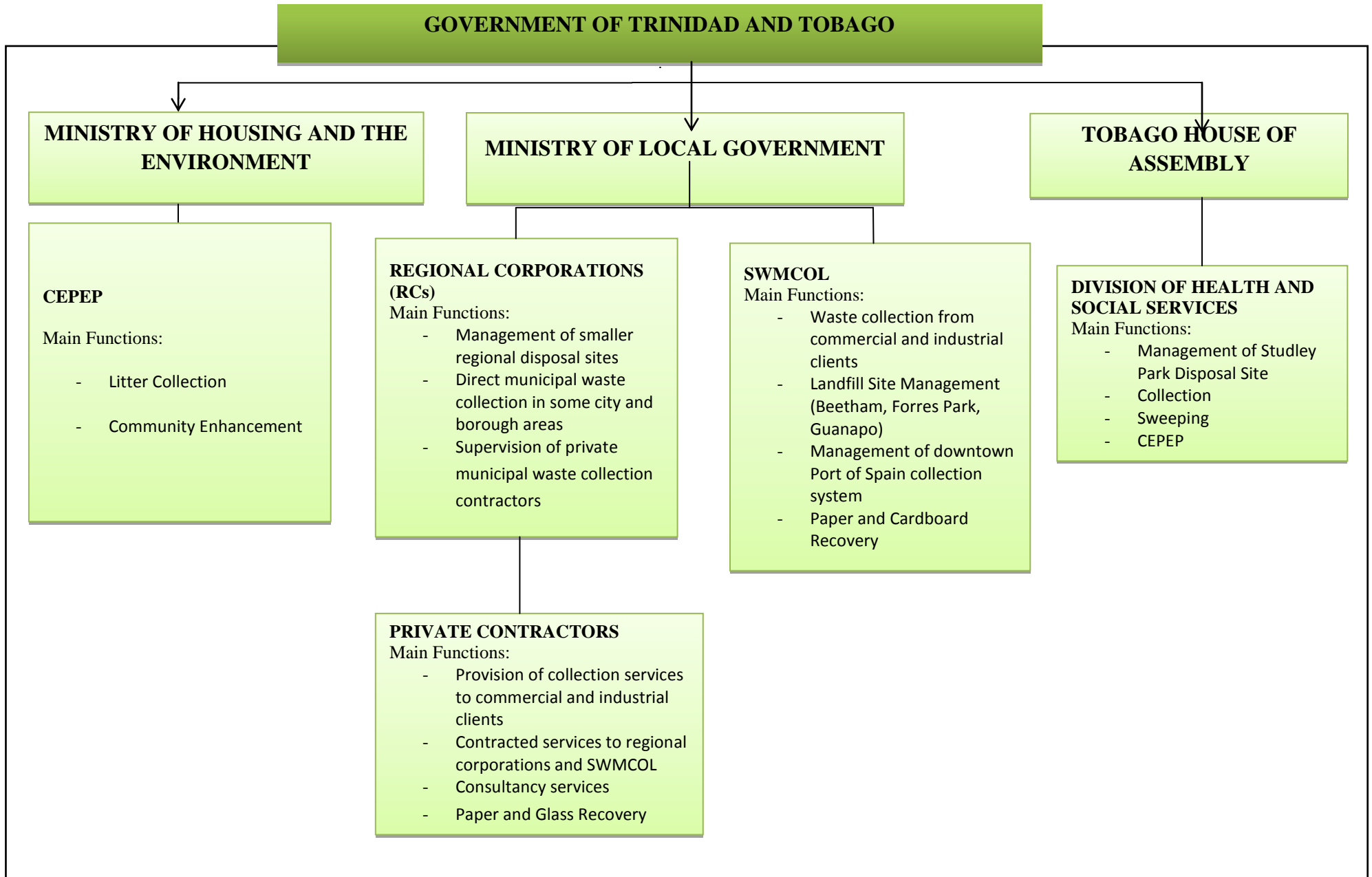
- Two City Corporations: Port of Spain and San Fernando
- Three Borough Corporations: Arima, Point Fortin and Chaguanas
- Nine Regional Corporations: Couva/Tabaquite/Talparo, Diego Martin, Mayaro/Rio Claro, Penal/Debe, Princes Town, San Juan/Laventille, Sangre Grande, Siparia and Tunapuna/Piarco.

In Tobago, the Tobago House of Assembly (THA) (which reports directly to the Central Government in Trinidad) is responsible for solid waste collection and disposal on the island. Studley Park is the only landfill site in Tobago.

The administrative framework for waste management in Trinidad and Tobago lies within three ministries i.e. Ministry of Local Government, Ministry of Public Utilities and Ministry of the Environment and Water Resources; one state limited liability company – SWMCOL; one statutory authority - the Environmental Management Authority (EMA) and the THA. As a result, due to the myriad of ministries involved in waste management within the country, there usually exists an unclear distinction as it regards waste management responsibilities. However, in an effort to close this gap across the different ministries, the EMA has signed Memoranda of Understanding (MoU) with various agencies, institutions and companies in order to ensure greater collaboration and cooperation in the area of waste and environmental management.

Figure 3 illustrates how responsibilities for solid waste management are delegated within the country.

Figure 3: Institutional Arrangement for Solid Waste Management in Trinidad and Tobago



Adapted from Pan American Health Organization, 2003

Like solid waste, the management of hazardous waste within Trinidad and Tobago is also fragmented across several different institutions and dispersed over multiple legal instruments. According to Sections 56-61 of the Environmental Management Act (2000), the EMA is mandated to provide national definitions of hazardous wastes, establish requirements for the handling and disposal of hazardous waste, establish appropriate standards and design criteria for handling and disposal facilities and establish licensing and permitting requirements as it relates to this type of waste. Thus, in order to fulfil this mandate, the EMA drafted the Waste Management Rules in 2008. However, these rules are yet to be finalised and enacted. In addition, since no sole unit or agency is charged with or has absorbed the responsibility for hazardous waste management within the country, few options have been developed to strategically deal with this issue³⁶.

³⁶ Basel Convention Regional Centre for Training and Technology Transfer for the Caribbean Region. (n.d.). *Hazardous Waste Management in Trinidad and Tobago*.

4.0 CURRENT WASTE CONDITIONS: STATUS AND TRENDS

4.1 Hazardous Waste

4.1.1 Definition

Hazardous waste may be defined as waste or combination of wastes, which because of its concentration, quantity or physical, chemical or infectious distinctiveness may inter alia (a) cause or significantly contribute to any increase in mortality or increase in serious irreversible or incapacitating illness; or (b) pose a substantial present or potential threat to human health, or the environment when improperly treated, stored, transported or disposed of, or otherwise managed³⁷. The hazards posed by these wastes result from both intrinsic properties of individual hazardous substances constituting the waste as well as extrinsic circumstances of exposure. As such, the effects of hazardous waste on both the environment and public health are dependent on the concentrations, exposure level and ambient conditions at which they exist.

4.1.2 Composition

The following section highlights the main types and sources of hazardous waste within Trinidad and Tobago:

➤ Petroleum-based Wastes

In a country like Trinidad and Tobago, which has experienced rapid industrialisation over the years and which is highly dependent on the oil and gas industry, petroleum-based waste emerges as a significant issue. This type of waste presents the country with two distinct types of pollution problems. The first being the historical issue of land and water contamination emanating from production and refinery operations and the second being the management of wastes generated from the use of petroleum products which are not suitably transported, recovered, treated or disposed of. The four main sources of petroleum-based waste are as follows:

- 1) Waste generated from oil and gas exploration and drilling activities, inclusive of offshore drilling operations and spills.
- 2) Waste produced as a result of the refining of crude oil and gas in order to obtain lubricants, fuel and natural gas.
- 3) Used lubricants inclusive of industrial lubricants, cutting oils and vehicular lubricating oils.
- 4) Marine and ship-generated oily wastes.

Table 3 summarises the different categories of petroleum-based waste as well as the contaminants associated with each.

³⁷ Environmental Management Authority. (1999). *State of the Environment Report- The Institutional and Legislative Landscape for Protection of the Environment in Trinidad and Tobago*.

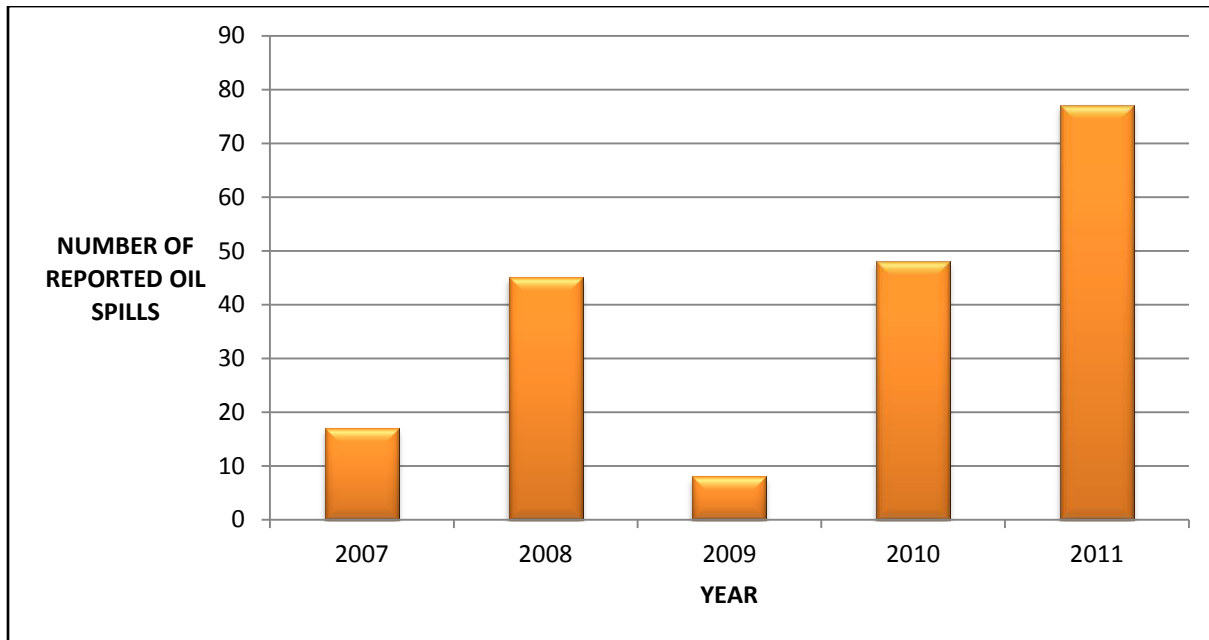
Table 3: Categories of petroleum-based waste and associated contaminants

| WASTE CATEGORY | CONTAMINANTS |
|---|--|
| Crude oil exploration and drilling, spills, sludges | Produced water, dirt, emulsifiers |
| Refinery Operations | Heavy metals 100ppm and Volatile Organic Compounds (VOCs)/ contaminated water |
| Waste lubricating oils | Metals, heavy metals, contaminated water, dirt, solvents, polycyclic aromatic hydrocarbons (PAHs) |
| Marine and ship-generated oils <ul style="list-style-type: none"> - Ballast - Bilge - sludge | <ul style="list-style-type: none"> - Ballast Water, pathogens - Oily Water, solvents - Wastewater, metals |

Source: Fleet and Associates, 1996

Figure 4 shows the number of reported oil spills in Trinidad and Tobago for the period 2007-2011. It should be noted that these are reported spills and should so be considered the minimum number of spills in any year, since it is possible that some spills may go unreported. Furthermore, figure 4 does not quantify the magnitude of the spills reported so assumptions on environmental impact based purely on the spill count should not be made.

Figure 4: Reported oil spills in Trinidad and Tobago, 2007-2011



Source: The Environmental Management Authority, 2011

It is evident that over the five year period, there was a general increase in the number or reported oil spills (with the exception of 2009), with the highest number of 77 spills being recorded in 2011. Some of these spills have also been recorded as affecting surface water systems, so resulting in algal and fish kills.

➤ **Exploration and Drilling**

According to a study carried out by Fleet and Associates (1996), it was found that waste generated as a result of oil exploration and drilling consisted mainly of oily water with small quantities of sludge. In an attempt to reduce the discharge of oil into the ocean and onshore, some industries have installed oily water treatment systems onto offshore platforms. However, oily sludge is produced as a result of this treatment process and this is usually deposited in landfills located close to drilling activities. In addition, disposal issues related to oily water runoff at drilling well sites and throughout the recovery process also poses a major pollution challenge. All water separation/treatment processes produce oily sludges, some of which contain high concentrations of heavy metals. However, though these are hazardous to the environment and public health, they continue to be disposed of in an unsuitable manner.

Oil Refining

Refinery processes bleed off waters and tank sludges which often contain catalysts and lead compounds, thus rendering this type of waste as being particularly hazardous. These wastes also contain many toxic VOCs such as benzene and phenols.

Lubricating Oils

Based on a study conducted by Fleet and Associates (1996), it was estimated that Trinidad and Tobago has an annual consumption of 3.8 million gallons of lubricating oils. However, it is likely that this figure has increased, given the rise in importation of cars which has occurred over the years. As such, there is a substantial volume of lubricating oils being discarded annually within the country. The report also stated that this waste is disposed off in sewers, waterways and on land, causing significant pollution problems due to the high levels of metals and solvents which are often mixed with these oils.

➤ **Maritime and Ship-Generated Oily Wastes**

At present, there are several collection agencies involved in the removal of oily waste from vessels, with no single agency monitoring the system. In addition, the captains of ships are often reluctant to admit that their vessels contain wastes for discharge since this would mean scrutiny of the Oil Record Book (which logs all oil movements) by local officials. It is also common practice for ports and marine yards to refuse to accept oily waste, so the ultimate fate of such wastes is unclear.

In addition to oily waste, marinas also receive other categories of hazardous waste including paint waste and solvent cleaning waste. Varying levels of activity can result in the generation of oily wastes from a maximum of 20,000 tonnes to an average of 7,500 - 10,000 tonnes annually³⁸. In addition, smaller yacht marinas are also known to receive waste such as used lubricating oil as well as substantial amounts of sewage and garbage discharged by smaller ships.

➤ Other Hazardous Wastes

- Pesticides: waste is generated through both the manufacture and use of pesticides.
- Food and Beverage Industry Wastes: The majority of local distilleries and breweries generate effluents containing high levels of pollutants such as high Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) levels, oils, grease and suspended solids.
- Agricultural Waste: waste is generated mainly through the use of chemicals and fertilisers which easily leach into rivers and watercourses.
- Household Hazardous Waste: this comprises the discarded, unused or leftover portions of household products that contain toxic chemicals e.g. household cleaners, batteries, solvents, paints, etc.

4.1.3 Overall Hazardous Waste Generation within Trinidad and Tobago, 2003-2008

In order to fulfil its national obligations under the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, the Government of the Republic of Trinidad and Tobago has undertaken national inventories of hazardous wastes, with the most recent of these being conducted for the years 2003 and for the period 2004-2008. The 2003 Hazardous Waste Inventory for Trinidad and Tobago was undertaken by the Caribbean Environmental Health Institute (CEHI) on behalf of the Ministry of Public Utilities and the Environment.

The 2004-2008 National Hazardous Waste Inventory was built on the findings of the 2003 inventory and was also undertaken by CEHI on behalf of the GoRTT through the Ministry of Planning, Housing and the Environment. The contracting agency for the project was the EMA. A total of 851 organisations participated in the inventory with 669 from Trinidad and 182 from Tobago. However, of this 851, due to the fact that certain organisations had multiple locations, the final number of entities participating in the survey amounted to 898, with 714 being from Trinidad and 184 from Tobago.

Of the 898 entities surveyed for the inventory period 2004-2008, 54.68% in 2004, 55.01% in 2005, 56.68% in 2006, 66.15% in 2007 and 76.95% in 2008 reported hazardous waste amounts.

³⁸ The Trinidad and Tobago Solid Waste Management Company Limited (SWMCOL). (2000). *Solid and Hazardous Waste Management Programme for Trinidad and Tobago*.

Furthermore, entities in Trinidad accounted for approximately 79.12% – 79.82% of the total amount of hazardous waste generators recorded in both Trinidad and Tobago. On the other hand, generators in Tobago only accounted for 19.35% - 20.88% of the total number for the inventory period.

Table 4 summarises the amount of hazardous waste generated within Trinidad and Tobago for the period 2004-2008.

Table 4: Summary of hazardous waste generation in Trinidad & Tobago, 2004 – 2008

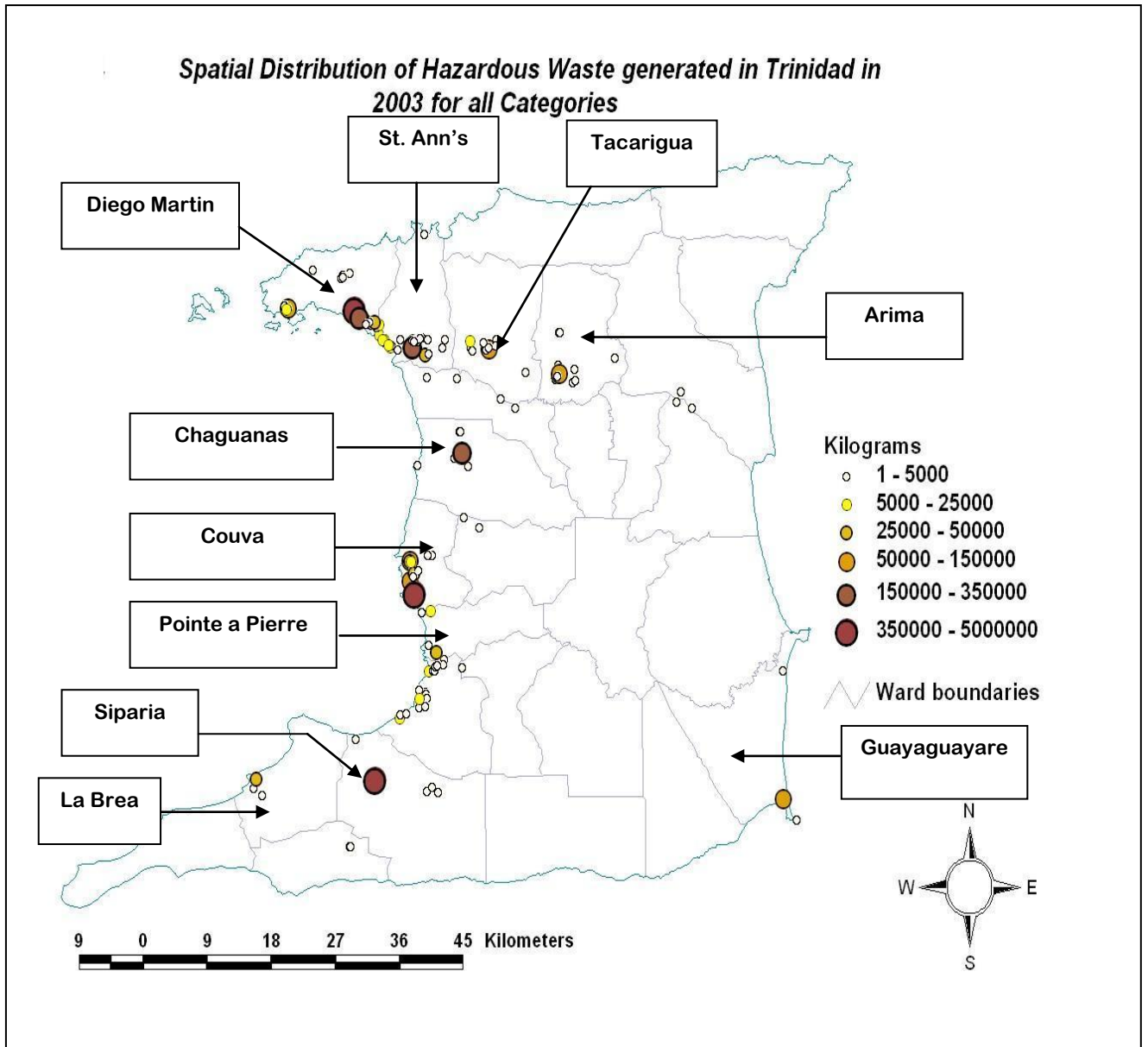
| Year | Tobago | | | Trinidad | | | Total | |
|--------------|--------------|-----------------|--------------|--------------|------------------|--------------|--------------|------------------|
| | No. Entities | Amount (tonnes) | % | No. Entities | Amount (tonnes) | % | No. Entities | Amount (tonnes) |
| 2004 | 95 | 3,896.1 | 12.52 | 396 | 27,215.4 | 87.48 | 491 | 31,111.6 |
| 2005 | 102 | 4,316.6 | 13.55 | 392 | 27,552.9 | 86.45 | 494 | 31,869.5 |
| 2006 | 105 | 4,350.0 | 13.78 | 404 | 27,215.6 | 86.22 | 509 | 31,565.7 |
| 2007 | 124 | 4,609.6 | 12.97 | 470 | 30,932.9 | 87.03 | 594 | 35,542.5 |
| 2008 | 134 | 5,479.0 | 13.08 | 557 | 36,409.7 | 86.92 | 691 | 41,888.8 |
| Total | | 22,651.4 | 13.17 | | 149,326.6 | 86.83 | | 171,977.9 |

Source: Caribbean Environmental Health Institute, 2009

In total, an estimated 171,977.9 metric tonnes of hazardous waste was reported as being generated within Trinidad and Tobago, with Trinidad reporting 149,326.6 metric tonnes (86.83%) of the total amount of hazardous waste for the five year inventory period while Tobago only accounted for 22,651.4 tonnes (13.17%). The disparity in the amount of hazardous waste generated between the two islands were attributed to: (i) a smaller number of entities existing in Tobago further resulting in a smaller number reporting and (ii) the difference in economic activities on both islands with Trinidad's economy being largely dependent on the energy, petrochemical, chemical and manufacturing industry and Tobago having a strong tourism and related services sector base. Both islands reported their largest amounts of hazardous waste in the year 2008 which contributed 24.36% to the total recorded for the five years investigated.

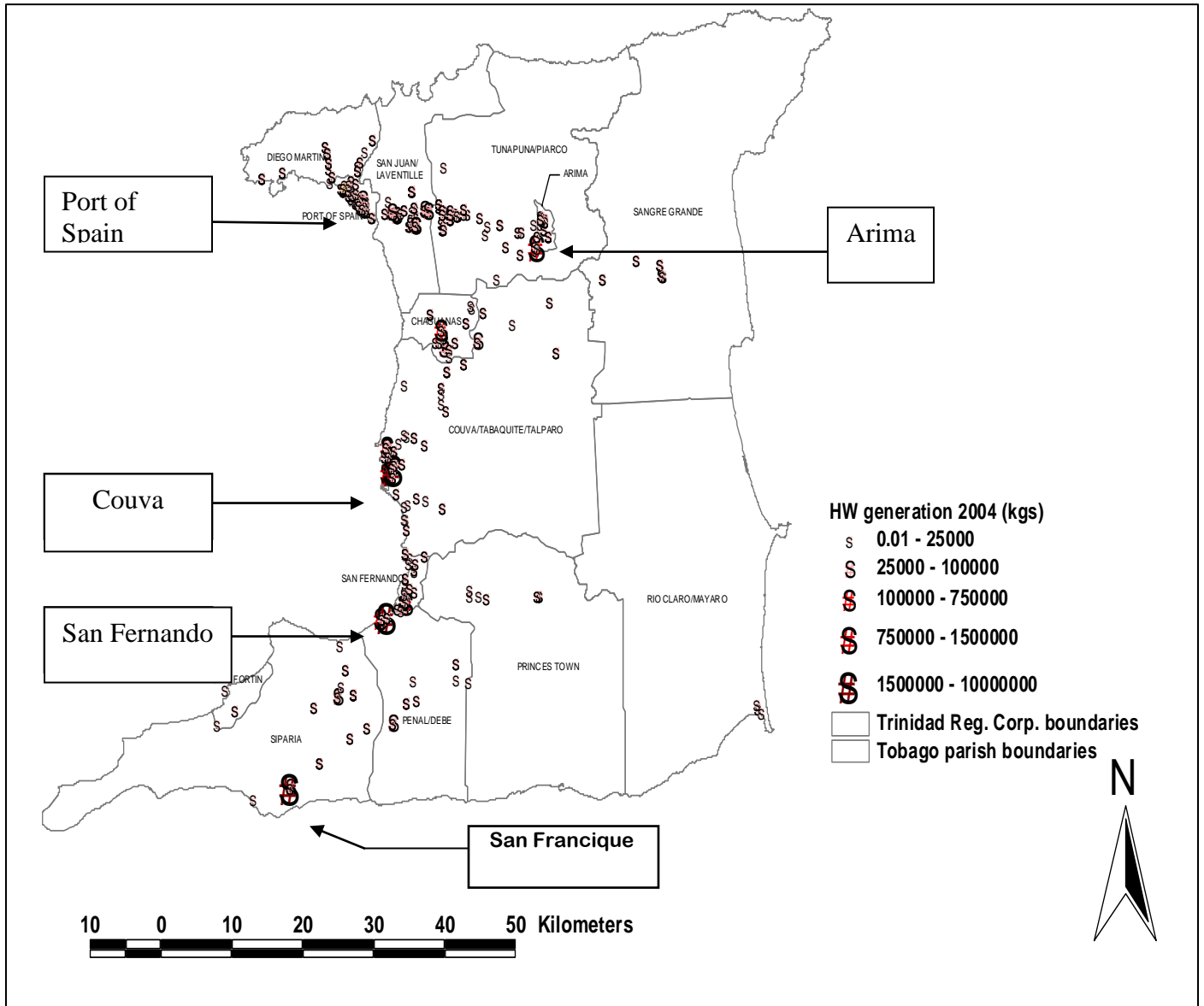
Figures 5, 6 and 7 illustrate the spatial distribution of hazardous waste generated in Trinidad for the years 2003, 2004 and 2008 respectively.

Figure 5: Spatial distribution of all reported hazardous waste generated in Trinidad in 2003



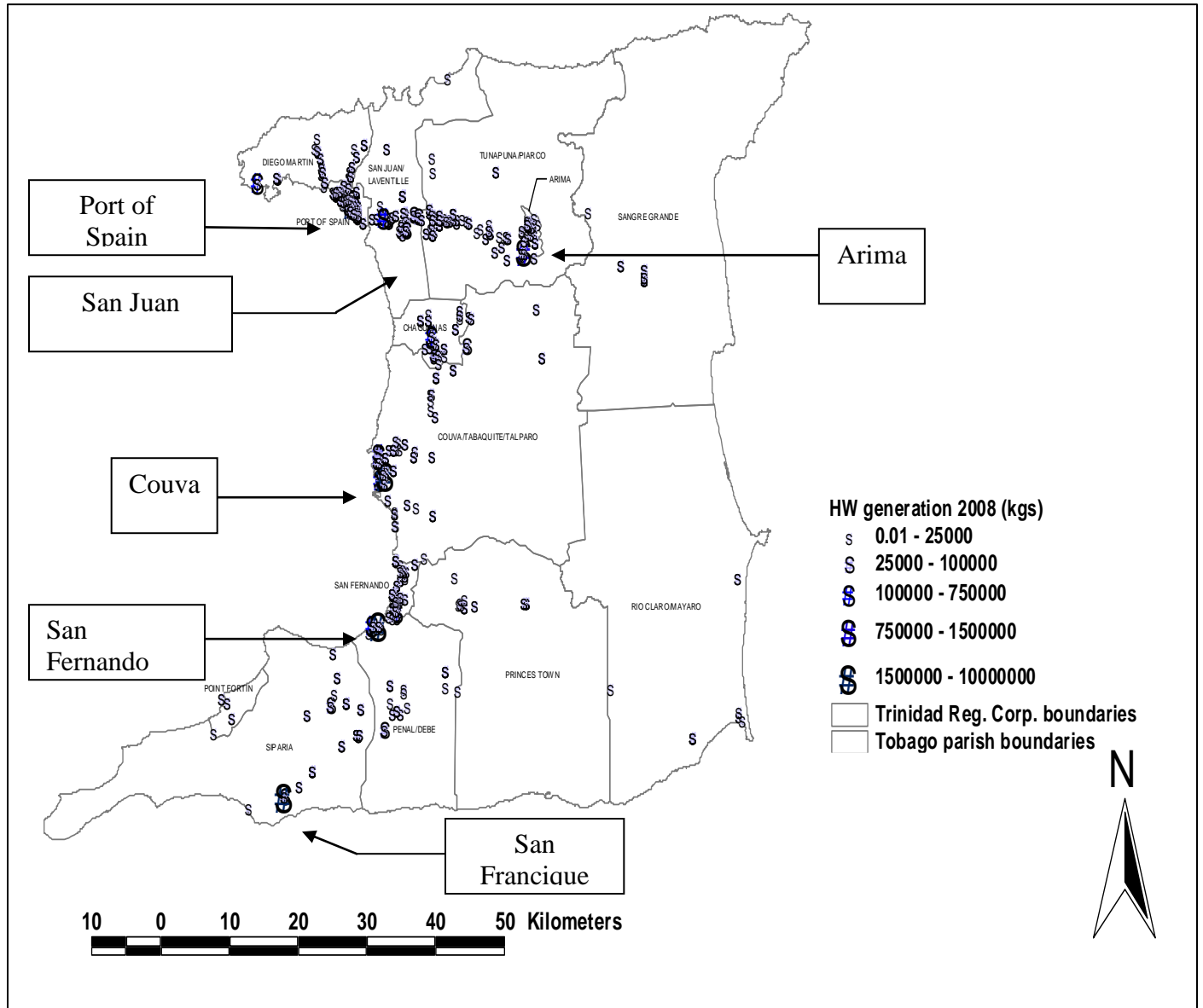
Source: Caribbean Environmental Health Institute, 2006

Figure 6: Spatial distribution of all reported hazardous waste generated in Trinidad, 2004



Source: Caribbean Environmental Health Institute, 2009

Figure 7: Spatial distribution of all reported hazardous waste generated in Trinidad, 2008

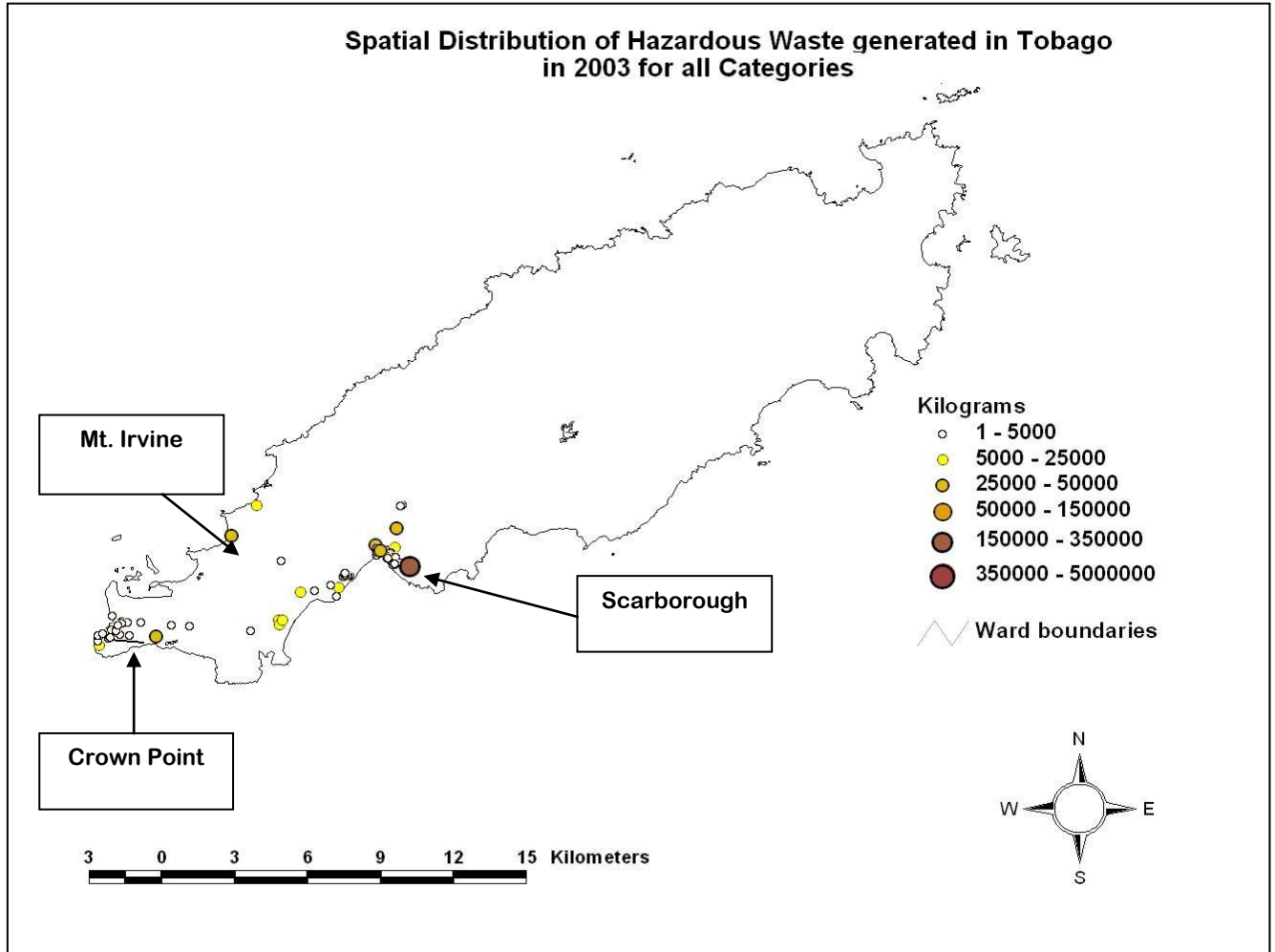


Source: Caribbean Environmental Health Institute, 2009

It is apparent that between 2003 and 2004, there was a significant increase in the amount of hazardous waste generated within Trinidad. Similarly, the spatial distribution of hazardous waste was also seen to increase from 2004 to 2008. As illustrated in figure 5, the areas highlighted in Trinidad as areas of high waste generation based on the 2003 inventory included Penal, Pointe a Pierre, Point Lisas and Port of Spain. On the other hand, based on figures 6 and 7 it was seen that the primary generating areas in Trinidad for the period 2004-2008 originated mainly from three regional corporations, namely the Couva/Tabaquite/Talparo Regional Corporation, the Siparia Regional Corporation and the Penal/Debe Regional Corporation with particular reference to the La Romain Area.

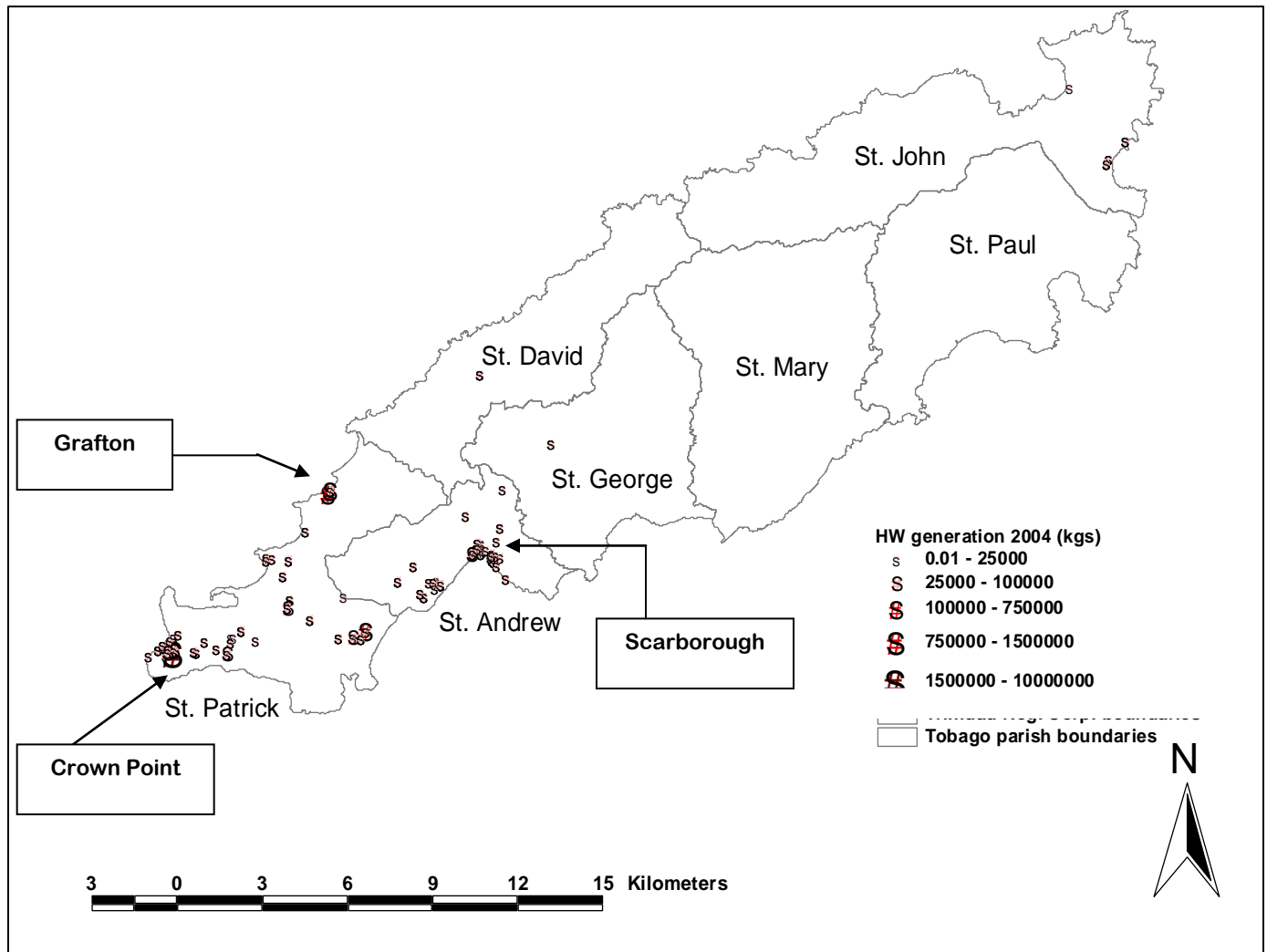
Figures 8, 9 and 10 illustrate the spatial distribution of hazardous waste generated in Tobago for the years 2003, 2004 and 2008 respectively.

Figure 8: Spatial distribution of all reported hazardous waste generated in Tobago, 2003



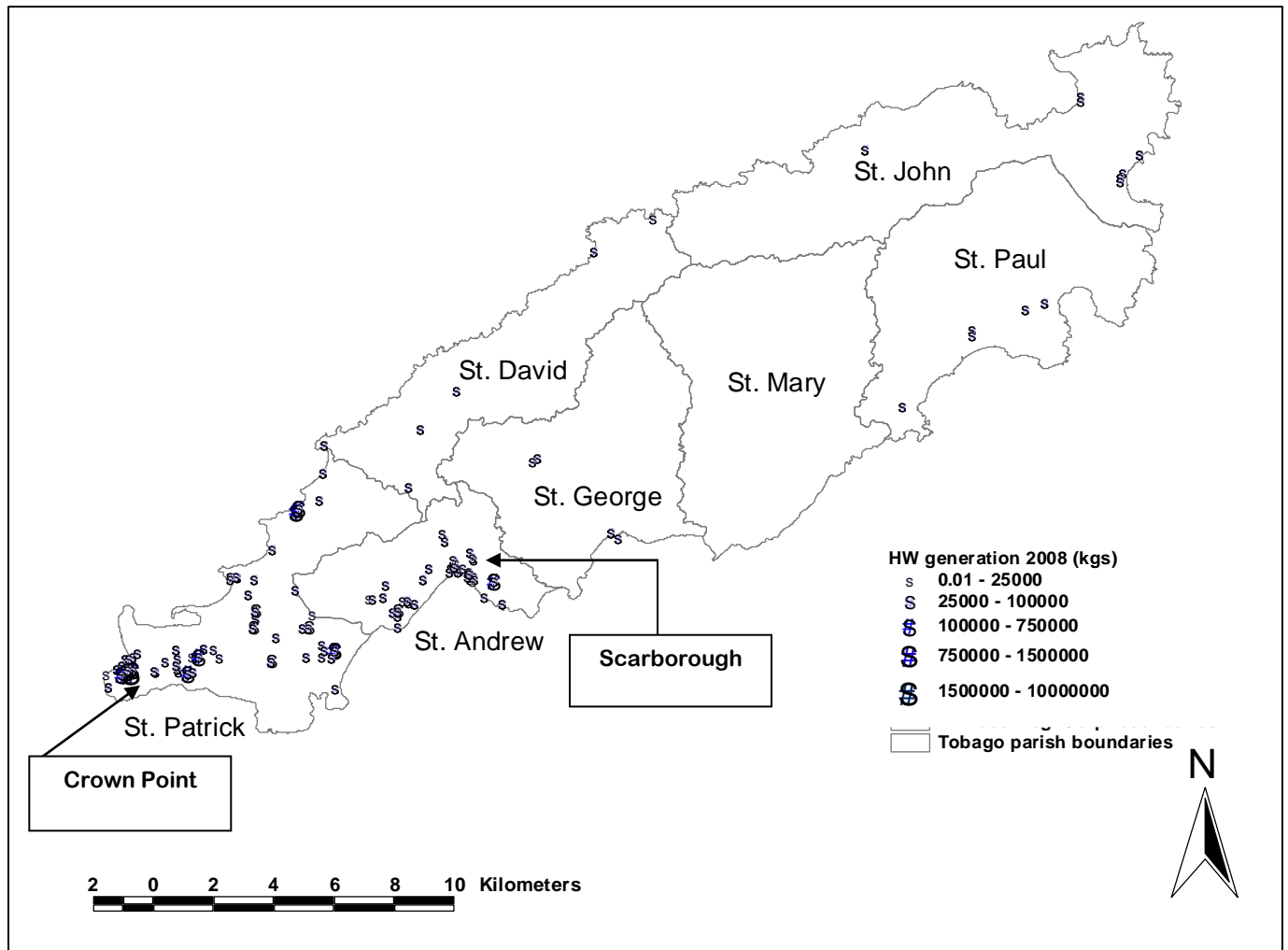
Source: Caribbean Environmental Health Institute, 2006

Figure 9: Spatial distribution of all reported hazardous waste generated in Tobago, 2004



Source: Caribbean Environmental Health Institute, 2009

Figure 10: Spatial distribution of all reported hazardous waste generated in Tobago, 2008

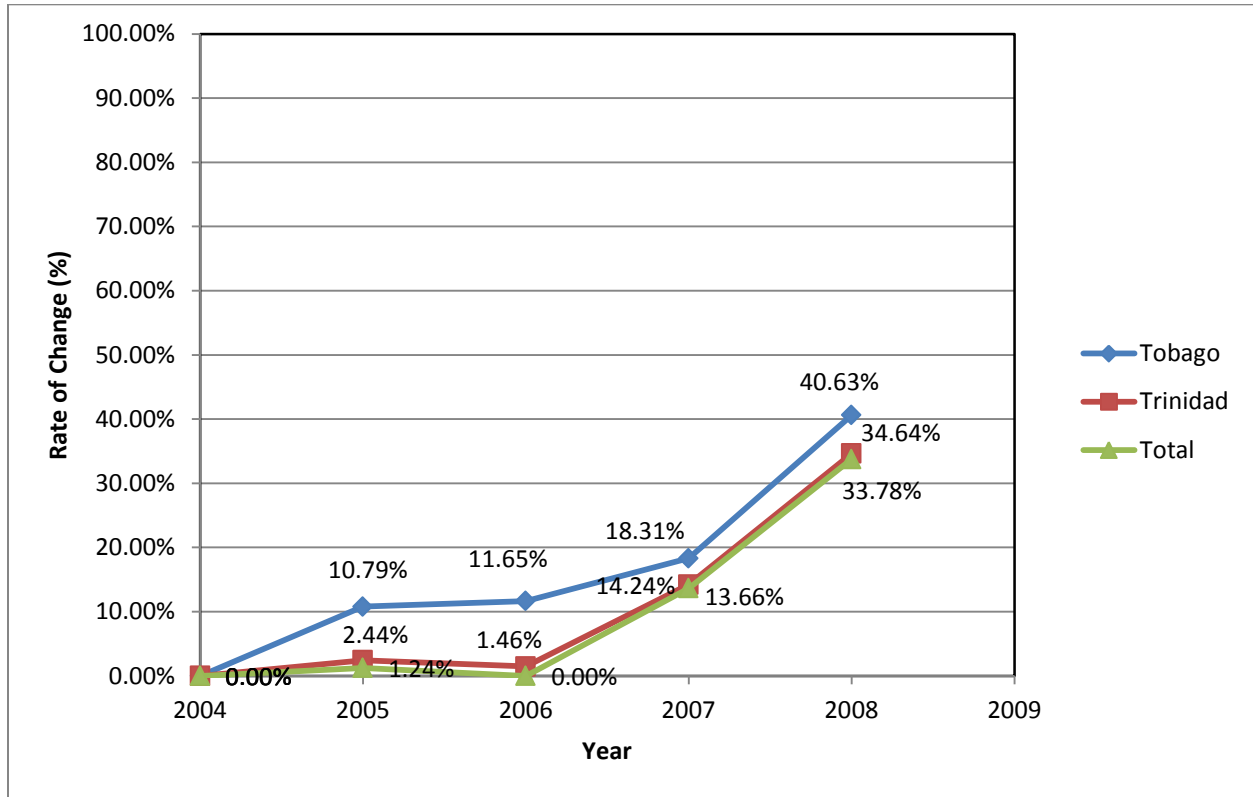


Source: Caribbean Environmental Health Institute, 2009

The figures above illustrate that between 2003 and 2004, there was an increase in the amount of hazardous waste generated within Tobago, especially with regard to the eastern side of the island, where although no hazardous waste generation was observed 2003, 2004 and 2008 saw the emergence of hazardous waste generators on this part of the island. The spatial distribution of hazardous waste was also seen to increase significantly from 2004 to 2008. As illustrated in figure 8, the areas highlighted in Tobago as areas of high waste generation based on the 2003 inventory consisted of the Scarborough and Crown Point areas. Similarly, based on figures 9 and 10 it was seen that the primary generating areas in Tobago for the 2004-2008 period originated mainly from the St. Andrew and St. Patrick Parishes, where both Scarborough and Crown Point are located.

Figure 11 shows how the amount of hazardous waste generated for Trinidad and Tobago changed within the study period from 2004 to 2008, using 2004 as the base year.

Figure 11: Percentage change in hazardous waste generated for the period 2004-2008



Source: Caribbean Environmental Health Institute, 2009

With the exception of 2006, there was seen to be a general increase from year to year in the amount of reported hazardous waste generated within Trinidad and Tobago, with 2007 and 2008 recording the highest of 14.24% and 34.64% respectively. Such a large increase during these years however, could have been partly attributed to entities not keeping proper records of their hazardous waste generation and so only being able to better recall and provide information for the more recent years as opposed to earlier ones. On the other hand, for Tobago, there was seen to be a steady increase over the period 2004-2008 with a 10.79% increase in 2005 and a maximum of 40.63% in 2008. It should be noted however that while an overall increase was observed for Trinidad during the inventory period, this increase was not as steady as that observed for Tobago.

Hazardous Waste Generation by Waste Stream, 2004-2008

The following table provides a summary of the total amount of hazardous waste generated from the main waste streams for the five year period, 2004-2008, within Trinidad and Tobago. A more detailed table outlining all of the waste streams is presented in Annex I of the report.

Table 5: Hazardous waste generation by waste stream in Trinidad and Tobago, 2004-2008

| Y Code | 5-year totals by island | | | | | | 5-year totals National level | |
|--|-------------------------|-------------------------|--------------------------------------|-----------------|-------------------------|--------------------------------------|------------------------------|--------------|
| | Trinidad | | | Tobago | | | Amount (tonnes) | % of Total |
| | Amount (tonnes) | % Contribution to Total | % Contribution to Waste Stream Total | Amount (tonnes) | % Contribution to Total | % Contribution to Waste Stream Total | | |
| Y1 : Clinical wastes from medical care in hospitals, medical centres and clinics | 331.05 | 0.2 | 61.4 | 208.35 | 0.9 | 38.6 | 539.40 | 0.31 |
| Y3: Waste pharmaceuticals, drugs and medicines | 262.22 | 0.2 | 99.9 | 0.32 | 0.0 | 0.1 | 262.55 | 0.15 |
| Y4: Wastes from the production, formulation and use of biocides and phytopharmaceuticals | 7.90 | 0.0 | 3.1 | 246.91 | 1.1 | 96.9 | 254.81 | 0.15 |
| Y6: Wastes from the production, formulation and use of organic solvents | 435.07 | 0.3 | 69.3 | 193.06 | 0.9 | 30.7 | 628.13 | 0.37 |
| Y8: Waste mineral oils unfit for their originally intended use | 47.33 | 0.0 | 20.4 | 184.25 | 0.8 | 79.6 | 231.58 | 0.13 |
| Y9: Waste oils/water, hydrocarbons/water mixtures, emulsions | 138,820.83 | 93.0 | 88.5 | 17,997.14 | 79.5 | 11.5 | 156,817.97 | 91.18 |
| Y12: Wastes from production, formulation and use of inks, dyes, pigments, paints, lacquers, varnish | 205.20 | 0.1 | 77.7 | 58.76 | 0.3 | 22.3 | 263.97 | 0.15 |
| Y14: Waste chemical substances arising from research and development or teaching activities which are not identified and/or are new and whose effects on man and/or the environment are not known | 124.38 | 0.1 | 100.0 | 0.06 | 0.0 | 0.0 | 124.44 | 0.07 |
| Y16: Wastes from production, formulation and use of photographic chemicals and processing materials | 134.78 | 0.1 | 99.7 | 0.42 | 0.0 | 0.3 | 135.20 | 0.08 |
| Y22: Copper compounds | 585.03 | 0.4 | 97.6 | 14.22 | 0.1 | 2.4 | 599.25 | 0.35 |
| Y23: Zinc compounds | 306.08 | 0.2 | 100.0 | 0.00 | 0.0 | 0.0 | 306.08 | 0.18 |
| Y34: Acidic solutions or acids in solid form | 324.66 | 0.2 | 53.7 | 279.66 | 1.2 | 46.3 | 604.32 | 0.35 |
| Y35: Basic solutions or bases in solid form | 381.13 | 0.3 | 14.4 | 2,273.11 | 10.0 | 85.6 | 2,654.24 | 1.54 |
| Y37: Organic phosphorus compounds | 2.46 | 0.0 | 0.2 | 1,000.64 | 4.4 | 99.8 | 1,003.10 | 0.58 |
| A1160: Waste lead-acid batteries, whole or crushed | 6,422.11 | 4.3 | 99.1 | 59.76 | 0.3 | 0.9 | 6,481.87 | 3.77 |
| A1180: Waste electrical and electronic assemblies or scrap (excluding scrap assemblies from electric power generation) containing components such as accumulators and other batteries included on list A OF The Basel Convention Waste Categories listing , mercury-switches, glass from cathode-ray tubes and other activated glass and PCB- capacitors, or contaminated with Annex I constituents (Basel Convention Waste Categories Listing e.g., cadmium, mercury, lead, polychlorinated biphenyl) to an extent that they possess any of the characteristics contained in Annex III of the Basel Convention Waste Category Listing | 207.32 | 0.1 | 86.9 | 31.12 | 0.1 | 13.1 | 238.44 | 0.14 |
| A2030: Waste catalysts | 553.90 | 0.4 | 100.0 | 0.00 | 0.0 | 0.0 | 553.90 | 0.32 |

Source: Caribbean Environmental Health Institute, 2009

Based on the above table, it was seen that for Trinidad, the Y9 waste stream (i.e. waste oils/water, hydrocarbons /water mixtures, emulsions) generated the greatest volume of hazardous waste (138,820.83 tonnes), while the A1160 waste stream (i.e. waste lead-acid batteries, whole or crushed) was seen to be the second largest generator of hazardous waste (6,422.11 tonnes) for the five year inventory period. In a similar manner, the Y9 waste stream was also seen to be the greatest contributor to hazardous waste on the island of Tobago, with the Y35 (basic solutions or bases in solid form) and Y37 (organic phosphorous compounds) waste streams being the second and third largest hazardous waste contributors generating 2,273.11 and 1,000.64 tonnes respectively. Thus, at a national level, the main contributors to hazardous waste was seen to be the Y9, A1160 and Y35 waste streams which altogether accounted for 96.40%, 95.47%, 97.16%, 97.41% and 96.07% for the years 2004, 2005, 2006, 2007 and 2008 respectively.

With respect to the waste management of A1160, it was found that most of this waste was sent back to suppliers for either recycling and/or export, with the largest generators in Tobago indicating that batteries were sent back to Trinidad for recycling. The largest generator in Trinidad acted as a collection depot for these lead acid batteries which were exported for recycling.

As mentioned earlier, the year 2008 recorded a large increase of 34.64% in the amount of reported hazardous waste generated for Trinidad and Tobago as compared to the year 2004, giving a total of 41,888,756 kg for the country. It was also observed that for the year 2008, there were increases in both the number of entities reporting as well as the number of reported waste streams.

Hazardous Waste Generation by Sector, 2004-2008

Table 6 highlights the amount of hazardous waste generated in each industrial sector within Trinidad and Tobago for the period 2004-2008.

Table 6: Contribution of each sector to the generation of hazardous waste within Trinidad and Tobago, 2004-2008

| International Standard Industry Classification (ISIC) Main Sector | | Contribution at National Level | |
|--|---|---------------------------------------|----------------------------|
| Code | Description | Amount (kg) | % of National Total |
| 1100 | Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying | 82,253,115 | 47.83 |
| 4000 | Electricity, gas, steam and hot water supply | 51,187,251 | 29.76 |
| 5500 | Hotels and restaurants | 17,504,301 | 10.18 |
| 2900, 3100 | Manufacture of machinery and electrical machinery, and apparatus and equipment n.e.c. | 4,975,585 | 2.89 |
| 5000 | Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel | 4,068,278 | 2.37 |

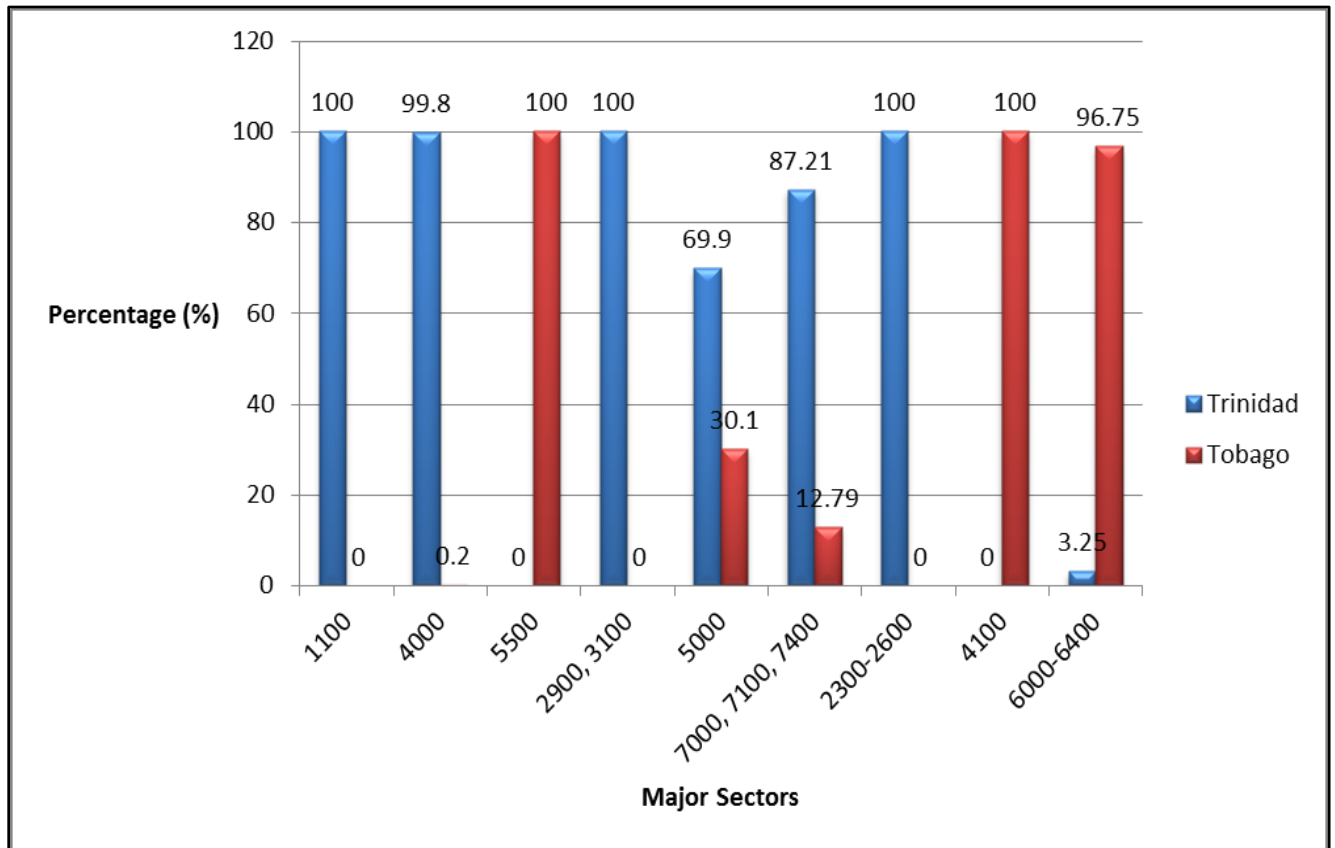
| | | | |
|---------------------|---|-----------|------|
| 7000, 7100 and 7400 | Real estate, renting and other business activities | 3,467,597 | 2.02 |
| 2300-2600 | Manufacture of refined petroleum products; chemicals and chemical products; rubber and plastics products; other non-metallic mineral products | 3,066,453 | 1.78 |
| 4100 | Collection, purification and distribution of water | 1,274,884 | 0.74 |
| 6000-6400 | Land and Air Transport, storage and communications and Telecommunications | 1,014,880 | 0.59 |
| 5200 | Retail trade, except for motor vehicles and motorcycles; repair of personal and household goods | 424.7 | 0.25 |
| 5100 | Wholesale trade, except for motor vehicles and motorcycles | 387.7 | 0.23 |
| 8500 | Health (and social work) | 367.2 | 0.21 |
| 2100, 2200 | Manufacture of paper and paper products; publishing, printing and reproduction of recorded media | 353.9 | 0.21 |
| 0100 | Agriculture, hunting and related service activities | 345.4 | 0.20 |
| 9200-9900 | Other community, social and personal service activities | 318.1 | 0.18 |
| 2000, 3600 | Manufacture of wood and of products of wood and cork; furniture | 245.3 | 0.14 |
| 2800 | Manufacture of fabricated metal products, except machinery and equipment | 138.0 | 0.08 |
| 4500 | Construction | 114.7 | 0.07 |
| 8000 | Education | 113.5 | 0.07 |
| 1400 | Other mining and quarrying | 86.3 | 0.05 |
| 1500 | Manufacture of food products and beverages | 90.5 | 0.05 |

| | | | |
|-----------|---------------------------------|------|------|
| 7500 | Public administration | 61.4 | 0.04 |
| 7200 | Computer and related activities | 53.8 | 0.03 |
| 6500-6600 | Financial intermediation | 36.1 | 0.02 |
| 7300 | Research and development | 30.3 | 0.02 |

Source: Caribbean Environmental Health Institute, 2009

Based on table 6 above, it is apparent that the three major contributors to hazardous waste generation within Trinidad and Tobago were those sectors related to (i) 1100: the extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying (ii) 4000: electricity, gas, steam and hot water supply and (iii) 5500: hotels and restaurants. These three sectors altogether accounted for 87.77% of the total hazardous waste generated within the country for the period 2004-2008. Figure 12 below illustrates the contribution of each island to the major waste generating sectors in Trinidad and Tobago.

Figure 12: Contribution of each island of Trinidad and Tobago to the major hazardous waste generating sectors, 2004-2008



Source: Caribbean Environmental Health Institute, 2009

Figure 12 illustrates that of the nine major sectors, the island of Trinidad accounted for the majority of waste generated within six of these sectors while Tobago accounted for the majority of waste generated within three of the sectors. Once again, the dissimilarity in contribution of each island can be attributed to the difference in economic reliance which exists between Trinidad and Tobago. In that, the three sectors which contributed the majority of hazardous waste in Tobago were seen to be those sectors related to hotels and restaurants; collection, purification and distribution of water; land and air transport, storage and communications and telecommunications, all of which are largely associated and linked to Tobago's tourism industry. On the other hand, it was seen that in the case of Trinidad, the six sectors which generated the majority of hazardous waste were those related to the petrochemical, industrial and manufacturing sectors, all of which Trinidad's economy heavily relies on.

The three sectors which generated the highest amount of hazardous waste within Trinidad and Tobago i.e. Sector 1100, Sector 4000 and Sector 5500, will now be looked at in detail.

Sector 1100: Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying

Throughout the inventory period, Sector 1100 was seen to be the largest contributor to the generation of hazardous waste within Trinidad and Tobago, with a recorded waste amount of 14,202,387 kg in 2004 and increasing annually to 21,933,938 kg in 2008. It should be noted however that generation from this sector occurred only in Trinidad. In 2007, a 24% increase was observed from 2006 followed by another 24% increase from 2007 to 2008. This increase was due to two new generators reporting large amounts in 2007 along with other generators reporting even larger amounts in 2008. In addition, the number of generators in Sector 1100 increased marginally during the review period from 28 in 2004 to 33 in 2008. Over 82,133,110 kg representing 99.85% of the total hazardous waste generated for this sector belonged to the Y9 waste stream. Furthermore, the main activities generating waste within this sector were oil and gas exploration and drilling, maintenance of plant and equipment, motor vehicle maintenance, building maintenance and cleaning and laboratory analysis.

More than 60% of Sector 1100 waste for the period 2004-2008 was generated in the Siparia Regional Corporation with Penal/Debe and Port of Spain generating the second and third largest amounts of 23.98% and 13.30% respectively.

Sector 4000: Electricity, Gas, Steam and Hot Water Supply

The electricity generation sector was the second largest contributor to the generation of hazardous waste within Trinidad and Tobago, accounting for 51,187,251 kg (29.76%) of the national total for the inventory period. All of the waste generated in Tobago originated from one organisation in the Scarborough area of which the Y9 waste stream served as the main constituent (75.60%) of the total hazardous waste generated. While there was a steady increase in the amount of hazardous waste generated for Tobago for the period 2004-2007, no waste was reported by this sector for the year 2008. In the case of Trinidad however, there was seen to be an increase in terms of volume during the period 2004 and 2006, while a decline in waste generation for this sector was reported in 2007 and 2008.

The electricity generation sector contributed to 11 waste streams with the greatest contribution (i.e. 99.68%) being to the Y9 waste stream. The main activities generating waste in this sector consisted of vehicle maintenance, plant and building maintenance and power generation (cooling). In Trinidad, the Couva/Tabaquite/Talparo area accounted for 98.03% of the waste from this sector during the period 2004-2008 while the Point Lisas Industrial Estate contributed 0.80%; Port of Spain 0.63% and Penal/Debe 0.54%.

Sector 5500: Hotels and Restaurants

The hotel and restaurant sector was the third largest contributor to the national waste generated and the highest generator by sector in Tobago. In addition, all waste generated in this sector was reported from Tobago with no reported waste for Trinidad. For the period 2004-2008, there was seen to be an increasing trend in both the volume of waste reported as well as the number of entities reporting. The sector contributed to 15 waste streams of which the Y9 waste stream represented the majority of waste generated by this sector i.e. 87.57%. In addition, the following four parishes in Tobago contributed to waste generation in this sector: St. Andrew (66.45%), St.Patrick (33.32%), St.John (0.18%) and St.David (0.05%).

Hazardous Waste Generation by Location, 2004-2008

During the period 2004-2008, the following locations were found to be the main contributors to hazardous waste generation in Trinidad:

- Couva/Tabaquite/Talparo Regional Corporation (36.23%)
- Siparia Regional Corporation (33.43%)
- Penal/Debe Regional Corporation (13.46%)
- Arima (3.40%)
- Chaguanas (1.63%)

For Tobago on the other hand, the following parishes were found to be the main contributors to hazardous waste generation in Tobago:

- St.Andrew (58.69%)
- St.Patrick (41.05%)

Comparative Analysis between the 2003 and 2004-2008 Inventories

While the 2004-2008 inventory consisted of a total of 851 organisations, the 2003 inventory comprised only 285 organisations. There was overlap with respect to the organisations participating with the majority surveyed in 2003 also participating in the 2004-2008 inventory. As a result, the disparity in reporting entities between both inventories limits the comparisons which can be made. Nevertheless, notwithstanding the latter, there were several observations which were worth noting between both inventories and these are as follows:

- An estimated 11,452.5 tonnes of hazardous waste was reported as being generated in Trinidad and Tobago during the 2003 inventory, while the 2004-2008 survey reported over 171,974.4 tonnes– an estimated difference of 160, 521.9 tonnes. These figures point to a significantly increasing trend of hazardous waste generation within the country.
- Both inventories reported the Y9 waste stream as being the largest contributor to hazardous waste in Trinidad and Tobago.

- Both inventories reported the oil and gas sector as being the largest contributing sector to hazardous waste generation in Trinidad and Tobago.
- In the case of Trinidad, both inventories found a large number of hazardous waste generators to be within the Siparia and Penal/Debe Regional Corporations. However, while the 2003 survey reported the largest generation of waste to be within the Penal, Santa Flora, Fyzabad area, the 2004-2008 survey found the largest waste generation to be within the Couva/Tabaquite/Talparo Regional Corporation. On the other hand, in the case of Tobago, both inventories recorded the largest generation to be within the Parishes of St. Andrew and St. Patrick.

4.1.4 Trends and Outlooks for Hazardous Waste Generation in Trinidad and Tobago

The development of waste generation in Trinidad and Tobago depends largely on economic development, consumption, population growth, operational changes and resource efficiency especially as it relates to (i) the petrochemical, industrial and manufacturing sector (ii) the power generation sector and (iii) the tourism-related sector, which altogether accounted for 87.77% of the total hazardous waste generated within the country during the period 2004-2008.

The country's largest contributor to GDP stems from the oil and gas industry, which according to the inventories conducted, was reported as being the single largest contributing sector to hazardous waste generation in Trinidad and Tobago. As such, based on the above findings and the growth in size and importance of the hydrocarbon and petrochemical sectors, the country can expect to see continual and substantial increases in the generation of hazardous waste. In addition, associated increases in the standard of living coupled with changes in the nation's pattern and rate of consumption are also expected to amplify such increases in waste generation. From the inventories conducted, it was seen that the bulk of reported hazardous waste was generated within Trinidad as opposed to Tobago. In addition, the 2004-2008 inventory reported the Y9 waste stream as being the main contributor to the reported hazardous waste in both islands. Y9 waste was generated by 22 of the 26 sectors surveyed with sector 1100, sector 4000 and sector 5500 being the major generators.

Trinidad and Tobago is the leading producer of oil and gas within the Caribbean region, both of which are significant drivers of the economy. In addition, the country is one of the key suppliers of manufactured goods to other Caribbean countries and is highly industrialised as is evidenced by the existence of several industrial estates within the country, including the Point Lisas Industrial Estate as well as other light industrial estates such as those located in O'Meara, Frederick Settlement, Macoya, Point Fortin, Diamond Vale and Sangster's Hill in Tobago. It is therefore expected that as the energy sector continues to expand, the development of energy intensive industries, inclusive of a range of petrochemicals such as ammonia, methanol, urea and Liquefied Natural Gas (LNG), will significantly increase the amount of hazardous waste being

generated within the country, with particular reference to the Y9 waste stream. In a similar manner, the tourism industry is also expected to expand, especially in Tobago, where the industry contributed almost 36.9% to the island's economic activity in 2009. As such, expansion in the tourism and related-services sector is also expected to bring along with it a substantial increase in hazardous waste generation.

4.2 Solid Waste

4.2.1 Definition and Composition

Solid wastes consist of household waste, plastics, paper, bulky consumer and municipal wastes and similar types of waste generated by industry. For purposes of this report, solid waste will be categorised either as (i) Residential Waste i.e. waste emanating from households or (ii) Institutional, Commercial and Industrial (ICI) Waste i.e. waste emanating from institutions, commercial and industrial enterprises.

4.2.2 Solid Waste Generation within Trinidad and Tobago: Trinidad Solid Waste Management Program Waste Characterisation and Centroid Study, 2010.

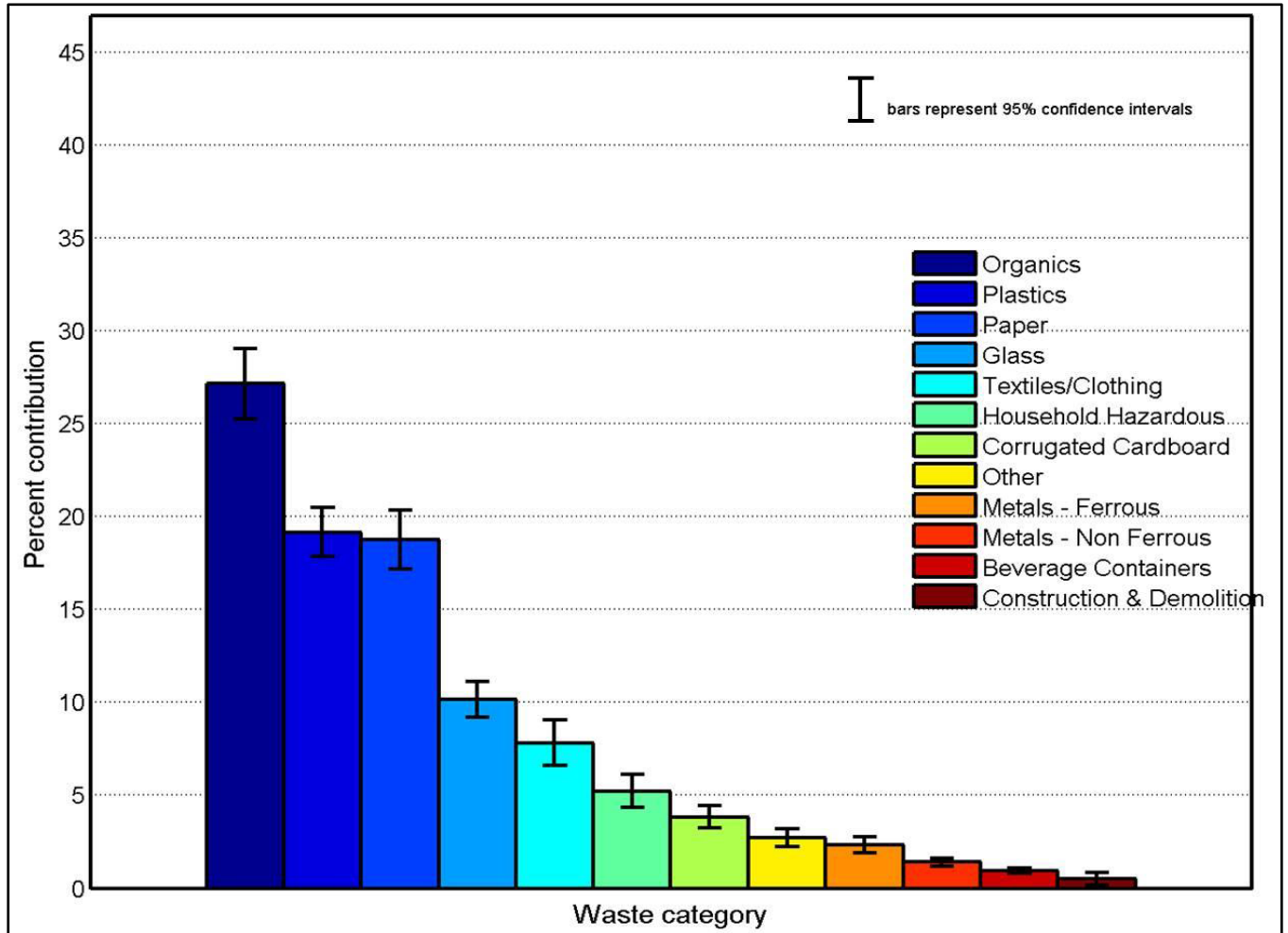
In 2010, a Solid Waste Management Program Waste Characterisation and Centroid Study was conducted for Trinidad. This study was aimed at providing data and information to be used in developing a regional, integrated solid waste management program for Trinidad and Tobago. As such, the study encompassed a comprehensive waste characterisation at four of the country's landfills i.e. the Beetham, Forres Park, Guanapo and Guapo Landfills, as well as a comprehensive waste centroid study. The findings of the Solid Waste Characterisation and Centroid Study are as follows:

❖ Residential Waste

Samples from residential sources taken at the four landfills were analysed and the following graphs generated:

Figure 13 illustrates the overall composition of the residential waste stream analysed within the study.

Figure 13: Average overall household waste composition

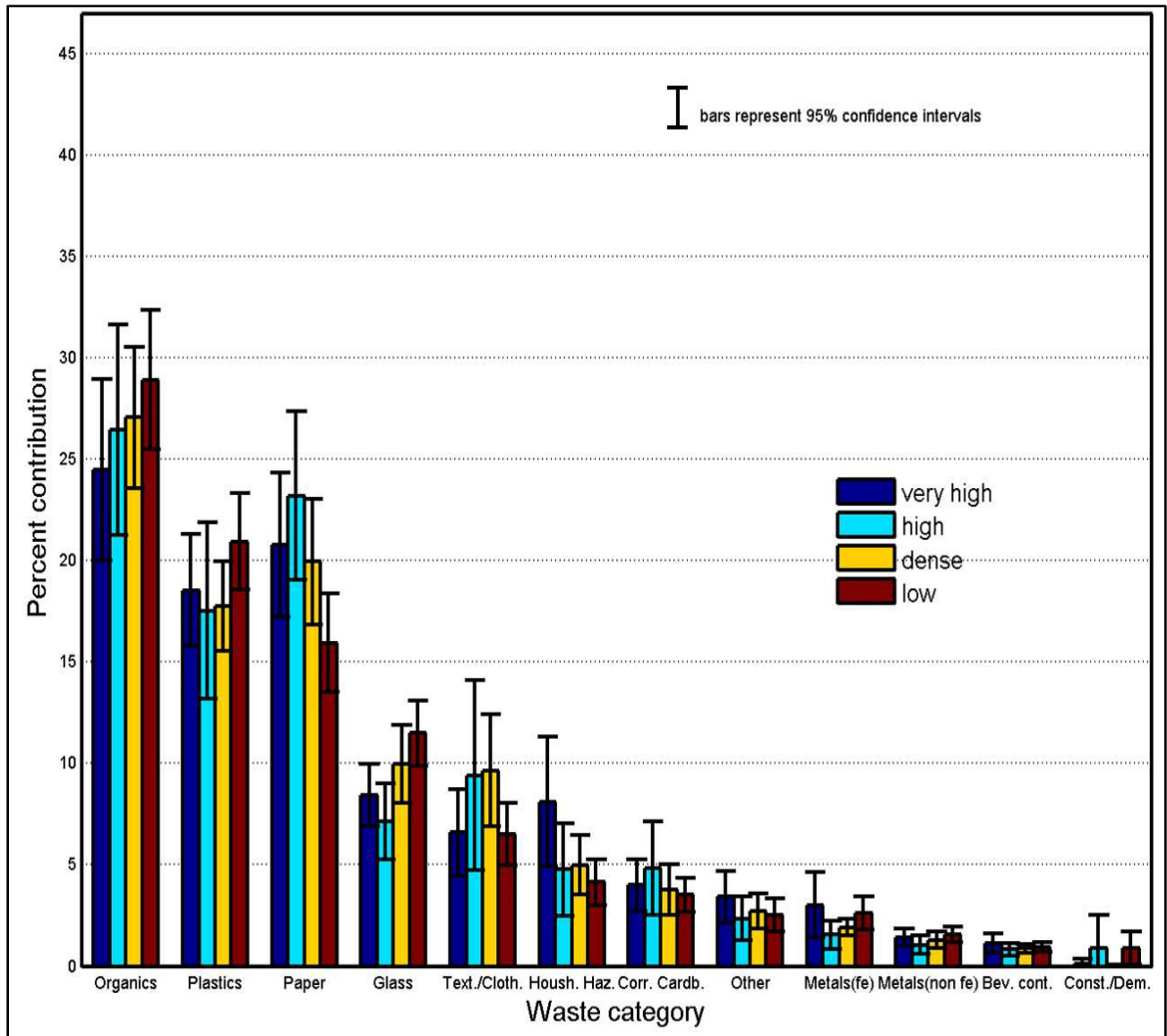


Source: CBCL Limited, 2010.

It is seen that the highest proportion of household waste consisted of organics whilst construction and demolition waste were least prevalent. Plastics and paper were also common and contributed similar amounts to the overall waste composition.

Figure 14 illustrates how the average household waste composition varied with population density as defined by very high, high, dense and low.

Figure 14: Average household waste composition by population density

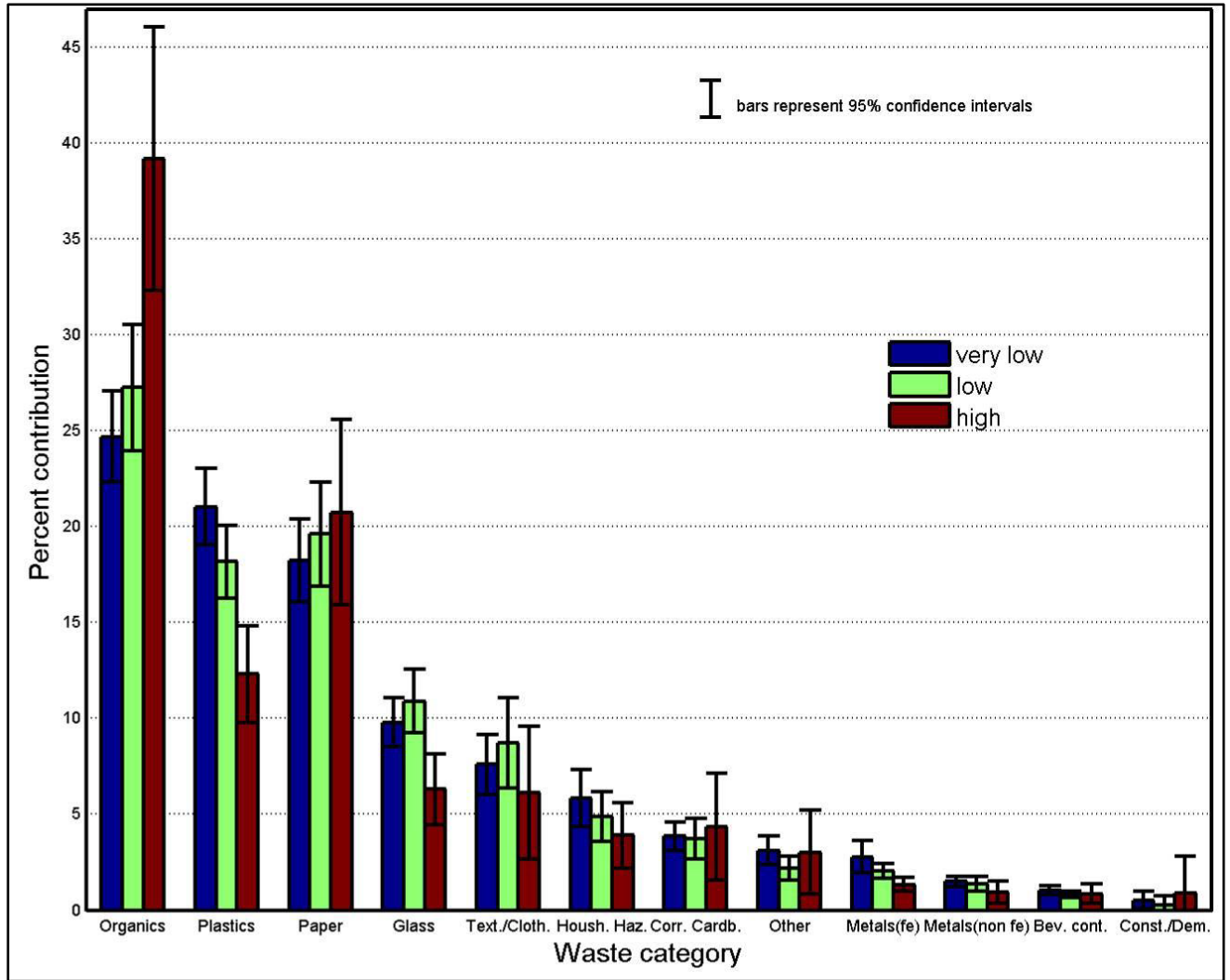


Source: CBCL Limited, 2010.

It is seen that organics, plastics and glass were most prevalent in areas of low population density. However, in the case of paper, the highest proportion was seen to be generated in areas of high population density.

Figure 15 below illustrates how the average household waste composition varied by income as defined by high, low and very low.

Figure 15: Average household waste composition by income

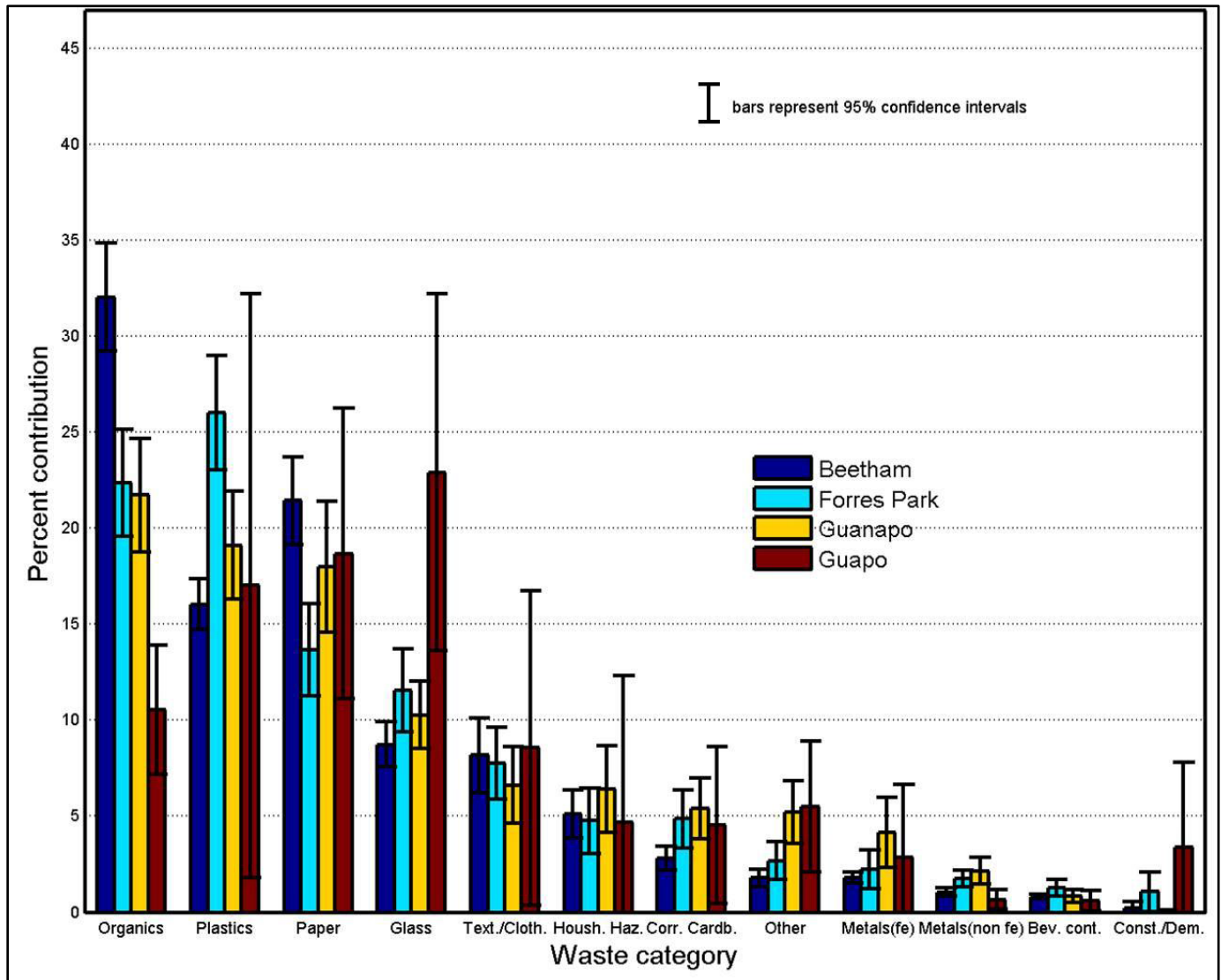


Source: CBCL Limited, 2010.

It is seen that a significantly high proportion of organics was seen to emanate from high income households. Paper was also most prevalent in households of high income. On the other hand, plastics were most commonly found disposed of from households of very low income whilst glass was most prevalent in low income households.

The following graph illustrates how the average household waste composition varied at the different landfill sites i.e. Beetham, Forres Park, Guanapo and Guapo.

Figure 16: Average household waste composition by landfill



Source: CBCL Limited, 2010.

It is seen that a significant amount of organics was found at the Beetham landfill. Paper was also most common at this landfill site. Plastics, on the other hand, were most prevalent at the Forres Park landfill whilst an exceedingly high proportion of glass was observed at the Guapo landfill as compared to the other landfill sites.

Overall Waste Stream Generation

In order to efficiently manage waste generation within Trinidad and Tobago, it is of vital importance that the overall waste stream generated within the country be effectively quantified. Such quantification has been occurring for some time as is evidenced by several studies conducted in the past, mostly by SWMCOL. Building on the data gathered from past exercises,

estimates were done with consideration given to changes which may have occurred over the years. The following highlights the overall findings as it pertains to the generation of solid waste within Trinidad and Tobago.

In 1995, the total amount of waste hauled into the Beetham landfill was calculated to be 143, 101 tonnes, borne on 76,653 vehicles. Later in 2009, SWMCOL estimated 307, 350 tonnes of waste to be entering the Beetham landfill. Thus, based on the trends observed over the period 1995-2009, the amount of waste disposed of at the Beetham Landfill in 2010 was estimated to be at least 350,000 tonnes.

The 2009 weights estimated by SWMCOL for the Guanapo and Forres Park Landfills were found to be 114,442 tonnes and 207,622 tonnes respectively. Extrapolation was done in order to include the Guapo landfill which was estimated by SWMCOL and Green Engineering to account for about 3% of the island's overall waste stream. Thus, an overall estimate for the island's waste generation in 2009 for the four landfills investigated (i.e. Beetham, Guanapo, Guapo and Forres Park) suggests a figure of at least 650,000 tonnes of waste being disposed of annually at these landfills. It should be noted however that this estimate is likely to be understated rather than overstated.

Based on the data gathered for 2010, it was estimated that about 700,000 tonnes of waste was generated within the country during this year. Of this figure, about one third of the waste was generated from institutional, commercial and industrial (ICI) sources whilst the majority of two thirds from household sources. Based on Trinidad's population, it is further estimated that 0.54 tonnes of waste is generated per capita per year amounting to 1.50 kilograms per person per day. Such a figure however is not unusual for modern, reasonably prosperous, industrialised economies like Trinidad where serious waste reduction initiatives and programmes have not yet been implemented³⁹.

Table 7 summarises the contribution of each source i.e. household and ICI to the overall waste stream generated within the country. The material groups for each source are further categorised based on those which have the potential for recycling or diversion to beneficial uses and those which are non-recyclable.

³⁹ CBCL Limited. (2010). *Trinidad Solid Waste Management Program Waste Characterization and Centroid Study*. Ministry of Local Government.

Table 7: Overall waste generation and composition for the different sources of waste generated within Trinidad, 2010

| MATERIAL | AVERAGE PROPORTION IN HOUSEHOLD WASTE | ESTIMATED WEIGHT IN 2010 (TONNES) |
|---|---------------------------------------|-----------------------------------|
| HOUSEHOLD SOURCE | | |
| RECYCLABLE | | |
| ORGANIC FOOD WASTE | 18.98% | 88,574 |
| ORGANIC OTHER | 8.17% | 38,127 |
| PLASTICS EXCLUDING BEVERAGE CONTAINERS | 19.17% | 89,461 |
| PAPER, ALL CLASSES | 18.77% | 87,594 |
| GLASS | 10.15% | 47,367 |
| OLD CORRUGATED CARDBOARD | 3.83% | 17,874 |
| METALS, FERROUS | 2.33% | 10,873 |
| METALS, NON-FERROUS | 1.41% | 6,579 |
| BEVERAGE CONTAINERS | 0.92% | 4,293 |
| SUBTOTAL RECYCLABLE | 83.73% | 390,742 |
| HOUSEHOLD SOURCE | | |
| NON-RECYCLABLE | | |
| TEXTILES AND CLOTHING | 7.82% | 36,494 |
| HOUSEHOLD HAZARDOUS | 5.24% | 24,453 |
| OTHER | 2.71% | 12,646 |
| CONSTRUCTION AND DEMOLITION | 0.50% | 2,333 |
| SUBTOTAL NON-RECYCLABLE | 16.27% | 75,926 |
| GRAND TOTAL HOUSEHOLD SOURCE | 100.00% | 466,668 |
| INSTITUTIONAL, COMMERCIAL AND INDUSTRIAL (ICI) | | |
| TOTAL ICI | | 233,333 |
| TOTAL WASTE DISPOSED AT ALL FOUR LANDFILLS IN 2010 | | 700,000 |

Source: CBCL Limited, 2010.

From table 7 above, there was seen to be a very high proportion of plastics and packaging materials observed within the waste samples. Observations made during the execution of the

study also revealed the vast presence of these materials in loads being discharged and within samples sorted during actual field work. On the other hand, while the proportion of organics was noted to be unusually low, this could have been explained not by an absence of the level of organics expected but more so by the unusually high proportions of other materials within the waste stream. It should also be noted that of the total organics proportion i.e. 27.15%, it was reported that the majority (18.98%) consisted of food waste whilst the balance (8.17%) consisted of yard/gardening waste. In this regard, it is worth noting, that the weeks preceding fieldwork were very dry and so there would have been little grass and garden cutting taking place, thus depressing the final organics figure.

The proportions of old corrugated cardboard, metals and beverage containers were found to be very low. This may have been a reflection of the vigorous entrepreneurial activities already evident in Trinidad, at least in the major centres of the country, by which these materials are collected in considerable quantities prior to disposal at the landfills. Thus, because these materials are being intercepted and marketed, it is not surprising that the amounts present in the waste stream were found to be relatively low. In terms of weight, the proportion of glass was found to be relatively high. Although the market is not strong for glass recycling, it can still be classed as recyclable in certain marketplaces.

Altogether, plastics and paper comprised about 40% of the residential waste stream. Large amounts of these materials were seen to exist in the form of packaging, including temporary containers and serving boxes from fast food outlets and in the form of reading material such as magazines and newspapers. As mentioned earlier, organics accounted for a substantial fraction of the waste stream, though not as high as in other countries in warm climates⁴⁰. Once again, this high proportion may be explained not by the absence of organics but rather the preponderance of non-organics, which would have depressed the percentage represented by organics.

Those materials categorised as non-recyclable are those which were found to be very difficult to divert to useful purposes and consisted of textiles and clothing, household hazardous material, construction and demolition and other miscellaneous material. These were found to exist in relatively low proportions.

The differences in proportions among social economic categories as illustrated in figures 14 and 15 suggests different patterns in relation to material types. In that, the proportion of organics and paper was seen to increase as income categories went from “very low” to “high”. Thus, it is credible to say that higher income households throw away more food and have more perishable organics (flowers, landscaping vegetation, etc) and also have more packaging and reading materials to dispose of as compared to low income households. All of the other categories of

⁴⁰ CBCL Limited. (2010). *Trinidad Solid Waste Management Program Waste Characterization and Centroid Study*. Ministry of Local Government.

material were characterised by much less difference in proportions across the varying income groups. In that, the averages and ranges were seen to be much closer together across income groups for those other materials, with the averages being very close and the confidence limits generally overlapping. On the other hand, as it relates to population density, there was seen to be only a slight relation between this and the proportions of material categories. Averages were seen to be quite close, with all of the confidence limit ranges overlapping.

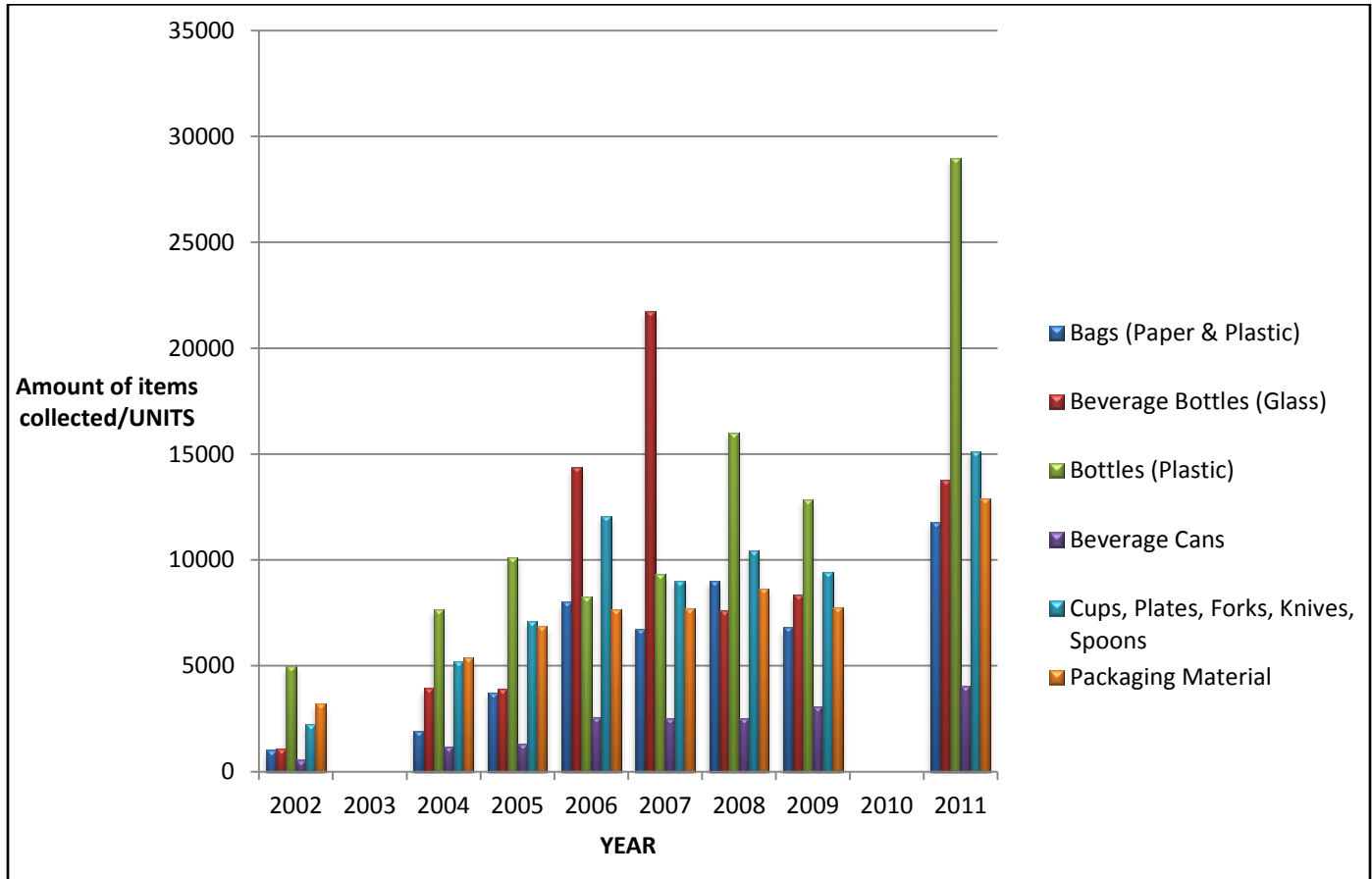
With the exception of the Guapo landfill (where the samples taken were quite small), it was seen that in all categories of material there was no significant difference amongst the three remaining landfills i.e. Beetham, Forres Park and Guanapo. It should be noted however that findings at the Beetham landfill indicated a higher proportion of organics and paper as compared to the other landfills. This however, could have been owed to the fact that the higher income households in Port of Spain and adjacent areas tended to dispose of more food waste and paper products as compared to elsewhere.

Based on table 7 above, institutional, commercial and industrial sources (ICI) were seen to generate a total of 233 333 tonnes of waste in 2010, an approximate one third of the total waste generated within the country. A rigorous analysis like that conducted for the residential waste stream could not have been done for this waste stream due to the unavailability of data.

4.2.3 Solid Waste Generation within Trinidad and Tobago: Ocean Conservancy's International Coastal Clean-Up (ICC), 2002-2011

One of the most comprehensive datasets regarding the sources and extent of coastal pollution in Trinidad and Tobago is derived from the annual Ocean Conservancy's International Coastal Clean-up (ICC), which is the single largest one-day clean-up and data collection event in the world and which Trinidad and Tobago has been a part of since 2002. ICC's data collection process facilitates the documentation of items of debris collected, number of garbage bags filled, total weight of collected waste material, the number of coastal miles cleaned and the number of volunteers participating in the exercise. Figure 17 below illustrates the quantity of the different solid waste material collected during the ICC clean-up for the years 2002 to 2011. Note that data for the years 2003 and 2010 was unavailable.

Figure 17: ICC Data showing the different numbers of individual material collected for the varying solid waste material groups, 2002-2011



Source: ICC, 2011

With the exception of the years 2006 and 2007, plastic bottles were seen to be the most prevalent waste material collected, with an overwhelming amount of 28,951 bottles being collected in 2011. For the years 2006 and 2007, glass bottles were seen to be the most common waste disposed of with the highest number of 21,729 bottles being collected in 2007. As such, ICC data collected over the years suggests that shoreline and recreational activities are major contributors to coastal pollution, with the most abundant materials being plastic bottles, glass bottles, containers, bags, plates and cutlery. However, the low density and durable nature of beverage containers, particularly those made of plastic, allow them to travel great distances from inland, neighbouring coasts or other countries and as such the source of coastal litter cannot be fully attributed to shoreline activity. These types of materials are known to be detrimental to marine species, especially turtles.

4.2.4 Trends and Outlooks for Solid Waste Generation in Trinidad and Tobago

An extrapolative appreciation of the data across the nation is critical to the implementation of policies and initiatives related to sustainable waste management. As such, based on the findings of this study, it was found that waste characterization of residential sources showed significant variability amongst the different social and economic categories across communities. In that, higher income communities were seen to produce proportionally more food waste and paper and this was especially evident for the proportion of food waste emanating from the urban concentration around Port of Spain, which is presently served by the Beetham landfill. Apart from this, there was seen to be little influence on the composition of household waste across Trinidad.

As was illustrated in Table 6 above the final analysis of data consisted of categorising the various material groups into those which were recyclable and those which were non-recyclable. As such, an alternative beneficial use of glass, for example, may be to utilize it as cover material or temporary roads in landfill operations. In a similar manner, organic materials can be readily diverted to beneficial uses such as for compost production or renewable energy via biomass or biogas processes.

From the data, it was evident that the Beetham landfill, being the largest landfill site in the country, contained the greatest amount of waste amongst the four landfills investigated. This is especially of concern given that this landfill is not an engineered, sanitary landfill and has exceeded the 20-year lifespan recommended for operation. As a result, this site poses a major health and security risk to the public and it is therefore critically important that measures be put in place to sustainably and adequately manage the volume of solid waste being disposed of at this landfill site. The same can be said for other landfills throughout Trinidad as solid waste generation rates are seen to be significantly increasing and are expected to continually increase as population density continues to rise and as consumption patterns change within the country. This was clearly illustrated where waste generation was seen to be the highest in those densely populated areas, predominantly consisting of the population along the western side of the island. It should be noted however that while this study did not include information for Tobago, many of the comments made may still be equally applicable to the island of Tobago as well.

Based on the ICC data collected, it is evident that the amount of solid waste that enter the country's marine environment has increased almost steadily over the years. Of particular concern however, is the increasing presence of plastic and glass bottles, not just within our waterways, but also throughout the country where they are seen commonly disposed of within the environment. As such, greater effort and emphasis needs to be placed on regulating solid waste disposal and reducing pollution within the country. Waste reduction efforts within Trinidad and Tobago have proven to be somewhat handicapped as a result of inadequate equipment,

technology and limited manpower and landfill space. As a result, private enterprises are left to transport recyclables at great expense, thus elevating the costs and challenges of sustainable waste management.

4.3 Special Waste Types

4.3.1 Waste Electrical and Electronic Equipment (WEEE) or e-waste

Definition and Problem Identification

E-waste, like other types of special wastes, has begun to attract greater attention within the waste management sector, especially in developing countries. Waste Electrical and Electronic Equipment (WEEE) or e-waste can be described as any refuse created by discarded electronic devices and components as well as substances involved in their manufacture or use. These end-of-life products encompass electronic appliances such as computers, Liquid-Crystal Display (LCD) and Cathode-Ray Tube (CRT) screens, laptops, televisions, Digital Versatile Disc (DVD) players, mobile phones, mp3 players, cooling appliances etc. which have been disposed of by their original users⁴¹. While no general definition of e-waste exists, in most cases it comprises mainly of relatively expensive and essentially durable products used for data processing, telecommunications or entertainment in both private households and businesses.

Electronic equipment and gadgets have become an essential part of modern life with such equipment being constantly replaced by new, updated ones. As a result, the increasing demand and easy availability of electronic and electrical items has exacerbated the challenges of managing e-waste, especially given the non-biodegradable and hazardous nature of the materials constituting this type of waste. Electronic waste (especially computers) contains toxic substances which can adversely affect human health and the environment. Examples of these toxic substances include lead, cadmium, barium, brominated flame retardants, highly flammable plastics and mercury. More often than not, hazards arise due to the improper recycling or disposal of e-waste. Landfilling for example, which is the most common method of waste disposal in Trinidad and Tobago, can be detrimental in the case of e-waste since it may result in toxic leachates contaminating the soil and groundwater. Lead, for instance, has been found to leach from broken lead-containing glass like that found in televisions and monitors. Unsecured landfill sites and uncontrolled dumps also have the potential to release hazardous emissions, especially in cases where there is the frequency of uncontrolled fires. Table 8 outlines some of the hazardous substances found in e-waste.

⁴¹ Egarr & Associates and EMPA. (2010). *E-waste Assessment in Trinidad and Tobago*. A situational analysis of e-waste management and generation with special emphasis on personal computers.

Table 8: Examples of hazardous substances found in e-waste and associated toxic effects

| SUBSTANCE | OCCURRENCE IN E-WASTE | EFFECTS |
|------------------------------------|--|---|
| Barium | Sparkplugs, fluorescent lamps and “getters” in vacuum tubes. | Forms poisonous oxides when in contact with air. Short-term exposure can result in brain swelling; muscle weakness; damage to heart, liver and spleen. Long-term effects on human health are still unknown. |
| Brominated Flame Retardants (BFRs) | Used in the manufacture of electronic and electrical appliances. | Flame retardants make materials, especially plastics and textiles, more flame resistant. They have been found to be present in indoor dust and air through migration and evaporation from plastics. Combustion at low temperatures of halogenated case material and printed wiring boards releases toxic emissions such as dioxins which can result in severe hormonal disorders. |
| Cadmium | Rechargeable nickel-cadmium batteries, fluorescent layer (CRT screens), printer inks and toners, photocopying-machines (printer drums) | Cadmium components easily accumulate in the body thus resulting in slow poisoning. Acute exposure to cadmium fumes causes flu-like symptoms of weakness, fever, headache, chills, sweating and muscular pain. Long term exposure may result in lung cancer and kidney damage. Cadmium is also believed to cause pulmonary emphysema and bone disease. |
| Chlorofluorocarbons (CFCs) | Cooling units, insulation foam. | CFCs accumulate in the stratosphere and so contribute to depletion of the ozone layer. This results in increased incidence of skin cancer in humans and genetic damage in many organisms. |
| Lead | CRT screens, batteries, printed wiring boards, cable sheathing. | Short-term exposure to high levels can cause vomiting, diarrhoea, convulsions, coma or even death. Other symptoms include loss in appetite, abdominal pain, |

| | | |
|----------------------------------|--|---|
| | | constipation, fatigue, sleeplessness, irritability and headaches. Long-term exposure can severely affect the kidneys. Lead exposure is particularly dangerous in the case of children since it can adversely affect the nervous system, blood and brain. |
| Mercury | Fluorescent lamps that provide backlighting in LCDs, in some alkaline batteries and mercury wetted switches. | Mercury is a toxic heavy metal which has the ability to bioaccumulate. It also causes brain and liver damage when ingested or inhaled. |
| Polychlorinated biphenyls (PCBs) | Condensers, transformers, additives in adhesives and plastics. | PCBs have been shown to cause cancer in animals. Also known to affect the immune system, nervous system, endocrine system and cause other health effects in animals. PCBs are persistent contaminants in the environment and also bioaccumulate in the fatty tissues of almost all organisms. |
| Polyvinyl chloride (PVC) | Most widely used plastic in everyday electronics and appliances, cable insulation. | PVC when burned produces large quantities of hydrogen chloride gas which when combined with water forms hydrochloric acid and can cause respiratory problems when inhaled. |

Table 9 provides a broad listing of the various e-waste categories as outlined in the WEEE Directive of the European Union.

Table 9: E-waste categories as defined by the WEEE Directive of the European Union

| No. | CATEGORY | EU WEEE |
|-----|--|--|
| 1 | Large Household Appliances | Washing machines, dryers, refrigerators, air conditioners, etc |
| 2 | Small Household Appliances | Vacuum cleaners, coffee machines, toasters, iron, etc. |
| 3 | Office Information and Communication Equipment | PCs, laptops, mobiles, telephones, fax machines, copiers, printers, etc. |
| 4 | Entertainment and Consumer Electronics | Televisions, VCR/CD/DVDs, Hi-Fi sets, radios, etc. |
| 5 | Lighting Equipment | Fluorescent tubes, sodium lamps, etc (except bulbs and halogen bulbs) |
| 6 | Electric and Electronic Tools | Drills, electric saws, sewing machines, lawn mowers, etc |

| | | |
|----|---|---|
| | | (except large stationary tools/machines) |
| 7 | Toys, Leisure, Sports, Recreational Equipment | Electric train sets, coin machines, treadmills. |
| 8 | Medical Instruments and Equipment | Medical Instruments and Equipment. |
| 9 | Surveillance and Control Equipment | Surveillance and Control Equipment. |
| 10 | Automatic Issuing Machines | Automatic Issuing Machines |

Source: Egarr & Associates and EMPA, 2010

Policy and Legislation

There is currently no legislation which specifically addresses the management of e-waste within Trinidad and Tobago. However, there exists general policies and pieces of legislation governing the disposal of waste in general and so these may be applied to the disposal of e-waste as well. These include the National Environmental Policy; the Draft Waste Management Rules 2008; the Litter Act and the Water and Sewerage Act.

E-waste Generation

At present, data regarding the generation of e-waste within Trinidad and Tobago is generally lacking as there has been limited research conducted with respect to this type of waste. However, two specific studies were carried out within recent years which served to highlight the generation of e-waste within the country. The first of these being the National Hazardous Waste Inventory conducted for the period 2004-2008 and an e-waste assessment which was conducted in 2010.

The Hazardous Waste Inventory provided data pertaining to the A1180 waste stream i.e. waste electrical and electronic assemblies or scrap. All the waste within the A1180 class consisted of electronic waste (e-waste) which contained one or more hazardous materials including lead, mercury, cadmium, copper and PCB. More specifically, the A1180 class mainly comprised discarded/retired computers, computer parts and peripherals, cell phones and batteries and other discarded electronic appliances and electronic parts. The activities generating this type of waste included the repairing of electronic equipment and appliances and the retirement of computers and other electronic appliances. Table 10 summarizes the generation of A1180 waste within Trinidad and Tobago for the period 2004-2008.

Table 10: Summary of A1180 waste generation for Trinidad and Tobago, 2004 – 2008

| YEAR | TRINIDAD & TOBAGO | | | TOBAGO | | | TRINIDAD | | |
|------|-------------------|-----------------|---|-------------|-----------------|--|-------------|-----------------|--|
| | Amount (kg) | No. of Entities | % contribution of waste stream to Total National Reported Waste | Amount (kg) | No. of Entities | % contribution of Tobago to total for Waste Stream | Amount (kg) | No. of Entities | % contribution of Trinidad to total for Waste Stream |
| 2004 | 31,788 | 45 | 0.10 | 3,887 | 11 | 12.23 | 27,901 | 34 | 87.77 |
| 2005 | 67,869 | 53 | 0.21 | 4,701 | 14 | 6.93 | 63,167 | 39 | 93.07 |
| 2006 | 33,109 | 57 | 0.10 | 4,640 | 15 | 14.01 | 28,470 | 42 | 85.99 |
| 2007 | 34,607 | 92 | 0.10 | 7,262 | 56 | 20.98 | 27,345 | 36 | 79.02 |
| 2008 | 71,070 | 96 | 0.17 | 10,631 | 39 | 14.96 | 60,440 | 57 | 85.04 |

Source: Caribbean Environmental Health Institute, 2009

From the above, it was seen that the total number of generators reporting A1180 waste gradually increased from 45 in 2004 to 57 in 2006, a sharp increase to 92 in 2007 and then to 96 in 2008. The amount of waste generated was seen to almost double between 2004 and 2005, while a significant reduction occurred between 2005 and 2006. However, the figure increased slightly in 2007 with the largest amount of waste (71, 070kg) being reported in 2008. The main reason for the increases in 2005 and 2008 was due to two large entities within Trinidad giving up/disposing of large numbers of electronic equipment in those years. Throughout the review period, Trinidad contributed between 79 -93% of the total A1180 waste stream reported, with 2005 being the year of highest contribution.

During the study period, the three sectors making the most significant contributions to the total A1180 waste generated included sector 4000: electricity, gas, steam and hot water supply (27.50%); sector 7200: computer and related activities (21.19%) and sector 6500-6600: financial intermediation (14.74%). Eleven of the 14 regional corporations within Trinidad reported A1180 waste, with the Mayaro/Rio Claro, Point Fortin and Princes Town corporations reporting none. The three regional corporations making the most significant contributions included Couva/Tabaquite/Talparo (45.60%); Port-of-Spain (24.54%) and Diego Martin (19.07%).

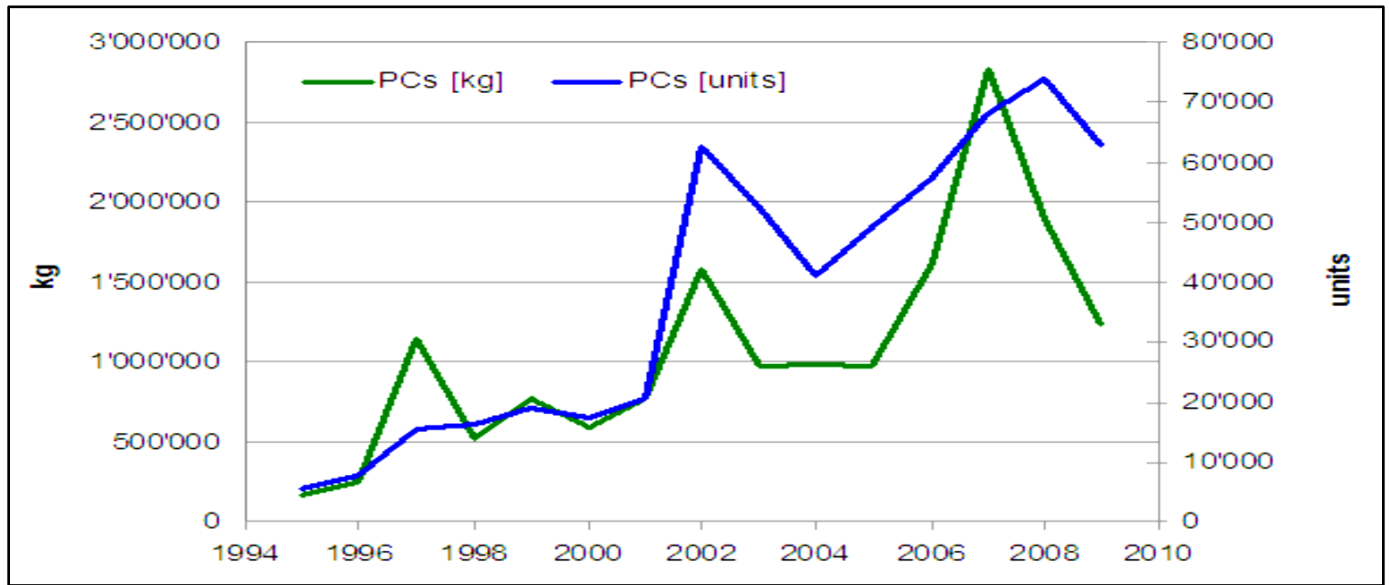
In Tobago, on the other hand, six of the seven parishes reported A1180 waste, with St.Mary reporting none. The three parishes making the most significant contributions included St.Andrew (72.49%); St.Patrick (11.83%) and St.David (8.68%).

It was found that the larger generators of A1180 waste (i.e. those generating over 1,000kg) utilised the services of waste contractors in dealing with the collection, treatment and disposal of the waste. Some of the smaller generators tended to send their waste to suppliers for the reuse/recycling of the waste as spare parts. The smaller generators when they did dispose of the waste usually did so via landfilling or by placing the waste into garbage bags to be disposed of as part of the general municipal waste stream.

In addition to the above, in 2010 an e-waste assessment was conducted in Trinidad and Tobago specifically focused on a situational analysis of e-waste management and generation with special emphasis on personal computers (PCs). This initiative was undertaken by the Government of Trinidad and Tobago, the United Nations Industrial and Development Organization (UNIDO), Microsoft (MS) and the Commonwealth Secretariat, in an attempt to determine the feasibility of establishing computer refurbishment centres within the country. It was proposed that these centres would address the recovery and distribution of refurbished PCs to small and medium enterprises (SMEs) in developing countries like that of Trinidad and Tobago. This process would involve the recovery of used PCs, refurbishment and distribution of those that can be reused and the proper disposal of the waste generated from the activities at the facility.

Stakeholders associated with the generation and management of e-waste within the country include the importers, distributors, retailers, users, repair technicians, collectors, recyclers and disposal entities. Since there is no manufacturing of PCs in Trinidad and Tobago (with the exception of small-scale assembly by individual companies), computers are mainly imported either by commercial distributors or brought into the country by individuals for personal use. Figure 18 and figure 19 illustrate the amount of computers and printers imported into Trinidad and Tobago for the period 1995-2009 and 1995-2006 respectively.

Figure 18: Imported computers (desktops and laptops) for Trinidad and Tobago, 1995-2009

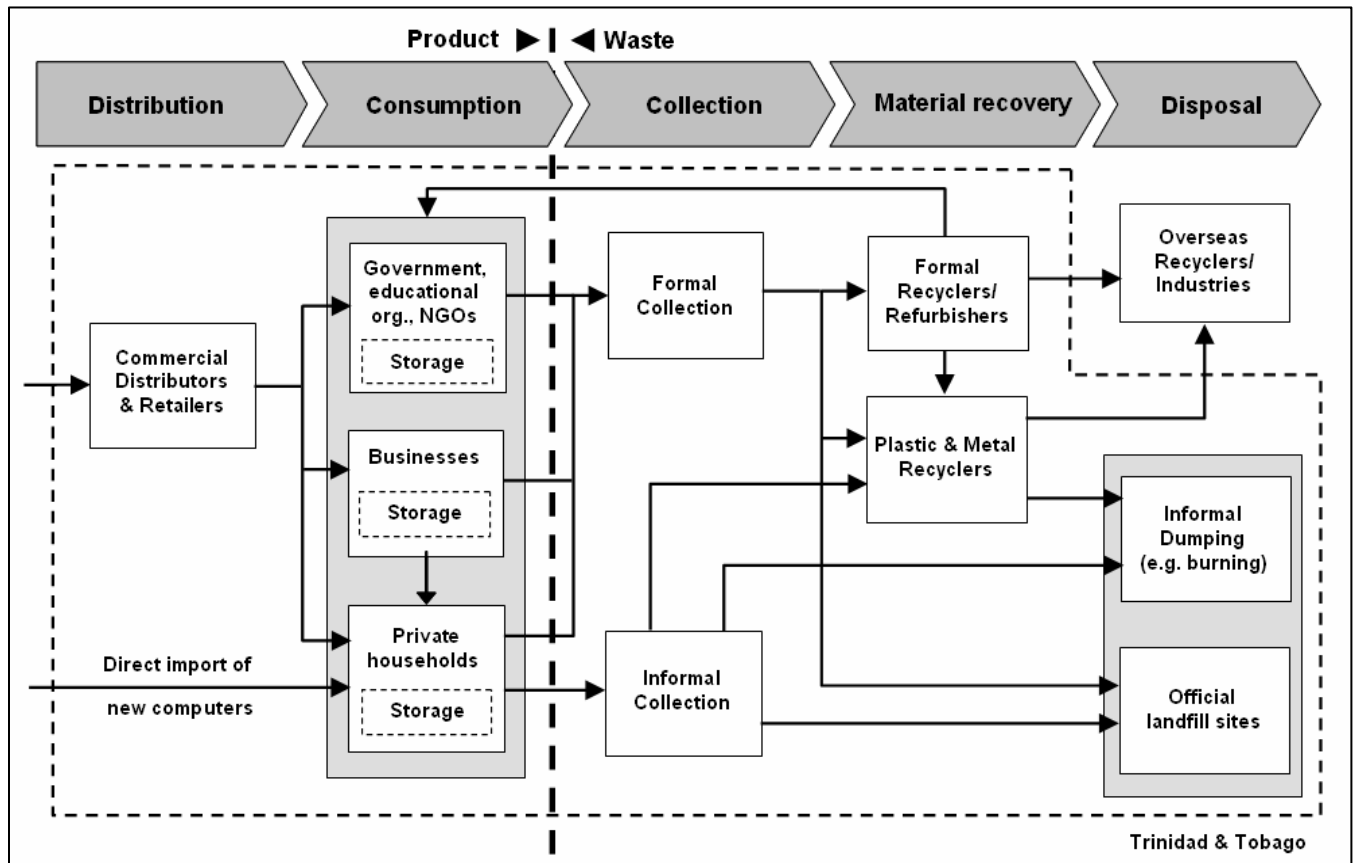


Source: Central Statistical Office, 2009.

Amidst the fluctuation, there is seen to be a general increasing trend in the number of computers imported into the country, with the highest number of imported PC units being recorded in 2008.

Figure 19 provides an overview of the typical life cycle of a computer in Trinidad and Tobago.

Figure 19: Mass flow chart for computers in Trinidad and Tobago (2009)



Source: Egarr & Associates and EMPA, 2010

From the mass flow chart it is seen that the main stages in the product life-cycle include the importation, distribution and consumption. Once the computer has approached its end-of-life, it either stays in storage at the consumer's for some time or enters the waste stream where it is dumped formally or informally. Upon request, end-of-life or discarded PCs are collected by SWMCOL and recyclers or as in the case of households, collected by contracted municipal waste collectors. In some cases, recycled/refurbished computers are donated to public institutions or sold and/or donated to households. E-waste generated by recyclers during their operations is shipped to foreign e-steward partners for processing and disposal.

In the year 2008, an estimated 30,000 computers became obsolete⁴². From this 30,000 however, only 11,000 were recorded as being recycled through a formal e-waste recycling company⁴². It is unknown as to the fate of the remaining 19,000 computers which were probably stored, donated,

⁴² Egarr & Associates and EMPA. (2010). *E-waste Assessment in Trinidad and Tobago*. A situational analysis of e-waste management and generation with special emphasis on personal computers.

passed on to an informal collector or landfilled. 30,000 PCs correspond to approximately 500 tons of waste or 0.40 kg per capita⁴². When compared to data gathered in other developing countries around the world, it is seen that the rate of computer waste generation within Trinidad and Tobago meets the level of countries such as Morocco, Chile and South Africa, while clearly exceeding generation levels in countries like Colombia, Uganda and China. In addition, the growth of obsolete computers is expected to double between 2008 and 2014 from 30,000 to 60,000 PCs per year. As such, the generation of e-waste within Trinidad and Tobago is expected to increase substantially given the rate of consumption and increasing demand for new, updated technology within the country. Specific reference can also be made to the recent initiative by the Ministry of Education in 2010, to award approximately 20,000 laptops annually to students writing the Secondary Entrance Assessment (SEA) Examination. This is expected to generate a large volume of e-waste in the form of laptops within years to come. Thus, such an increasing trend in the generation of e-waste can have detrimental effects on the environment and human health if improper recycling and inadequate disposal is allowed to prevail.

E-waste Management in Trinidad and Tobago

At present, there is no final disposal system in place for hazardous waste, inclusive of e-waste, within Trinidad and Tobago. Two of the three major landfills within the country are not lined and although the disposal of e-waste is prohibited at landfill sites, this special waste type still continues to be disposed of as part of the general municipal solid waste stream. The issue of proper e-waste management was highlighted at three national symposia hosted by SWMCOL over the period 2005 to 2007. In addition, an initiative was commenced in 2005 by SWMCOL to sensitise the public on the hazards associated with e-waste, with a system of storage of PCs being undertaken. However, in the absence of any formal system of e-waste management within the country, SWMCOL was forced to terminate the collection of end-of-life PCs due to the overwhelming response and absence of sufficient storage. Though some of the objectives regarding sensitization and education may have been achieved via these initiatives, any real development of e-waste management within the country has still not materialized. As a result, e-waste management has been limited to the recovery and some dismantling prior to final disposal of unrecovered components which are shipped to overseas processing plants.

There are currently two major recyclers of e-waste in Trinidad and Tobago and both of these companies export processed items to external markets. These recyclers as well as their recycling activities are dealt with in more detail in Chapter 6 of this report. It should be noted however that the undertakings of these e-waste recyclers have contributed to national waste diversion efforts through a reduction in the volume of waste generated for final disposal since these efforts aid in diverting the waste from landfill sites which reduces the potential for environmental pollution.

In the absence of policy and legislation needed for the efficient and sustainable management of e-waste, disposal continues to occur at landfill sites and unauthorised dumps throughout the country, thus contributing to water and land-based pollution.

Some of the main deficiencies relating to e-waste management within the country include the following:

- The unavailability of data regarding e-waste generation within the country
- The absence of and general lack of enforcement of existing policy and legislation related to hazardous waste management and by extension e-waste management
- The absence of a dedicated hazardous waste facility to facilitate the disposal of e-waste
- Lack of a clear position of manufacturers, importers and distributors regarding the extended producer responsibility
- Lack of public awareness

4.3.2 Biomedical Waste

Definition and Problem Identification

Biomedical waste as defined by the Code of Practice for Biomedical Waste Management in Trinidad and Tobago (2005) refers to “any solid or liquid waste which may present a threat of infection to humans including non-liquid tissue, body parts, blood, blood products, and body fluids from humans and other primates; laboratory and veterinary wastes which contain human disease-causing agents; and discarded sharps”.

The poor management of biomedical waste poses a serious public health risk to health care workers, waste handlers, patients and the general public, all of which may come into contact with such hazardous waste. It is therefore necessary that all biomedical waste materials be segregated at their point of generation, properly stored, appropriately treated and then safely disposed of in an environmentally sound manner. Major healthcare facilities within the country are seen to have their own on-site disposal facilities mainly in the form of incinerators and autoclaves. Such disposal facilities are also utilised by smaller generators of biomedical waste for the purpose of final disposal. On the other, there are also many generators who make use of waste contractors and municipal waste collection facilities in order to collect and dispose of their waste. Whether or not treatment occurs prior to disposal at biomedical waste generating facilities still remains unclear.

The following outlines the major health and environmental hazards associated with the poor management of biomedical waste:

Health Hazards

- Injuries from sharps to hospital personnel and waste handlers
- Manifestation of nosocomial infections in patients as a result of poor infection control and poor waste management

- Risk of infections outside hospitals for waste handlers, waste salvagers and by extension the general public
- Improper storage posing a risk to individuals coming into contact with hazardous chemicals and drugs

Environmental Hazards

Ineffective treatment and disposal of biomedical waste can result in air, water and soil pollution.

Policy and Legislation

Locally, there exist pieces of legislation which specifically address the management of biomedical waste within Trinidad and Tobago. These include the Code of Practice for Biomedical Waste Management in Trinidad and Tobago (2005) and the Infection Prevention and Control (IPC) Policies and Guidelines for Health Care Services (2011).

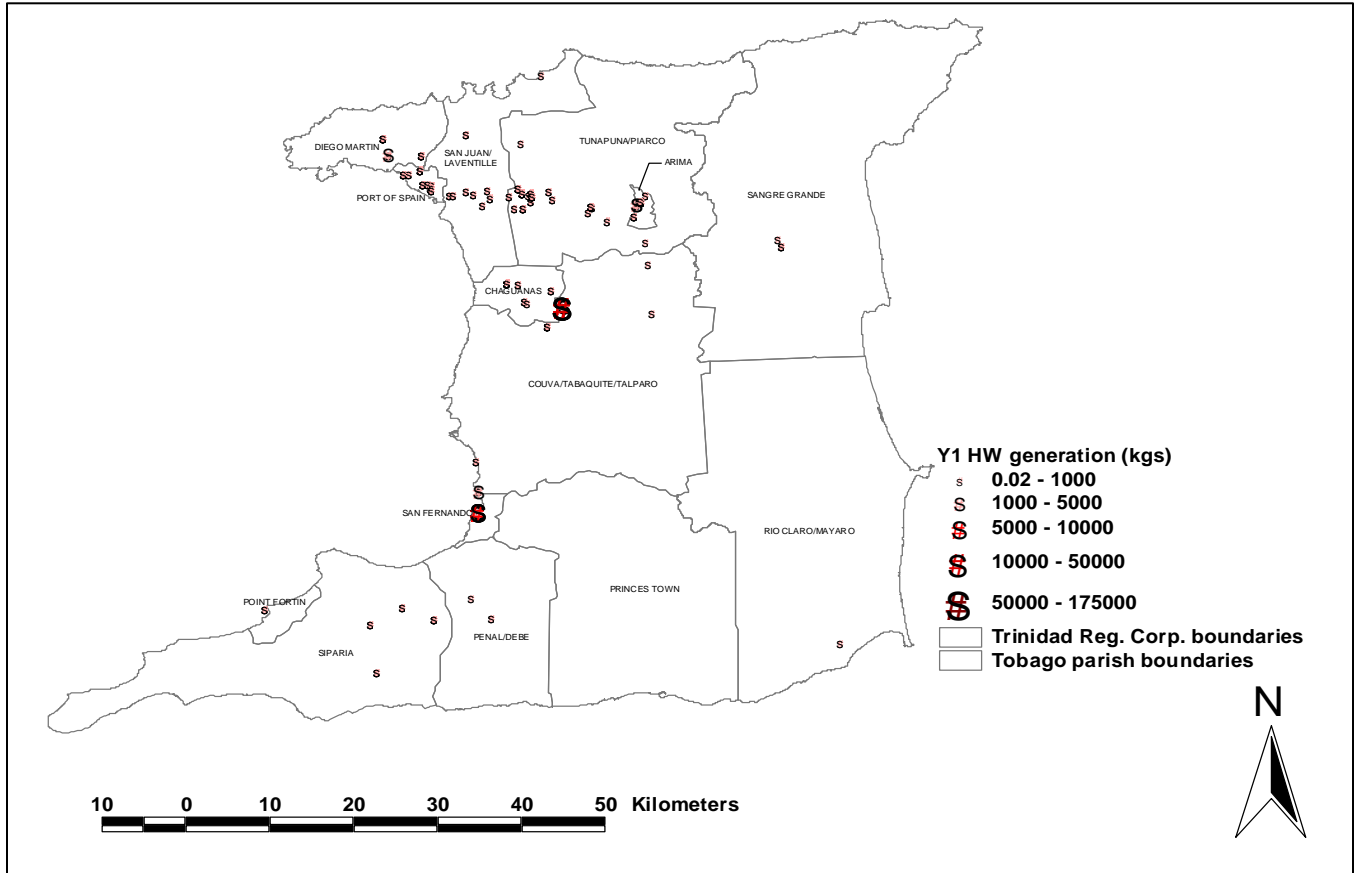
Biomedical Waste Generation

Based on the National Hazardous Waste Inventory conducted for the period 2004-2008, it was found that the Y1 waste stream (i.e. clinical wastes from medical care in hospitals, medical centres and clinics) was found to generate a total of 0.22-0.6% of waste during the period investigated. In 2008, the highest amount of Y1 waste (250, 753kg) was recorded and this was due mainly to the large amount of contaminated waste water reported from the Scarborough Regional Hospital, which was generated from its laboratories and mortuary. There was also an increase in the number of generators reporting from 44 in 2004 to 73 in 2008. It should be noted that Trinidad accounted for the majority of this type of waste generated i.e. 0.18% - 0.27% whilst Tobago only accounted for 0.14% - 0.15%.

The main types of waste constituting the Y1 waste stream consisted of animal and human body parts, body fluids including blood and urine samples, needles, syringes, special garbage bags, reagent bottles, sharps, oils, chemicals including used chemicals and those consisting of or containing dangerous substances, wash water, gloves, bandages, spent vials, radioactive and amalgam waste. The majority of waste (75%) existed in a solid or semi-solid state. All of the Y1 generators indicated that they had some sort of on-site waste storage in place including the use of specially designated areas, bio-hazard bins or specifically marked/coloured bottles or plastic bags for the solid and semisolid waste. However, no pre-treatment was carried out for this type of waste. In the case of the liquid waste, this was generally diluted with water and flushed down the drains.

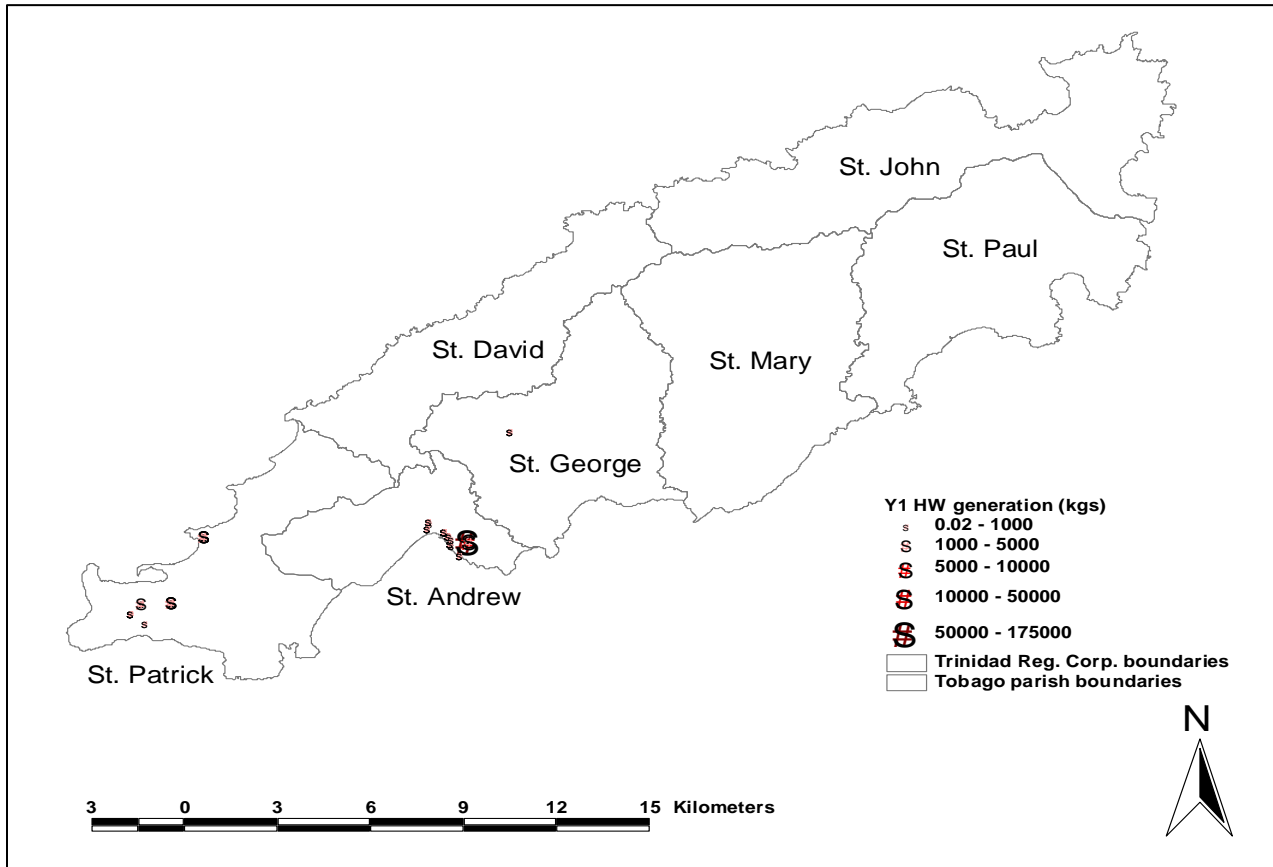
Figure 20 and figure 21 depict the spatial distribution of Y1 generation within Trinidad and Tobago respectively.

Figure 20: Spatial distribution of Y1 generation in Trinidad, 2004-2008



Source: Caribbean Environmental Health Institute, 2009

Figure 21: Spatial distribution of Y1 generation in Tobago, 2004-2008



Source: Caribbean Environmental Health Institute, 2009

The maps above indicate that for Trinidad the major generators were seen to originate from the vicinity of Chaguanas and San Fernando while in the case of Tobago, the largest generator of Y1 waste was seen to be from the Scarborough area.

Biomedical Waste Management in Trinidad and Tobago

Incineration is one of the most common disposal methods used for biomedical waste within Trinidad and Tobago. Incineration refers to the controlled burning of medical waste within a dedicated medical waste incinerator. Waste does not need to be separated or sorted prior to treatment and subsequent to treatment the resulting incinerated waste is disposed of in landfills. It should be noted that although a Code of Practice for Biomedical Waste Management in Trinidad and Tobago (2005) does exist and does provide guidelines for the treatment and disposal of biomedical waste, it is not mandatory.

While the incineration process serves as a quick, cheap method of waste disposal and provides a quick solution for a large amount of waste by substantially reducing the volume of the waste and eliminating the need for pre-processing before treatment, there are many environmental concerns

associated with this type of disposal method. The largest concern is atmospheric pollution especially through the combustion of plastics which release toxic gases. In addition, the contents of incinerator ash are also of concern since they may contain potentially toxic chemicals which become ultimately disposed of in landfills.

The main deficiencies associated with the management of biomedical waste within the country stem from the incineration process and the lack of laws and legislation to regulate the disposal of such waste. The following highlights the major weaknesses:

- Use of out-dated and malfunctioning incinerators
- Execution of incineration activities on-site at health care institutions
- Lack of regulation of incineration activities conducted by external contractors
- Lack of laws which allow for the active monitoring and compliance of public and private institutions as it regards biomedical waste management

4.4 Data: Sources and Limitations

The availability of data has always been a challenge due to the limited research which has been conducted locally. However, while studies exist that can provide an overall understanding of the state of waste generation and management within the country; these are limited by the following factors.

With respect to solid waste generation, the focus of the solid waste characterisation study was found to be on residential waste since this constituted the largest percentage of waste generated within the country. As a result, information regarding ICI generated waste was very sparse. In addition, apart from the 1995 Beetham survey, current information on the ICI waste stream was very difficult to find as the required data from any source proved to be typically anecdotal and impressionistic rather than based on actual measurement. In addition, the solid waste characterization study would have been affected by the time during which the research was carried out (i.e. during the months of April-May). As such, seasonal changes and special events (e.g. Carnival) which could otherwise affect waste composition were not accommodated for. It should also be noted that this particular study was only conducted for Trinidad and not Tobago. As such, while some of the findings may apply to Tobago, this is merely based on assumption and is therefore not definitive.

Data on hazardous waste generation was obtained from the hazardous waste inventories conducted for the period 2003 and 2004-2008. However, because these surveys were voluntary, many companies chose not to participate thus decreasing the final sample size. In addition, there tended to be a general lack of information among many of the organisations surveyed, either because reporting was not mandatory and therefore data was simply not recorded, or due to confidentiality issues on the part of the organisations. As a result, while the information

presented in the inventories helped in providing an overall idea of hazardous waste generation within the country, it should be noted that this data may be an underestimation of what is actually occurring within Trinidad and Tobago.

Waste recovery and recycling was highlighted within the report in order to provide a general understanding of the status of recycling activities within the country. However, it is important to note that this report only provides a snapshot of recycling initiatives within the country since data was retrieved from a limited number of companies. In addition, some of these establishments may not have kept proper records and so this would have affected the final quality of the data.

4.5 Waste Storage and Collection

4.5.1 Non-Hazardous Solid Waste

Storage

Proper waste storage comprises a critical aspect of any efficient waste management system since it impacts directly on: (i) public health arising out of exposure to contaminated waste, creation of breeding grounds for pests and obstruction of water and drainage channels and (ii) ecosystem health resulting from contamination and leakage of harmful waste into the environment. Over the years, as it regards waste storage prior to disposal, the country has seen a proliferation of buckets, oil drums, pesticide containers and more recently, paper and plastic bags, which have begun to create a problem due to their non-biodegradability and subsequent ability to persist in the environment⁴³. In addition, plastic garbage bags which are presently the most common method of storing waste, have proven to be especially vulnerable to human and animal attacks and also unable to accommodate certain waste items such as branches, cardboards, heavy objects and objects with sharp/pointed edges. At present, there is a lack of standardization of storage containers within the country and this has adversely affected the sanitary storage and collection of waste.

The Public Health Ordinance stipulates that all household waste be placed at curb side in a moveable metal or metal-lined receptacle not exceeding 2.5 cubic feet in capacity. Such a receptacle must be of a reasonable weight and must have a cover of similar nature. Most domestic waste is stored in plastic bags and placed in an enclosed area so as to minimise interference from dogs and other animals. However, it is also common practice, especially in rural areas, for household waste to be placed at the side of the road (not enclosed) for collection.

⁴³ Garraway, E. (1997). Changing Approaches to Solid Waste Management in Trinidad and Tobago. *Association of Professional Engineers of Trinidad and Tobago*. Port of Spain.

For commercial waste, (i.e. waste generated in city centres such as restaurants, retail outlets, etc) the size of the receptacle must not exceed 12 cubic feet in capacity, as outlined in the Regional Corporation Act. By nature, the volume of waste generated in this sector is known to vary widely and as such waste may be stored either in individual garbage bags or in bins containing bags of varying sizes. While small bins may be covered, larger bins are open and generally situated outdoors.

For industrial waste, (i.e. waste generated from manufacturing processes for paints, plastics, petrochemical, electrical, etc) there are generally two waste streams: (i) process waste and (ii) administrative/office waste. In cases where pre-treatment is required prior to disposal, such waste is dealt with separately (REF. Section 4.5.2 Hazardous Waste) Storage of industrial waste is done on the generator's property.

For bulky waste, (i.e. appliances, cars, large household furniture, etc) waste is placed either at curb side or privately transported directly to a disposal site. However, it is also common practice within the country for such waste to be indiscriminately dumped into rivers and at other unofficial dump sites.

For construction/demolition waste, private arrangements must be made by generators for storage. In most instances, such waste is left to accumulate until a sufficient quantity is reached for disposal. In the case of large generators, privately hauled 20 cubic yard bulk bins are used for temporary storage on site.

In the case of yard and garden waste, these are generally placed at the curb side in areas where a collection system has been established for this type of waste. For example, the Diego Martin Regional Corporation provides a green waste/bulky waste collection one day per week to all seven of its collection areas. In addition, the Penal/Debe Corporation also provides a green/bulky waste collection service on request and this is available for 20 days every month. In some instances this waste may be bagged (e.g. grass cuttings and leaves) or left un-bagged for collection. In other instances, the waste may be subject to informal composting practices or burnt on site. This tends to occur mostly in rural areas.

For institutional waste (i.e. waste generated from hospitals, clinics, veterinary clinics, schools and other government institutions, etc) the waste which is generated is usually stored in plastic garbage bags. However, in larger hospitals and institutions where some level of secured isolation is required for the waste generated, stationary compactors may be utilised on site.

Collection

The waste collection system in Trinidad and Tobago has experienced a series of modifications within the last 20 years, all in an attempt to cope and adapt to the changes in waste volume and composition which have occurred within the country.

In Trinidad, waste is collected three to four days per week in most residential areas and seven days per week in the town centres and at the central vegetable and meat markets. In Tobago on the other hand, waste is collected seven days per week. At present, approximately 90% of the collection function is performed by private contractors and the remaining 10% by the public sector which focuses primarily on waste collection in the town centers⁴⁴.

The Port of Spain City Council controls approximately 90% of the collection for the capital city. In addition, San Fernando, Point Fortin and Arima also perform some collection in their town centres. Private collection contractors are engaged by the Municipal and Regional Corporations through a tendering process. Such services are engaged for a three-year period and primarily address household, commercial and market waste.

Over the years, there have been significant technological advancements in collection systems with traditional manual roll-top systems being replaced by automated rear and side-loading compaction systems. In addition, increased private sector involvement has brought increased investments in new technologies such as bulk bin systems for the transport of commercial and industrial waste and stationary compactors in cases where secured waste isolation is required. At present, the main type of waste collection vehicles being utilised are rear-loading compaction vehicles, with one private contractor operating side-loading vehicles for commercial and industrial customers⁴⁵.

At present, there are approximately 266 collection districts in the country which are defined by boundaries such as rivers, access roads and foothills of mountain ranges. Collection activities for household waste are typically conducted by a crew of three workers, comprising of one driver and two loaders. Crew numbers are predominantly determined by the requirements for the use of rear-loading compactors as well as labour agreements in the varying municipalities across the country. Rear-loading trucks have an opening at the rear through which the waste collector can throw waste/garbage bags into or in some cases, empty the contents of the bins into the truck. These vehicles contain hydraulically-powered ramps which compact the waste so as to increase payload and subsequently eject the waste from the vehicle at the respective disposal site.

⁴⁴ Ministry of the Environment and Water Resources. (2011). The Environmental Policy and Planning Division

⁴⁵ Ministry of the Environment and Water Resources. (2011). The Environmental Policy and Planning Division

Domestic waste is collected free of charge whilst a collection fee is charged for institutional, commercial and industrial waste.

Except in cases where the waste volume exceeds the established quota for municipal collection, commercial clients in towns and city centres usually benefit from the service provided by the municipal corporations.

In most cases, private waste collection is conducted for industrial waste since the waste volume generated usually exceeds that required for collection by municipal corporations. On the other hand, because there is no established routine for bulky waste collection, in most instances, private arrangements are made for haulage. For construction/demolition waste, there is usually private pick-up and transport of waste to disposal sites. In very rare cases, collection arrangements are made with municipal corporations. Yard and garden waste are collected in some areas by municipal corporations whilst in other instances private arrangements may be made for collection. Institutional waste, specifically that of the major public hospitals, utilise private haulers mainly because they provide stationary compaction equipment and bulk bins needed to facilitate this type of waste. It should be noted though that although a system is supposed to exist within hospitals whereby infectious waste is appropriately stored prior to collection for incineration, there is still evidence of syringes and blood-contaminated waste entering landfill sites⁴⁶.

4.5.2 Hazardous Solid Waste

Within the past ten years, the country has seen the formation of several private sector companies to specifically deal with certain hazardous wastes in Trinidad and Tobago. Examples of these include Green Engineering, Oil Mop Environmental Services Limited, Kaizen Ltd, Envirocare, Piranha International, NB Environmental Services Ltd and Earth Ltd⁴⁷. These companies provide for the collection, treatment and disposal of hazardous wastes within the industrial sector. Some of the services offered include bioremediation of oil contaminated materials, incineration of waste chemicals, disposal of fluorescent light bulbs, recycling and disposal of electronic wastes, treatment and export of lead acid batteries and recycling of waste oil at the Petrotrin Refinery⁴⁸. In a similar manner, specific handling, collection, treatment and disposal techniques are required for biomedical waste originating from both public and private institutions such as hospitals, clinics and veterinary clinics. There exists evidence to suggest that some sort of waste separation

⁴⁶ The Trinidad and Tobago Solid Waste Management Company Limited (SWMCOL). (2000). *Solid and Hazardous Waste Management Programme for Trinidad and Tobago*

⁴⁷ Caribbean Environmental Health Institute (CEHI). (2009). *National Hazardous Waste Inventory for Trinidad and Tobago, 2004-2008*.

⁴⁸ The Trinidad and Tobago Solid Waste Management Company Limited (SWMCOL). (2000). *Solid and Hazardous Waste Management Programme for Trinidad and Tobago*

procedure is present at some institutions, whereby the biomedical waste generated is separated according to waste type and bag colour, prior to disposal.

4.6 WASTE DISPOSAL

4.6.1 Landfill Sites

There are nine solid waste disposal sites within Trinidad and Tobago. Comprising these nine sites are: the large public landfills, where the majority of solid waste generated in the country is disposed of and of which there are three in Trinidad and one in Tobago; smaller regional landfills dispersed throughout Trinidad and; a single private landfill. The following details the public landfill sites in Trinidad and Tobago⁴⁹:

TRINIDAD

❖ Beetham Landfill

The Beetham landfill is the largest landfill site in the country having an area of approximately 92 hectares and receiving an estimated 458 tonnes of general waste/day. It has been in operation for over thirty years, being under the management of SWMCOL since 1983. The site is located south of the Beetham Highway within the Caroni Swamp which is an ecologically sensitive site protected under the Ramsar Convention. Prior to the mid-1980s, the site served as an open burning dump site. At present, this landfill serves the northwest region.

❖ Forres Park Landfill

The Forres Park landfill is the second largest landfill in the country having an area of approximately 22 hectares and receiving an estimated 243 tonnes of general waste/day. This site has been in operation since 1983 and is also managed by SWMCOL. It is the only landfill designed to operate using engineering principles. The site has a leachate collection system running throughout the centre of the landfill and draining into a leachate pond. The site was constructed on several metres of naturally formed compacted clay and has groundwater monitoring wells incorporated as part of its infrastructure. In addition, cover material is excavated from an embankment located along the landfill's boundary. This landfill serves the central and southern regions.

❖ Guanapo Landfill

The Guanapo landfill is the smallest landfill site within the country having an area of approximately 12 hectares and receiving approximately 132 tonnes of general waste/day. The site has been operated by SWMCOL since 1983 and is located at the foothills of the Northern Range (Guanapo Heights), about 2km east of Arima. Initial development of the Guanapo landfill accommodated for expansion of the site, however, due to encroachment by squatters this has not

⁴⁹ Ministry of the Environment and Water Resources. (2011). The Environmental Policy and Planning Division.

been achieved. There are a number of physical constraints plaguing the site and these include depth of overburden, presence of adjacent homes and a failing main access road. Scavenging is also a common problem. This landfill site serves the north eastern areas of the country.

TOBAGO

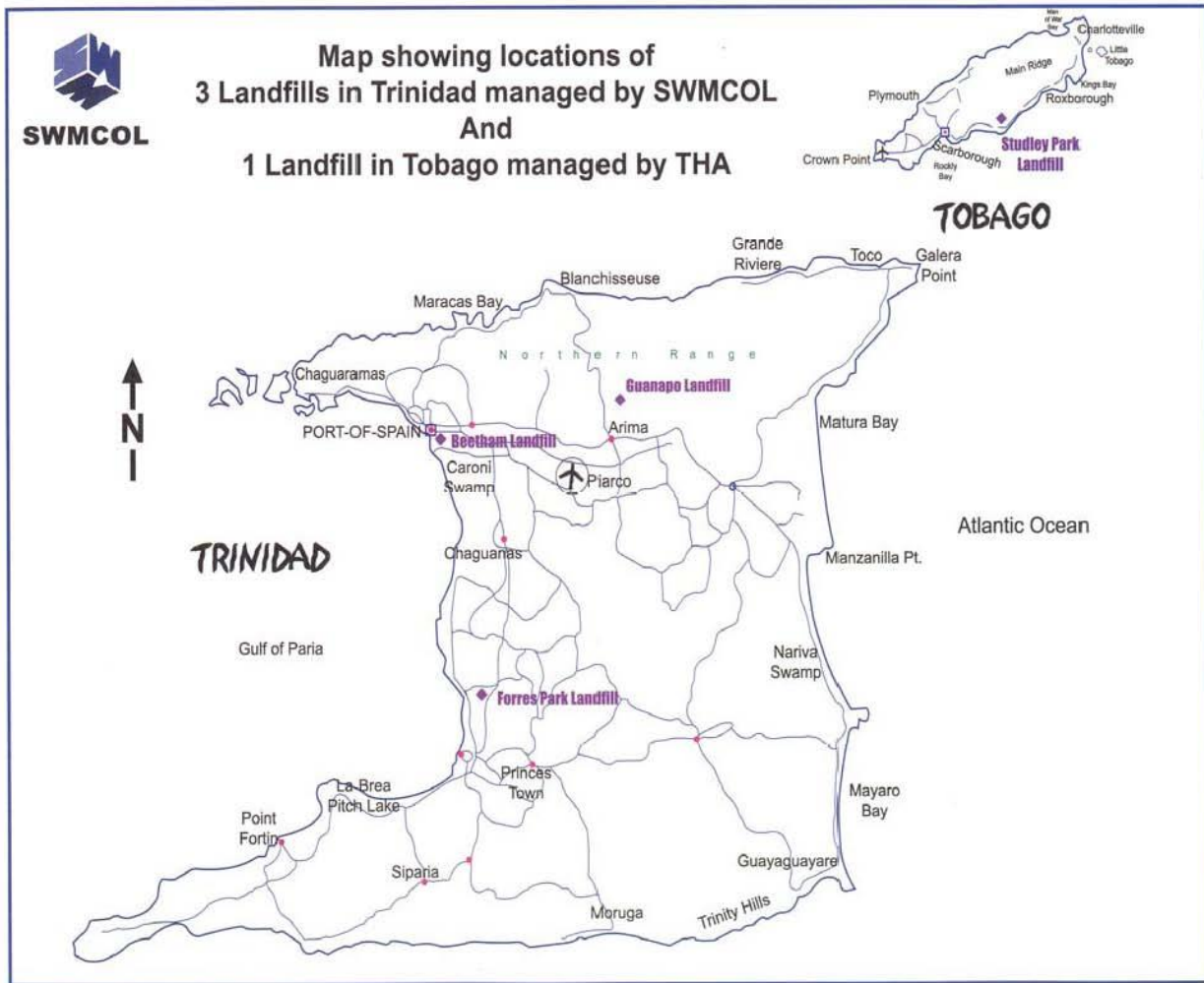
❖ Studley Park Integrated Facility

The Studley Park Integrated Facility houses the only public landfill in Tobago. It is located on the southern coast of the island and is operated by the Tobago House of Assembly (THA). This site was constructed between 1984-1985 and serves as an integrated facility comprising of a sanitary landfill which was originally designed to service Tobago for 20 years and to accommodate: (i) an average of 7,360 tonnes of solid waste per year and (ii) an oily waste collection facility and a faecal waste disposal system designed to house 2,600m³ of faecal waste per year. At present, the site primarily accepts municipal waste and utilizes the trench method of disposal followed by the use of on-site material for the covering of compacted wastes. Special waste such as tyres, white goods and construction debris are diverted and stockpiled away from active tipping areas. In addition, organic waste is segregated into windrows subsequent to which composting can occur. Biomedical and abattoir wastes are also accepted and isolated for burying⁵⁰.

Figure 22 depicts the locations of each of the above named public landfill sites throughout Trinidad and Tobago.

⁵⁰ Egarr and Associates. (2010). *A Proposal for a Solid Waste Characterization Study for Tobago*.

Figure 22: Location of Public Landfill Sites within Trinidad and Tobago



Source: SWMCOL, 2011

In addition to the above, there also exist five other active solid waste disposal sites located within Trinidad. Four are under the jurisdiction of the regional corporations and one is privately owned mainly because of the lack of legislation regarding the establishment and operation of landfills and disposal sites in Trinidad and Tobago. These sites are as follows:

❖ Toco

The Toco site occupies an area of three hectares and has been in operation since 1969. It is located in the Melajo Forest Reserve adjacent to a nature reserve and within the vicinity of a wildlife sanctuary. The site drains into a channel which discharges on the western side of the forest and which has been blocked by loose waste, thus resulting in flooding to the north of the site during periods of extreme rainfall. The site is also plagued by vultures feeding on food exposed due to a lack of cover material at the site. Scavenging by local villagers is also common

and there have been complaints by those located west of the landfill of offensive odours, leachate and runoff emanating from the site.

❖ Blanchisseuse

The Blanchisseuse site is situated in the hills of the Northern Range and has been in operation for the past ten years. The site occupies private lands which slope about 60 degrees thus impeding the site's ability to accommodate proper landfill operations. The surrounding lands comprise of natural forest and agricultural holdings, with drainage from the landfill terminating in the nearby forest. In addition, there is limited cover material at the site and burning of waste is also known to occur. Salvaging however has not been observed.

❖ Cedros

The Cedros landfill is located in the county of St. Patrick east of the town of Bonasse. The site is situated within a mangrove swamp. Due to the lack of cover material available at the site, waste is mostly left uncovered. Waste is also commonly burnt so as to reduce waste volumes. It is believed that the leachate which is generated from the site is allowed to wash into the swamp, thus posing a threat to human and ecological health. Salvagers are also known to frequent the site, although there is recent indication that use of the site has been reduced and/or prohibited.

❖ Los Bajos

The Los Bajos site has been in operation for the past ten years and is situated in close proximity to the forest, thus creating a risk to forest vegetation and wildlife. This is so since the site drains into the nearby forest and is cluttered with uncovered waste so leading to surface water contamination. In addition, operations at the site are known to result in gas production as well as elevated noise levels. Waste is reduced on site via burning and salvaging.

Lastly, there is one privately managed waste disposal facility at Guapo, Point Fortin and this facility deals with waste originating from the Point Fortin Borough and the Municipality of Siparia. It is located on lands owned by the Petroleum Company of Trinidad and Tobago (PETROTRIN). Prior to its use as a disposal site, the land was utilized for oil exploration following which disposal operations commenced in 1991. However, at present, there is no cover material on site while fires as well as salvaging activities are known to occur regularly.



Guapo dumpsite located in Point Fortin. The only privately operated solid waste disposal site in Trinidad

Source: EMA Annual Report, 2005

Of the nine solid waste disposal sites located within Trinidad and Tobago, only the Forres Park Landfill (Trinidad) and Studley Park Landfill (Tobago) are engineered landfills. Such a lack of environmental control systems within the majority of the landfill sites therefore allows for the migration of leachate and landfill gases into the island's fragile ecosystem. Especially in the case of the Beetham landfill; although being the largest landfill site in the country, there is no system in place to contain its harmful by-products. Box 1.0 further highlights the adverse effects of the Beetham Landfill on human health and the environment.

Box 1: Beetham Landfill and its Associated Effects

The Beetham Landfill is located within a local, protected wetland i.e. the Caroni Swamp. Although this is an ecologically sensitive area, there is no system in place to protect the surrounding ecosystem from the toxic substances released from the landfill.

In close proximity to the Beetham Landfill is the Beetham Estates which is a low income settlement directly impacted upon by the negative effects of the landfill. Methane fires have been a recurring problem at the landfill, with the resulting emissions directed towards adjacent communities as well as commuters utilising the Beetham Highway. In May 1999, a fire of unknown origin was started at the landfill site. Due to the nature of the solid waste encountered at the site (i.e. rubber tyres, batteries, plastics, metal cans, cloth, scrap metal, etc) the fire soon became uncontrollable, emitting toxic fumes. These fumes potentially posed a health hazard to over 4,000 inhabitants of the nearby Beetham settlement. Subsequent air quality testing at the landfill revealed that nitrogen oxide emissions and sulphur dioxide levels were above that recommended by the United States Environmental Protection Agency (USEPA). It is also suspected that ground water contamination via leachate from the landfill may be adversely affecting the nearby community. However, this has not been investigated or documented to date.

Modified open dumping techniques are evident at the landfill, with sporadic covering of incoming waste leading to bug and animal infestation, inclusive of significant presence of vultures on-site. There is also a distinct stench emanating from the landfill which inter alia creates a major public nuisance. Further compounding the situation is the strong presence of a salvaging contingent at the Beetham Landfill who because of the nature of their work, are exposed to major health risks as a result of their direct contact with waste at the site. Illegal activities, such as robbery and general harassment of incoming drivers along with violence amongst the salvagers themselves, are also known to occur.

Hazardous Waste Disposal

As it relates to hazardous waste disposal, there is currently no dedicated hazardous waste landfill or disposal facility within the country to accommodate this type of waste. As such, a substantial percentage of the hazardous waste which is generated is usually disposed of either as part of the general municipal solid waste stream or indiscriminately dumped.

Based on observations made during execution of the 2004-2008 National Hazardous Waste Inventory for Trinidad and Tobago, it was reported that larger organisations as well as organisations in the oil and gas and petrochemical sectors, tended to manage their waste in an

environmentally friendly manner. As such, the majority of these organisations utilised the services of waste contractors which demonstrated good environmental stewardship. There was also some indication that the larger generators of hazardous waste were taking steps aimed at reducing the potential impacts of hazardous waste generation, storage, treatment and final disposal on human health and the environment. On the other hand, smaller generators (in terms of volume) of hazardous waste generally exhibited low levels of environmentally friendly behavior as it pertained to hazardous waste treatment and disposal. This was especially apparent in Tobago where generators displayed a lack of/low level of awareness of the impacts of hazardous waste on human health and the environment. The preferred means of disposal of liquid waste and in particular Y6 (wastes from the production, formulation, and use of organic solvents), Y8 (waste mineral oils unfit for their originally intended use), Y9 (waste oils/water, hydrocarbons/water mixtures, emulsions) and Y35 (basic solutions or bases in solid form) waste streams by most generators in Tobago and smaller operators in Trinidad, was found to be via direct disposal into drains and water ways, with very little indication of pre-treatment of these waste streams prior to disposal.

Several private sector companies have been established to provide services in the disposal of certain categories of hazardous wastes. In addition, SWMCOL which has responsibility for the management of landfills within the country, disposes of special waste streams at a cost to such generators. However, this system is mostly unregulated and examples of hazardous waste disposed of include waste oils and oil contaminated materials, waste chemicals, fluorescent light bulbs, waste electrical and electronic equipment used lead-acid batteries, asbestos and spent catalysts⁵¹.

4.6.2 Incineration

Incinerators are predominantly used by the major hospitals in Trinidad and Tobago in order to dispose of biomedical waste, with most being situated on-site at these hospitals. Incinerators are also utilised by private establishments (e.g. crematoriums) to dispose of waste as well.

Incinerators are known to emit numerous toxic substances, with residues such as fly and bottom ash requiring disposal at landfill sites. When medical waste is burnt, it emits a number of pollutants such as carbon monoxide/ carbon dioxide, particulate matter, hydrochloric acid, toxic heavy metals and volatile organic compounds. One of the major problems with on-site hospital incinerators is the age of the incinerator used. Most of the incinerators being presently utilized are very old and as a result do not possess pollution control equipment and often have low stack heights which allow emissions to remain close to the ground and surrounding areas. In addition, these incinerators were originally designed to burn only pathological waste. However, as the composition of the biomedical waste stream continues to evolve, a large amount of disposables

⁵¹ Basel Convention Regional Centre for Training and Technology Transfer for the Caribbean Region. "Hazardous Waste Management in Trinidad and Tobago." n.d.

such as plastics and lightweight metals have also been included in the incineration process. Such a situation poses a serious risk both to the public and the environment.



Source: N. Ramsewak, 2011

Smoke being emitted as a result of incineration at one of the country's public hospitals. The black smoke produced is indicative of incomplete combustion

4.6.3 Waste Exportation and Importation

Based on the National Hazardous Waste Inventory conducted for Trinidad and Tobago for the period 2004-2008, it was reported that a total volume of approximately 29,276 tonnes of hazardous waste was exported within the five years investigated. The majority of waste exported consisted of lead acid batteries (37.9%), ferrous and non-ferrous material from smelting (37.6%) and lead/lead compounds (19.6%).

Table 11 summarizes the types of hazardous wastes as well as the individual export quantities exported for 2004-2008.

Table 11: Summary of export quantities and types of hazardous wastes exported for the period 2004-2008

| Waste Type | Waste Stream Y Code | Export (tonnes) | Quantities |
|---|------------------------|--------------------|------------|
| Expired Drugs | Y3 | 0.005 | |
| Ferrous and non-ferrous material from smelting | Y17 | 11,000 | |
| Copper Compound (spent catalysts) | Y22 | 723 | |
| Zinc Compound | Y23 | 167 | |
| Lead; lead compounds | Y31 | 5,750 | |
| Lead Acid Batteries | A1160 | 11,100 | |
| Nickel | A2030 | 536 | |
| TOTAL AMOUNT EXPORTED : 29, 276.005 Tonnes | | | |

Source: Caribbean Environmental Health Institute, 2009

The export of the waste was carried out by established hazardous waste export contractors, with the waste being exported mainly to the United States of America (USA) and Venezuela. The export depots are located in Port of Spain and at the Point Lisas Industrial Estate. In addition, recovery options for the wastes within the importing countries, i.e. USA and Venezuela, were identified as the recovery of components from catalysts and recycling of acid batteries.

The only importation data recorded for hazardous waste for 2004-2008, was that of 1.5 tonnes of lead acid batteries which was shipped from Tobago to Trinidad in 2008 to be recycled. Apart from this there were no other reported cases of hazardous waste importation for this period.

The EMA being the competent authority for the transboundary movement of waste is responsible for processing all notifications of waste to be exported, imported or in transit with respect to Trinidad and Tobago. The following data was derived from notification forms received by the EMA for the period 2009-2011:

Table 12: Summary of export quantities and types of hazardous wastes exported for the period 2009-2011

| Waste Type | Waste Stream Y Code | Export Quantities (tonnes) |
|---|------------------------|----------------------------|
| Used Engine Oils | Y9 | 2, 880 |
| Waste Lithium Batteries | Y34 | 4 |
| Lead Acid Batteries | A1160 | 22, 200 |
| E-waste | A1180 | 200 |
| Hydroxyl Ethyl Cellulose, Lignite, Ethylene glycol, Gilsonite | - | 2.728 |
| TOTAL AMOUNT EXPORTED : 25, 286.728 Tonnes | | |

Source: Environmental Management Authority, 2011

A total of 25,286.728 tonnes of hazardous waste was recorded as being exported during the three year period of 2009-2011. Of this amount, lead acid batteries accounted for almost 88% of the total waste exported. Waste was exported mainly to countries such as Canada, Venezuela, Barbados, Nepal, Israel, Peru and Singapore.

The only importation data for the period 2009-2011, was that of 1,728 tonnes of drained lead acid batteries which was imported from Jamaica into Trinidad and Tobago in 2010.

4.6.4 Illegal Dumping

Illegal dumping is quite common throughout the country as is evident by the abundance of unofficial, illegal dump sites. Within rural areas, these sites are most commonly found at or around abandoned estates, in accessible areas of forest reserves, in swamps and along river courses. In urban areas, on the other hand, garbage is most prevalent in uncovered drains, unattended lots and on the sides of streets and sidewalks.

Illegal dumping directly impacts upon public health. For example, an accumulation of illegally dumped special waste items such as tyres, abandoned vehicles and appliances can increase the potential for insect-borne diseases, due to the deposit of water into these items which provides a breeding ground for insects, especially mosquitoes. In addition, illegal dumping interferes with proper drainage through the accumulation of debris such as plastic bottles and styrofoam containers, thus making certain areas more prone to flooding.



Litter accumulated within a broken pavement located in the borough of Arima causing a public nuisance to pedestrians.

Source: EMA



Source: EMA

Illegal dumping of waste in front of a vacant building located on a main street in the commercial area of Arima.

5.0 CONSEQUENCES OF IMPROPER WASTE TREATMENT AND DISPOSAL

Proper waste management practices comprise an integral part of public health and environmental protection. As such, the improper disposal and treatment of solid and hazardous waste can have significant environmental, health and socio-economic impacts.

5.1 Environmental Impact

The most adverse environmental impacts resulting from improper solid and hazardous waste management can be attributed to inadequate or incomplete collection and recovery of recyclable/reusable waste as well as co-disposal of hazardous and solid waste items. Environmental impacts also originate from the inappropriate siting, design, operation and maintenance of dumps and landfill sites. The following highlights the main environmental impacts emanating from improper waste disposal and treatment:

- Ground and Surface Water Contamination

Leachate originating from dumps and landfills may contain toxic materials and pathogenic organisms which in the case of unlined landfills can easily contaminate ground and surface water.

- Release of greenhouse gases and other air pollutants

As waste decomposes within landfills, methane is generated. This greenhouse gas is more efficient at trapping heat in the atmosphere as compared to carbon dioxide, thus giving it a higher global warming potential (GWP)⁵². In addition, open burning, which is done at most landfills in order to reduce the volume of waste at these sites, is known to create thick smoke comprising of carbon monoxide, soot and nitrogen oxide, all of which can adversely affect human health in the form of respiratory diseases. The general air quality of surrounding areas is also degraded as a result of such burning.

- Damage to Ecosystems

Illegal dumping of solid and hazardous waste, especially into waterways, can have detrimental effects on marine life through the alteration of aquatic habitats. For example, marine species can ingest or become entangled in waste, especially in the form of plastics, which can result in death. In addition, organic wastes because of their high nutrient content may also deplete the dissolved oxygen content in water bodies, thus reducing the availability of oxygen to fish and other aquatic life. Solids can also cause sedimentation which can alter stream flow and bottom habitat. In the case of hazardous waste, chemical contamination may result in lethal and sub-lethal toxic effects on marine species. This can disrupt biological communities since key organisms may be affected in the form of bioaccumulation or other food chain interruptions. The siting of dumps and landfills within sensitive ecosystems can also adversely affect ecosystem dynamics and increase the vulnerability of such ecosystems to becoming damaged.

⁵² United States Environmental Protection Agency (USEPA). (2008). *High Global Warming Potential (GWP) Gases*. Retrieved from <http://www.epa.gov/highgwp/scientific.html>

Box 2: Marine Litter

Marine pollution is presently one of the greatest threats facing local marine biodiversity. Such pollution exists in the form of litter/solid waste and toxic/hazardous waste. Litter/solid waste emanates from the improper disposal of consumer goods and inadequate waste collection and disposal infrastructure. It is comprised mainly of plastic bags, plastic and glass bottles, packaging containers and styrofoam products.

Toxic/hazardous waste on the other hand, originates mainly from land-based industrial operations and landfills/dumps which leak toxic substances.

Marine litter, whether washed up on beaches or floating in the ocean, can severely impact upon marine life, particularly via entanglement and ingestion. This is so since in most cases waste debris tends to resemble the natural prey of many marine organisms. For example, sea turtles are susceptible to swallowing plastic bags because they resemble jelly fish. Plastic is not digestible and once it enters the stomach of animals it accumulates and clogs the intestines resulting in immediate death or causing malnutrition and disease until death. The direct impacts of marine debris are not only limited to mobile organisms but also affect immobile organisms such as plants which can become smothered by plastic bags and fishing nets. In addition, coral reefs can be easily damaged by derelict fishing gear which may break or suffocate corals.

Marine litter can also significantly impact upon economies and the health of inhabitants residing within coastal communities. In addition, the presence of hazardous material and medical waste in the form of syringes and other sharp and/or dangerous debris within the country's water ways and on seashores, can adversely impact upon public health.

As it relates to local initiatives which have been taken to reduce the amount of marine debris within the country's waterways, apart from the ICC's annual beach clean-up which (as mentioned earlier) serves to remove solid waste discarded/accumulated on beaches, in December of 2011, CEPEP Marine was formed to aid in the removal of marine litter. However, this body is so far only focused on waters located on the western side of Trinidad.

There have been numerous incidents locally involving the mismanagement of hazardous wastes that has led to this issue being highlighted at a national level. Such mismanagement has included incidents of oil spills both inland and offshore, the indiscriminate dumping of lead-containing waste, the unsafe and improper removal of asbestos-containing materials and the establishment of hazardous waste generating industries locally. Box 3 below highlights an incident which occurred in Demerara Road, Wallerfield involving the dumping of lead-contaminated waste.

Box 3: Case Study of Lead Waste Contamination in Wallerfield, East Trinidad

In 1993, lead contamination was reported to have occurred in a community located on Demerara Road, Wallerfield in East Trinidad. The problem was initially identified following the hospitalisation of several children displaying symptoms of lead poisoning. The situation arose as a result of the illicit dumping of lead-contaminated waste within the area resulting in contaminated soils. Lead contaminated fill was also used to repair roads within the community and villagers also mined the fill in search of lead pellets to be used as fishing sinkers. This incident gained national attention leading to the intervention of the EMA, given the human health and environmental risks which were posed by the presence of such hazardous waste. Immediate health care, evacuation of residents, permanent resettlement and land decontamination and remediation of lead “hot spots” throughout the community had to be carried out in order to mitigate against the effects of the improper disposal of this type of hazardous waste.

5.2 Health Impact

The public health threat posed by improper waste disposal is greater for tropical countries as opposed to temperate regions due to increased biological degradation rates and conditions favouring the growth of pathogenic organisms. In addition, solid waste that is not properly collected and/or disposed of can serve as breeding grounds for insects, vermin and scavenging animals which can transmit air and water-borne diseases. This is especially problematic within landfills lacking adequate cover material. Examples of diseases which can be spread include gastroenteritis, leptospirosis and salmonella. In the case of mosquitoes, dengue, malaria and yellow fever may be transmitted.

5.3 Impact on Social Development

The social consequences of poor sanitary conditions resulting from improper waste management are usually directly and indirectly linked to health and environmental consequences. In most instances, the problem of improper waste disposal and treatment is exacerbated by rapid rates of urbanization which results in increased density and the emergence of slums which encompasses communities largely underserved with basic infrastructure and services, inclusive of waste collection and sanitation.

It should be noted that poor living environments can have particularly far-reaching consequences for children and adolescents who may be more vulnerable to the effects of improper waste disposal and treatment as compared to adults, since they are more likely to be affected in ways

that have longer-term repercussions. In the same manner, sanitation solutions which may be able to accommodate adults may sometimes be impractical for children.

Salvaging activities occurring at waste disposal sites is usually accompanied by issues of violence and insecurity. In some cases violence may ensue amongst the salvagers themselves whilst in other instances it may be imposed on the wider public.

In addition, the poor state of sanitation and the physical living environment of communities in close proximity to improperly managed waste disposal sites can have implications for community characterization and stigmatisation. For example, residents of poor urban communities with poor infrastructure and unsanitary physical environments usually face stigmatisation by the wider public which can adversely affect the development of such communities.

6.0 PROMOTING SUSTAINABLE WASTE MANAGEMENT IN TRINIDAD AND TOBAGO

6.1 Strengths and Weaknesses of the Current Waste Management System

In 2010, it was estimated that Trinidad and Tobago generated 700,000 tonnes of solid waste⁵³. This figure indicated a 24% increase in daily waste generation between 2005 and 2010. On the other hand, it was also estimated that for the year 2008, approximately 41,888.76 tonnes of hazardous waste was generated, representing a 265% increase from 2003. Such increases in waste generation can be attributed to the rapid rate of economic growth, consumption and urbanization which has been occurring within the country. Waste management is especially important in Trinidad which is highly industrialized and Tobago where the success of the tourism industry can be severely affected by poor waste management practices. However, although waste generation has increased over the years, there is still currently no integrated waste management strategy in place to holistically and cohesively manage the volume and types of waste being generated within Trinidad and Tobago.

Several factors affect the effectiveness and efficiency at which waste management services are executed and these include institutional, legislative, technical and financial aspects. The following highlights the major strengths and weaknesses which exist within the current waste management system:

⁵³CBCL Limited. (2010). *Trinidad Solid Waste Management Program Waste Characterization and Centroid Study*. Ministry of Local Government.

❖ **Legislation and Enforcement**

In recent years, the GoRTT has undertaken several initiatives aimed at strengthening the strategic framework for solid waste management within Trinidad and Tobago. These include the Code of Practice for Biomedical Waste Management in Trinidad and Tobago (2005), the National Environmental Policy (2006), the Draft Municipal Solid Waste Management Policy (2008) and the Draft Waste Management Rules (2008). In addition, the draft Beverage Container Bill which was amended in 2011, seeks to treat with the collection of beverage containers in order to reduce their disposal in the environment and so combat any subsequent pollution and waste management problems which may arise. Box 4 further highlights the main aspects of the Beverage Container Bill. The GoRTT has also embarked on the development of an integrated solid waste/resource management policy for Trinidad and Tobago, which is aimed at formulating and effecting a sustainable integrated solid waste management programme for the country. The proposed policy seeks to integrate socio-cultural, environmental and economic factors; pursue strategies for waste prevention and minimization; promote public awareness and involvement in waste-related matters and facilitate partnerships amongst public, private and community stakeholders.

Box 4: National Waste Reduction through Draft Beverage Container Bill

In 1998, a study was commissioned by the Environmental Management Authority (EMA) to evaluate the economic feasibility of introducing a Deposit Refund System (DRS) for Beverage Containers (BC) in Trinidad and Tobago. The study identified benefits (aesthetic and atmospheric) which resulted from a reduction in pollution due to a reduction in litter/improper disposal of beverage containers into the environment. In that, the reuse and recycling of beverage containers was seen to incur lower energy costs as opposed to the utilisation of virgin material in manufacturing new bottles. Other benefits included a substantial reduction in flooding which would have been otherwise caused by clogging of drains and waterways by beverage containers. The Beverage Container Bill therefore seeks to provide for the regulation of the sale of beverages in sealable containers through the implementation of a payment of a deposit on prescribed classes of beverage containers and subsequent refund of the deposit on the return of the respective reusable and recyclable beverage container. Other administrative and fiscal measures will also be implemented so as to encourage the continuous reuse and recycling of beverage containers, thus reducing their disposal into the environment.

However, notwithstanding the above, achieving sustainable waste management within the country has still proven to be a major challenge due to the poor legislative framework which currently exists and which is exacerbated by the slow implementation of proposed waste initiatives. The latter may be owed to the lack of prominence of waste management at a national level which can be partly attributed to the absence of a national institution to exclusively deal with waste management and so have the authority to highlight waste issues nationally. There also presently exists a general lack of legislation which is needed to effectively manage waste within the country. This is seen especially in the area of special waste management (e.g. e-waste) for which there is the absence of appropriate legislation and supporting regulation.

In addition, the existing legislation does not comprehensively address current waste management issues such as hazardous waste management and waste minimization. There is also a general lack of enforcement of existing laws and legislation. This is especially evident, for example, through significant littering which is seen throughout the country and which can be attributed to a lack of enforcement of the Litter Act. The major deficiencies which exist within the present legal regulatory framework include the use of inconsistent terminology, lack of definition, low penalties and the general use and application of old and out-dated concepts.

❖ **Institutional Framework**

As mentioned earlier, one major constraint to the waste management process is the absence of a single institution/agency to exclusively deal with the management of waste within Trinidad and Tobago. Although the EMA was established to manage and address environmental issues within the country, waste responsibilities are still divided and shared across a myriad of ministries, statutory bodies and governmental agencies. This results in either a duplication of efforts or neglect in certain areas. As such, because existing legislation is distributed across several different institutions and agencies, implementation and enforcement becomes increasingly difficult and fragmented. This can be owed to the fact that existing institutions do not have the capacity or authority to effectively execute policies.

❖ **Waste Disposal**

Solid Waste

Despite the fact that landfilling continues to be the country's primary method of solid waste disposal, with the exception of the Forres Park and Studley Park landfills, there exist no other engineered landfills within Trinidad and Tobago. In addition, the three public landfills within Trinidad, all of which have passed the average 20-year lifespan which is recommended for operation of a landfill, operate at low levels of efficiency and pose health and security risks to those entering and operating within these facilities⁵⁴. It should also be noted that the majority of

⁵⁴ Binger, A. (2011). Economic Opportunities in Waste Management in Small Island Developing States (SIDS). *CSD Intercessional Conference on Building Partnerships for moving towards Zero Waste*. Tokyo.

waste disposal sites lack essential environmental engineering infrastructure such as leachate management systems, gas vents, surface and groundwater monitoring wells and protective liners⁵⁵. These sites have thus transformed into potential pollution points as they have not been engineered to facilitate the waste which they house.

Waste diversion efforts, especially those that have been effected by the private sector and non-governmental organisations, have had minimal impact on the solid waste being deposited at landfill sites. However, because national efforts have been predominantly geared towards waste disposal rather than waste minimisation, this has resulted in a build-up of comingled waste which is yet to be managed. Such mismanagement of waste at disposal sites can have detrimental effects on the country, especially in the case of a small island developing state like Trinidad and Tobago, where land mass and resources are limited.

There is also increasing evidence to suggest the presence of household hazardous waste, waste generated by commercial and industrial activities, biomedical waste and e-waste at landfills. This existing practice of landfilling all different types of waste not only threatens the ecology of such disposal sites but also poses a major threat to public health. In addition to the above, there also exist within the country significant littering and illegal dumping, both of which contribute to the blockage of drains, flooding and the breeding and harbouring of vectors.

Hazardous Waste

The treatment and disposal of hazardous wastes is of major concern, especially in Trinidad where there is a heavy reliance on the petrochemical, industrial and manufacturing sectors and in Tobago where there is a heavy reliance on the tourism industry. In addition to hazardous wastes generated from industrial activity, the country's three major hospitals; private clinics; medical laboratories; vehicles; the agricultural sector and domestic sector all generate hazardous waste as well⁵⁶. There have been efforts both at a national and international level to manage the volume and type of hazardous waste generated within the country (as detailed in Section 3.0) and of those previously mentioned the following are noteworthy:

- Ratification of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal in 1994, which inter alia, aims to reduce the transboundary movement of hazardous wastes while promoting the environmentally sound management of such waste generated within countries.

⁵⁵ Pan American Health Organization (PAHO). (2003). *Regional Evaluation Municipal Solid Waste Management Services. Country Analytical Report Trinidad and Tobago - Evaluation 2002.*

⁵⁶ Caribbean Environmental Health Institute (CEHI). (2009). *National Hazardous Waste Inventory for Trinidad and Tobago, 2004-2008.*

- Development of the Draft Waste Management Rules in 2008, which seeks to regulate the storage, treatment and disposal of hazardous waste through the use of waste handling permits and also encompasses rules for the registration of generators of hazardous wastes. The rules also address the safe transport (importation or exportation) of hazardous waste.

In addition to the above, several national studies have been conducted within the country in order to evaluate and provide a broader understanding of the state of hazardous waste generation within Trinidad and Tobago. Some of the main studies include a Pre-feasibility Study on the Management of Hazardous and Oily Wastes in Trinidad and Tobago (1998), A Pollutant Inventory Study for Trinidad and Tobago (1998), An Inventory of Obsolete Pesticides and Toxic Chemicals for Disposal in Trinidad and Tobago (1999), A report on the Sources and Environmental Levels of Persistent Toxic Substances in Trinidad and Tobago (2002) and a National Hazardous Waste Inventory for Trinidad and Tobago for the periods 2003 and 2004-2008 (2009).

However, although the volume of hazardous waste generated within the country continues to increase, Trinidad and Tobago still lacks an environmentally sound waste management strategy. As there are currently no legal provisions for the separation of waste prior to disposal, hazardous waste continues to be disposed of within local landfills.

In addition, in the case of hazardous waste which is produced from the oil refining process, landfarming is the primary method used in managing refinery wastes which contain significant levels of toxic metals including lead and cadmium. However, although landfarming degrades some of the oil wastes via biodegradation, there is evidence to suggest that a substantial volume of the wastes is lost through percolation into the ground and through volatilization. Furthermore, land which is utilized for landfarming is permanently lost for any future use and can adversely impact on surrounding land and local communities. As such, it is of vital importance that the country pursue a more environmentally sustainable method of treating with hazardous waste produced from oil and gas activities, especially given that alternative economical treatment technologies do exist.

On the other hand, as it regards biomedical waste, incineration is currently the most common method of disposal. There is also evidence to suggest that sorting of biomedical waste prior to disposal is carried out by certain institutions. However, although a Code of Practice for Biomedical Waste Management in Trinidad and Tobago (2005) does exist, it is not mandatory and so while some institutions adhere to the disposal guidelines provided, there still exist a significant number of medical institutions which do not. Though other methods of biomedical waste treatment and disposal (such as autoclaving, sterilization by irradiation, chemical disinfection, gas/vapour sterilization and thermal inactivation) are available, these may not be

feasible for Trinidad and Tobago since most of these methods require the use of landfills. As such, given that the country has already overflowing landfills and dumpsites exacerbated by the availability of limited land space, the incineration process seems most feasible as it significantly reduces the volume of post-incineration waste to be disposed of via landfilling. In addition, incineration is relatively fast, cheap and does not require highly skilled labour. It should be noted however that at present, the incineration process within the country remains highly flawed and unregulated. For example, incineration activities are seen to occur on-site within hospitals and this can have an adverse impact on public health. Most incinerators also do not have an ash collection device which results in large volumes of ash and smoke being emitted. Additionally, many local incinerators are not properly functional and do not achieve the desirable temperatures required to completely destroy pathogens. On the other hand, for incineration activities which are outsourced and so occur off-site, these are usually unregulated and not monitored.

While many private sector companies have been established to deal with the collection, treatment and disposal of hazardous waste, there is still evidence to suggest the indiscriminate dumping and release of hazardous waste into local water ways and at local landfill sites, constituting part of the municipal solid waste stream. Apart from household hazardous waste such as batteries and common cleaning chemical containers, biomedical waste and electronic waste (e-waste) have also emerged as major concerns within recent years, as there is no dedicated facility for the treatment of toxic and hazardous waste within the country.

❖ Waste Recovery and Recycling

At present, the country recognises the existence of both formal (private sector and NGOs) and informal (salvaging activities) waste recovery and recycling. As mentioned earlier, waste recovery is done both at the source of waste generation and at landfill sites with there being a significant salvager presence at the public landfills. It is common practice for men, women and children to be seen rummaging through waste in order to salvage items for economic gains. Such an activity however can severely threaten the health of salvagers and pose a threat to the wider community.

Formal waste recovery on the other hand is carried out mainly by small and medium enterprises. Items such as paper, cardboard, glass, plastics and metals are commonly recovered and processed for recycling. In addition, within recent years, the country has also seen the emergence of e-waste recovery and recycling. Private sector initiatives in waste recovery and recycling are therefore commendable as industries continue to expand and evolve. Current recycling operations within Trinidad and Tobago will be more comprehensively addressed in the following chapter.

Regrettably, waste management within the country has been focused on waste disposal rather than waste minimisation via waste recovery and recycling. As a result, both the formal and informal sectors are yet to be incorporated and guided by a national framework which prescribes environmental standards for operations and which could lead to more sustainable rewards for individuals operating within these sectors.

❖ **Public Awareness and Education**

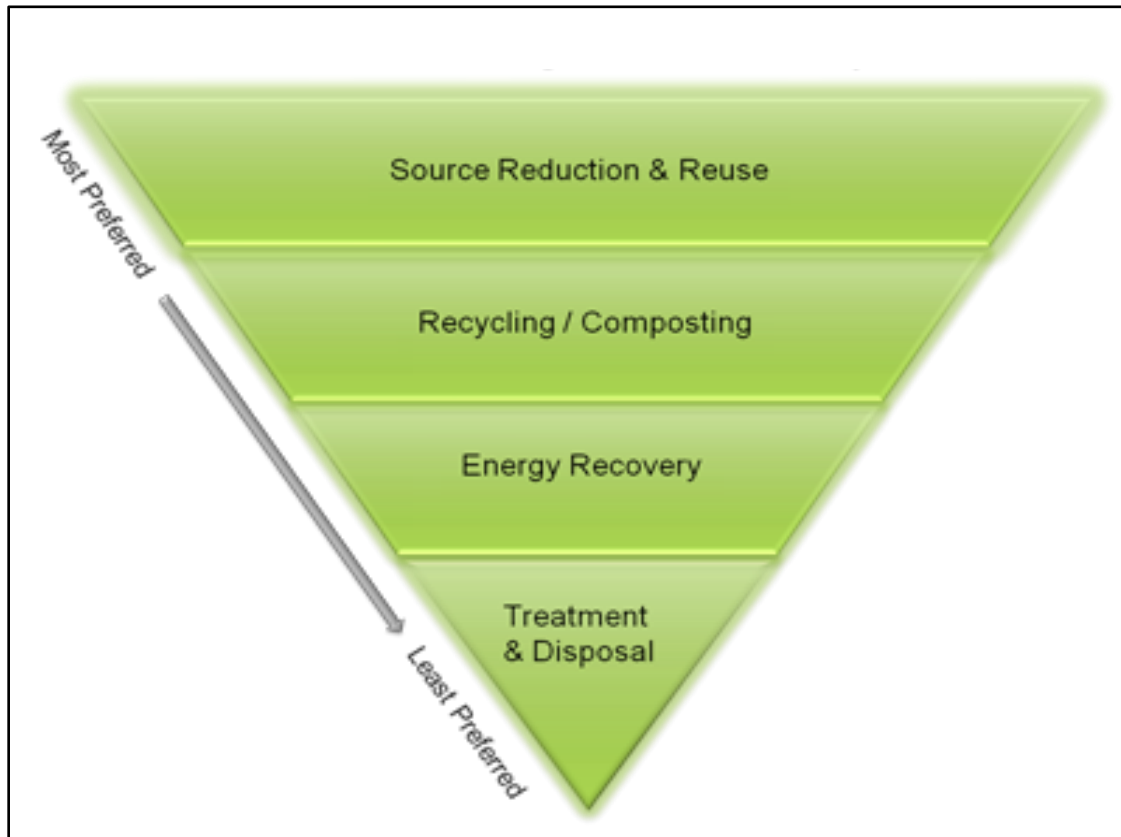
In order to effectively promote sustainable waste management within Trinidad and Tobago, there needs to be put in place a rigorous public education campaign aimed at changing patterns and attitudes regarding waste-related issues. The “Chase Charlie away” programme which was executed by SWMCOL in the 1980s, was the last major anti-litter campaign executed within the country. Since then, there has been no national programme of such a magnitude to promote environmental education and sensitization within the country. Instead, initiatives aimed at increasing public awareness have been limited to advertisements and activities highlighted as short-term clean-up exercises by NGOs and the private sector. In addition, environmental education, which would encompass waste-related issues, still remains optional and not mandatory within schools.

As such, achieving attitudinal change not only necessitates sustained educational effort but also requires the participation and active involvement of all stakeholders in order to ensure the successful transformation of the current waste management sector into one which is more environmentally sustainable.

6.2 Waste Minimisation Strategies

The effective management of solid waste within Trinidad and Tobago requires an integrated approach which, inter alia, takes cognizance of the rate and direction of production activities, exploits opportunities for the environmentally sound treatment and disposal of different waste types and includes the collaboration of all key stakeholders including consumers, producers and the government. More importantly, recycling should not be seen as an alternative to managing solid waste but more so as an integral element of an integrated system. The following depicts the typical waste management hierarchy.

Figure 23: Waste Hierarchy



Source: United States Environmental Protection Agency, 2011

Source Reduction and Reuse

Source reduction and reuse also known as waste prevention refers to the reduction of waste at the source. This may take the form of reusing items, reduced packaging and product redesign. Although the practice of product reuse tends to dominate in the beverage container industry, it can also be employed to incorporate other items such as plastic containers, shopping bags and gift wrap. Some factors accounting for the low frequency of reuse of certain products include urbanization, increased standard of living, changes in product design and rising infrastructure cost of refillable systems⁵⁷.

Source reduction initiatives are usually focused on reducing the rate of waste generation with most efforts being directed towards:

- Reducing waste generation volumes through technology changes
- Encouraging the production of easily recyclable products
- The redesign of products, material use changes and restrictions on specific product types
- Reducing the toxicity of waste

⁵⁷ Ministry of Planning and Development with responsibility for the Environment. (1999). *To formulate a Strategy for the development of the Recycling Industry*. The Recycling Steering Committee.

Recycling/Composting

Recycling refers to the collection of used or unused items that would otherwise be considered waste, the sorting and processing of such recyclable items into raw materials and the remanufacturing of these recycled raw materials into new products. There are two basic approaches to collecting recyclables and these include either the separation of recyclable items at the source of generation and subsequent transport to recycling enterprises (local and/or foreign) or the collection of mixed/comingled waste and subsequent separation into recyclable and non-recyclable material at a central processing facility. Prior separation at the waste generation source however, has the advantage of recyclable items not being contaminated by other waste products. In the past, recycling activities have tended to focus on non-biodegradable materials such as glass, metal, plastic, etc. which account for a substantial portion of the solid waste stream and which contribute largely to the saturation of landfill sites.

Composting on the other hand, is an organic process through which solid waste is biodegraded through the metabolic activities of micro-organisms. It usually involves the composting of food scraps, yard/garden trimmings and other organic materials. Simple composting can be carried out by residents and at sanitary landfills.

Energy Recovery

Energy recovery from waste refers to the conversion of non-recyclable waste material into useable heat, electricity or fuel through a variety of processes including combustion, gasification, pyrolyzation, anaerobic digestion and landfill gas (LFG) recovery. This process is often referred to as waste-to-energy (WTE)⁵⁸.

Treatment and Disposal

Landfilling is the predominant method of waste disposal used locally to treat with all different types of waste. Even residues originating from composting and incineration are required to be disposed via landfilling. Landfills however should be engineered and operated in a manner so as to protect human health and the environment. Landfill gas (LFG) produced from the anaerobic decomposition of organic matter can be recovered with the accompanying methane burned either with or without energy recovery so as to reduce GHG emissions.

Incineration is also a common method of disposal locally, especially with respect to biomedical waste. It involves the thermal destruction of waste through controlled burning at high temperatures and can reduce the volume of disposed waste by up to 90%. Typically, incineration without energy recovery (as is the situation locally) is not a preferred option due to high costs

⁵⁸ United States Environmental Protection Agency (USEPA). (2011, January 15th). *U.S. Environmental Protection Agency*. Retrieved September 05th, 2011, from <http://www.epa.gov/wastes/nonhaz/municipal/hierarchy.html>

and pollution effects. In addition, the use of inefficient incinerators and combustion of certain materials such as plastics can result in adverse health and environmental effects.

Open burning is also known to occur at some landfill sites in order to reduce waste volumes. However, this is particularly discouraged due to the severe air pollution associated with such low temperature combustion.

The State of Recycling within Trinidad and Tobago

Being a small island developing state (SIDS), Trinidad and Tobago faces the challenge of limited land space thus making the reduction in the amount of waste entering the country's landfills a top priority. However, efforts geared towards waste minimization have been minimal with the recycling industry within the country still being regrettably underdeveloped. Contributing to this is the fact that the citizenry themselves do not place value on enlightened waste disposal practices and this may be owed to a general lack of public awareness within the country.

In 2011, a study⁵⁹ was conducted locally in order to ascertain the state of awareness of recycling in Trinidad and Tobago. Questionnaires were distributed to 500 randomly selected participants within eight counties (i.e. Nariva, Victoria, St. Patrick, St. George, St. David, St. Andrew, Mayaro and Caroni) throughout the country. Based on the results of the study, it was highlighted that recycling was currently being practiced to varying degrees in households throughout Trinidad and Tobago. Although respondents generally believed that recycling was somehow related to more effective use of resources, they were not fully convinced that recycling would lead to a better environment. This suggested a greater demand for public health education and awareness as it relates to recycling activities. Glass, electrical appliances, electronics and lead automobile batteries were found to be the main items donated to recycling agencies. On the other hand, paper was found to be the most re-used item. The current perception seems to be that economic benefits derived from recycling are not considered as being financially lucrative and this may be the main reason why respondents were hesitant to recycle. As such, the study suggested a greater need for public awareness programmes so as to foster greater participation and involvement in recycling, thus endorsing the recycling culture among all stakeholders. The following were found to be the main perceived barriers to recycling within the country:

- Recycling requires a lot of time in order to sort items.
- Inconvenient location of recycling bins prevents the use of such bins.
- Recycling companies require large amounts of recyclable items which may not be obtained from individual households, especially in cases where households require these items to be picked up promptly since when left for too long they may pose a risk to public health.

⁵⁹ Patron, D. (2011, January). The State of Awareness of Recycling in Trinidad : Implications for Sustainable Use of Resources. *HSE Quarterly*, pp. 8-16.

- The economic benefits of recycling are perceived as being low thus discouraging prospective investors and entrepreneurs.

At present, there are several private organisations involved in material recovery and recycling. While glass and steel are regarded as the main two recyclable materials, other items such as plastics, paper, non-ferrous and ferrous metals and e-waste are also recovered and either recycled locally or shipped to foreign countries for processing. Most of the sorting and separation of recyclable from non-recyclable items is carried out at the landfills by salvagers and this is known to be very risky for those individuals involved in such sorting of waste.

The existing waste recovery and recycling activities within Trinidad and Tobago comprises both formal (small and medium private sector businesses and NGOs) and informal sectors (individual salvaging activities on and off landfill sites). The following highlights these sectors and their contribution to waste diversion within the country.

❖ **Formal Recycling Sector: Current Recycling Operations within Trinidad and Tobago**

At present, the main recycling operations being conducted locally are those involving the recycling of paper, plastics, glass, metal and e-waste.

1. Paper

Trinidad currently houses the only paper mill within the English-speaking Caribbean i.e. Grand Bay Paper Products Ltd. This mill plays a critical role in the local recycling of paper through the conversion of waste paper into new paper in the form of napkins, facial tissues, paper towels, etc. In addition, the mill utilizes a water recycling stream whereby through various clarification processes, water is continuously treated and reused. An average of 17% of the total waste paper utilized is obtained from local suppliers whilst the majority of 83% is obtained from foreign suppliers.

One of the major paper recycling companies within Trinidad and Tobago is that of Ace Recycling Limited which currently serves over 500 clients. The company indicated an average collection of 13,500,000 pounds of waste paper/year (approximately 6, 123 tonnes), with an observed increase in annual totals over the years. In addition, it was also indicated that the company's customer base was seen to be expanding with an average increase of 50-100 customers per year. All of the paper which is collected by Ace Recycling is done so free of charge and is obtained locally from both commercial and household sources. The paper collected is transported to the company's facility where it is sorted by grade, compressed into units called "bales" and shipped to paper mills. Approximately 20% of the paper collected is sold to the local paper mill while the remaining 80% is exported to countries such as Korea, Taiwan, China, Italy,

Indonesia, India, Mexico, Dominican Republic and Columbia. Ace Recycling also offers free off-site shredding of confidential documents.

In addition, SWMCOL has also been involved in the collection, sorting, bailing and sale of consumer waste paper for recycling as feedstock at paper mills. The company also offers shredding facilities for used paper containing confidential information. Like Ace Recycling, both recycling and shredding services are offered free of charge to the public. All of the paper recycled is sourced locally with special emphasis on output from commercial and industrial entities. However, estimated totals by SWMCOL for waste paper collected in Trinidad indicated a decrease in the amount of paper collected from 758 pounds in 2010 to 520 pounds in 2011. Such a decrease may have been due to the general lack of public awareness within the country regarding paper recycling.

While the figures highlighted above may mean little to those not involved in paper recycling, it is worth noting the significant difference which paper recycling makes. In that, recycling just one tonne of paper reduces 587 pounds of pollution, saves 5.06 cubic yards of landfill space as well as 4, 077 kilowatt hours of energy and preserves 17 mature trees from being harvested⁶⁰.

2. Plastic

Plastikeep, which was started in 2010, is a non-profit organisation whose service allows for the facilitation of plastic recovery. At present, it is the only organisation within Trinidad and Tobago which provides for the collection of separated post-consumer plastics from the general public. Since its inception, Plastikeep has successfully installed recycling bins (mainly within North Western Trinidad), established a recycling system and educated the public on proper plastic disposal and recycling. The public is usually required to rinse, crush and bag the plastic for collection prior to disposal into Plastikeep bins. Upon collection, the plastic is then transported to a processing facility where it is sorted, weighed, chipped, baled and exported to a foreign recycling facility. Bins are strategically located within various communities, schools and designated recycling areas. It is important to note that eight months into the launch of the Plastikeep recycling program (i.e. May 2010-January 2011) 20,000 pounds of material was collected of which an estimated 85% (17,000 pounds) was found to be reusable/recyclable plastic. In addition, for the entire period of 2010-2011, a total of 28, 764 kg of plastic waste material were collected. Plastikeep has also been involved in public education geared towards informing communities, the general public and corporate entities about the importance of proper disposal of waste plastic.

Secure Recycling Limited (SRL) has been involved in the small-scale recycling of cardboard, aluminium cans and plastic films for almost four years. All of the material is sourced locally,

⁶⁰ ACE Recycling Limited (Personal Communication, 2011)

mainly from commercial enterprises, in particular the beverage sector. Sorting and baling is done on-site after which the material is transported to the company to be shipped to foreign markets mainly in south-east Asia. The company indicated figures of 92, 253 and 115 metric tonnes of plastic for the years 2009, 2010 and 2011 respectively. The decline in 2011 was as a result of the organization losing one of its major clients to a competitor.

3. Glass

In 1989, the structure of glass recycling within the country underwent a significant change whereby the local glass manufacturer Carib Glassworks Limited, in a joint venture with existing salvagers and SWMCOL, adopted a participatory approach so as to incorporate major stakeholders into the glass recycling process. From this initiative, the United Bottles Vendors Association (UBVA) was formed and consisted mainly of salvagers at the Beetham Landfill Site. Carib Glassworks provided training as well as a vehicle to assist the UBVA with transportation. On the other hand, SWMCOL allowed salvagers controlled access to waste containing high glass content and also provided site administration and infrastructure of sheds and utilities in order to accommodate the processing of glass material. It was estimated that this initiative resulted in a recovery rate of 20% (as opposed to the previous 5%) of the annual total amount of glass reaching the country's three major landfills. Most of the glass recovered was seen to originate from the Beetham Landfill.

Attempts to retrieve current data related to glass recycling activities within the country proved futile due to the unwillingness of the respective organisation to participate. However, it is known that at present the only deposit-refund system in place within the country is that related to glass bottles. In such a system there is an added charge/deposit associated with the purchase of Carib beer for example, where upon return of the glass bottle, the customer is refunded. On the other hand, if an individual chooses not to return the bottle, he/she would have already paid for polluting in the form of the deposit. It is common practice within the country for individuals (mostly the homeless) to be seen collecting discarded glass bottles which are subsequently traded in for a refund. Recycling and reprocessing of glass is carried out locally by Carib Glassworks Limited and this reduces the cost of importing raw materials. In addition, unlike other substances such as paper, glass can be recycled infinitely without any loss in purity or quality.

In order to encourage and promote glass recycling amongst the nation's citizenry, several glass recycling bins have been placed throughout the country in order to facilitate the collection of glass bottles from the general public. Additionally, economic incentives such as that of the deposit-refund system greatly aid in encouraging consumer participation in recycling efforts through the return of recyclable items which further results in less dumping into the natural environment.

4. Metal

Premier Metals has been involved in the recycling of non-ferrous metal for almost 12 years. All metal is sourced locally with the largest sources currently being the electricity and telecommunications sector. Other sources of metal include the automotive sector (e.g. car engines, rims, transmissions, etc.), the construction sector, scrap iron dealers and households. Upon collection, the metal is sorted into difference grades to be exported to countries such as China, Taiwan, Korea and Holland. It was indicated that in 2008 the market price for metals began to drop, so resulting in a plummet in recycling activities for the company. Although prices began to gradually increase from 2009 up until 2011, the annual recycling totals for these years were still lower when compared to those in 2007 as there was a lower demand for scrap metal. Table 13 illustrates estimated figures for the years 2007 and 2011 as reported by Premier Metals.

Table 13: Summary of the amount of metal recycled by Premier Metals for the years 2007 and 2011

| Type of Metal | Total Annual Amount Recycled (Metric Tonnes) | |
|--------------------------|--|------|
| | 2007 | 2011 |
| Aluminium | 368 | 263 |
| Dry Batteries | 243 | 174 |
| Brass | 67 | 48 |
| Copper | 126 | 90 |
| Electric Motors | 35 | 25 |
| Insulated Copper Wire | 36 | 26 |
| Insulated Aluminium Wire | 161 | 115 |
| Automotive Radiators | 35 | 25 |
| Stainless Steel | 36 | 26 |

From the above, it is seen that the annual recycled amounts for 2011 were seen to have decreased by about 40% when compared to those figures for 2007. Such a decrease can be attributed both to a decrease in demand for scrap metal and increased competition resulting from an influx of foreign dealers into the country who have set up businesses thus competing with local recyclers. Ross & Sons Recycling and Salvage Limited has also been involved in the local recycling of ferrous and non-ferrous metal. The main sources from which material is bought include commercial (65%), household (20-25%) and salvagers (10%). It was reported that on average about 100 tonnes of ferrous metal and 50 tonnes of non-ferrous metal is received by the company per month. Of all the material collected, 100% is sold locally: 75% to local wholesalers and 25% to a local exporter. The company indicated a relatively consistent amount of material being received for recycling over the years. However, it was also pointed out that because the largest

source of material is the constructor sector, the success of the business is largely determined by the state of the local economy.

Based on data from the Trinidad and Tobago Scrap Iron Dealers Association (TTSIDA), it was reported that at a national level, approximately 8, 400 containers of scrap metal, amounting to 184, 800 tonnes is exported annually. Only scrap iron however is allowed for export. Scrap iron prices are known to vary depending on the world market price, the time of year and the destination of the metal.

In August of 2011, during the State of Emergency within Trinidad and Tobago, the local scrap metal industry suffered losses when exporting of scrap metal was prohibited for two weeks along with tons of scrap iron being removed from local scrap dealers within the Beetham Gardens. Within recent years, local scrap iron dealers have also expressed concerns over the migration of foreign dealers into Trinidad and Tobago to establish scrap metal yards thus competing with local dealers.

At present, the recovery of scrap metal is governed by the Old Metal and Marine Stores Act Chapter 84:07 which only addresses the management of ferrous material and not non-ferrous material such as copper, brass and aluminium, all of which are also actively recovered for recycling within the country. As such, this legislation is insufficient as it does not adequately reflect how the scrap metal industry within the country currently operates.

5. E-waste

The two main recyclers of e-waste within Trinidad and Tobago are Piranha International Ltd and Caribbean Tech Disposals Ltd. Both companies collect e-waste obtained solely from local sources such as government and private institutions and in some cases households. The items collected are shipped to foreign, external markets for further processing. The major types of e-waste collected by both recyclers consist mainly of monitors, CPUs and keyboards. In addition, Piranha also reported high amounts of computer mouse devices and networking equipment while Caribbean Tech Disposals reported a high influx of toner cartridges and florescent tubes.

Communication with both recyclers indicated a general increase in e-waste recycling over the years with Piranha International specifically estimating an increase of 28 metric tonnes in 2006 to 283 metric tonnes in 2011. However, there still exist many challenges facing local e-waste recyclers which are yet to be addressed at a national level. One of the major challenges includes the general lack of public awareness regarding the adverse effects of improperly disposed e-waste on human health and the environment. As a result, it is still common practice in Trinidad and Tobago for e-waste to be discarded at landfills or illegally dumped at remote locations. Especially of concern is the disposal of fluorescent tubes which are changed every six months by

most buildings and which contain mercury, thus rendering them particularly hazardous to both human health and the environment.

In addition, because there is no legislation specifically addressing e-waste disposal, e-waste recyclers are left to operate in a culture where there is no need/urgency to partake in e-waste recycling, with the private and public sector being hesitant to participate and pay for a service which is viewed as being non-essential. It was also indicated that most companies are hesitant to recycle due to the cost attached especially since recycling is not zero rated and so VAT is additionally charged. According to feedback received from Caribbean Tech Disposals, only recently are persons willingly contacting the company for quotes related to disposal of their equipment. However, most times the company has to make great efforts to explain the benefits of recycling and so encourage the wider public to utilise the service provided for e-waste recycling. The environmental footprint of a refrigerator, computer or any other electronic device can be significantly reduced if recycled in an environmentally sound manner. As such, e-waste recycling plays a vital role in conserving already limited landfill space and preventing the contamination of soil and water by toxic and hazardous substances contained within electronic devices.

In summary, there have been few and isolated efforts with respect to recycling within the country. This highlights and reiterates the need for greater collaborative efforts aimed at reducing the volume of waste generated through reuse and recycling. Waste should be viewed as a resource whereby recovery activities are seen to generate revenue whilst at the same time achieving waste reduction and prevention, with minimal risk to public health and the environment. Past studies have shown that over 80% of residential waste is recyclable with this waste stream representing two thirds of the overall waste generated within Trinidad. Organics, paper, paper board and plastics represent over 70% of the waste generated in Tobago. Considering the country's limited land space and increased waste generation rates, there is an urgent need to minimise the amount of waste reaching the nation's landfills. As such, the development of the recycling industry within Trinidad and Tobago needs to be pursued aggressively so that waste can be managed in a sustainable and environmentally sound manner.

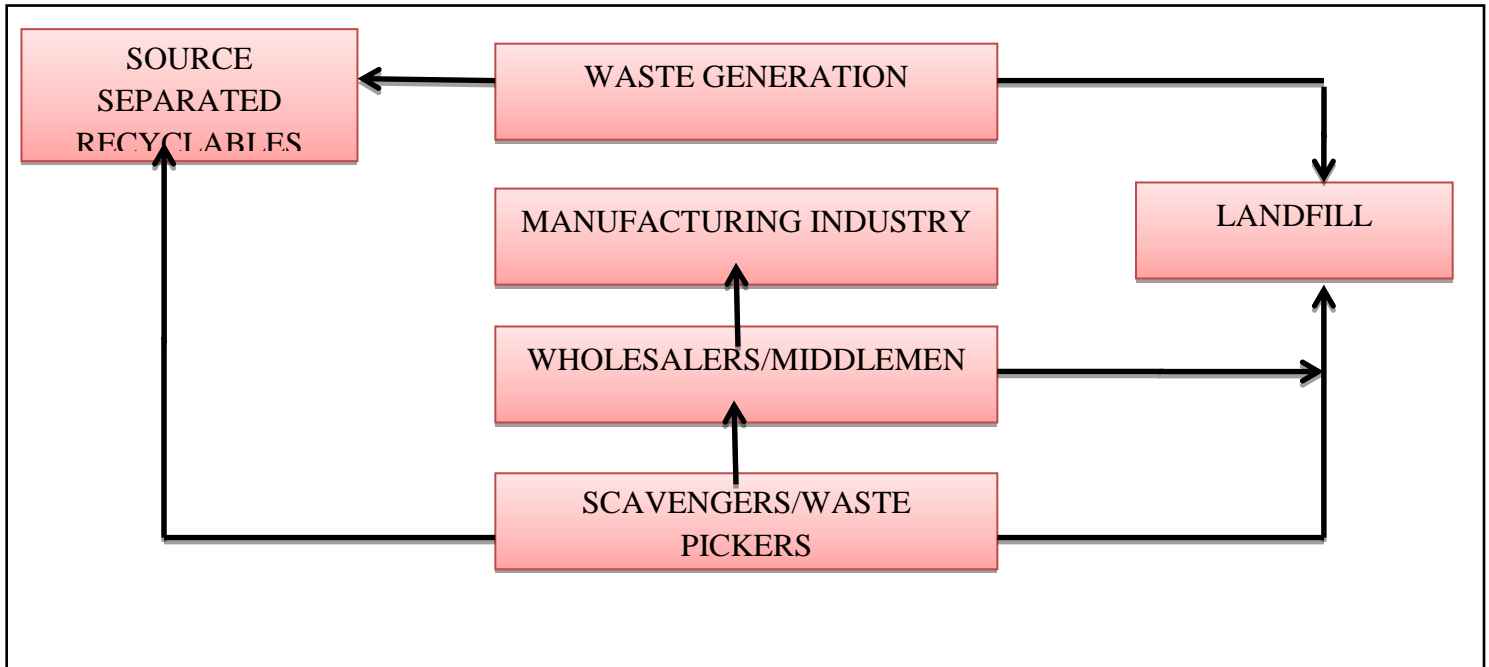
Informal Recycling Sector

Within the context of municipal solid waste management, the informal recycling sector refers to those waste recycling activities carried out by scavengers and waste pickers and characterised by small-scale, labour-intensive, low technology and largely unregulated salvaging activities⁶¹. Furthermore, the terms scavengers and waste pickers are used to describe those individuals involved in the removal of recyclable and reusable materials from mixed waste. A common

⁶¹ Wilson et al. (2006). Role of informal sector recycling in waste management in developing countries. *Elsevier*, 797-808.

hierarchy exists within the informal waste management sector with salvagers and waste pickers forming the base of this hierarchy as depicted in figure 24 below.

Figure 24: Typical hierarchy within the informal recycling sector.



The recyclable materials separated by the salvagers and waste pickers are sold to wholesalers and junk dealers where further processing of the material is done, subsequent to which it is sold to industrial clients. In most instances, the lower end of the hierarchy is made up of impoverished individuals who utilise the waste stream in order to satisfy their basic needs, through the recovery of clothing, materials for shelter and sometimes even food.

The four main categories of informal waste recycling, as determined by where and how material recovery takes place, are as follows:

- 1) *Itinerant Waste Buyers*: this refers to waste collectors who go from door to door collecting sorted dry recyclable materials from households. The material is either bought or bartered and then transported to recycling shops/companies. Countries like China, for example, are highly dependent on this type of informal recycling.
- 2) *Street Waste Picking*: Secondary raw materials are recovered from mixed waste disposed of on the streets or from communal bins, prior to collection.
- 3) *Municipal Waste Collection Crew*: Secondary raw materials are recovered from waste collection vehicles transporting municipal solid waste to disposal sites.
- 4) *Waste picking from dumps*: Waste pickers/scavengers sort through waste which is uncovered or prior to such waste being covered.

Within Trinidad and Tobago, dump salvagers are most common and consist mainly of individuals residing in close proximity to dumps/landfill sites. This type of livelihood usually stems from extreme poverty. Secondary materials recovered via informal recycling are usually traded locally with end-users consisting mainly of local industries, inclusive of craftsmen and artisans. A series of intermediate dealers such as intermediate processors, brokers and wholesalers, often exists between the scavengers and end-users.

Due to their low position in the hierarchy, scavengers/waste pickers earn very little for the material which they salvage. This is especially true in monopoly markets, where only one buyer exists and where the remote location of many dumps and landfills makes it difficult and cumbersome for salvaged material to be transported elsewhere. Commonly collected materials include plastics, paper, cardboard, aluminium, steel and other metals, glass (especially in the form of glass bottles) and textiles.

The major health and safety risks associated with the informal recycling sector can be categorised into two main groups:

- (1) Occupational health risks faced by scavengers/waste pickers
- (2) Health and security risks posed to near-by communities and the general public

The aforementioned risks may originate from the type of waste present at the disposal site or during the actual salvaging process. Although scavenging in open dumps is considered the most detrimental to human health, it still remains a common practice within Trinidad and Tobago as witnessed through the significant salvager presence at the three major public landfills within the country.

Firstly, the occupational health risks encountered by scavengers/waste pickers is high due to manual handling which is carried out without the use of personal protective equipment (PPE). As such, individuals come into direct contact with waste which may consist of broken glass, hazardous chemicals and chemical containers, human/animal faecal matter and needles/bandages. In addition, inhalation of toxic fumes and smoke emanating from landfill sites can severely impact on health. Examples of illnesses ensued by exposure to improperly treated and disposed waste consists of respiratory and dermatological diseases, eye infections and low life expectancy.

Secondly, communities located in close proximity to waste disposal sites are known to be adversely affected by the activities occurring on-site. For example, manual sorting of waste within or near living space can create unsanitary living conditions for residents. In addition, waste which is improperly treated/disposed of can attract disease-carrying organisms and other scavenging animals (such as vultures), thus posing a risk to nearby communities.

There have also been numerous complaints from site users of vandalism, assault and other interference by salvagers. Salvagers also sometimes recover spoilt/expired foodstuff and products for sale to the public, which further creates health problems for themselves as well as the wider community. In general, the attitude of the general public towards informal recycling is often very negative as this sector is regarded as being backward, unhygienic and generally incompatible with modern waste management strategies.

Insufficient collection, uncontrolled street collection points, illegal dumping and improper waste disposal all contribute to the easy availability of waste for informal recycling via scavenging/waste picking. It should be noted however that despite the health and social implications of informal recycling, studies have indicated that it provides significant economic benefits. As such, it has been demonstrated in the past that establishing new formal waste recycling streams without consideration for the already existing informal systems, can be highly counterproductive. Instead, it is more useful to integrate the informal sector into waste management planning through the use of the sector's practices and experiences so as to improve the efficiency, living and working conditions of scavengers and waste pickers.

6.3 Recommendations

The price of economic and social progress has translated into an overwhelming build-up of a variety of wastes ranging from effluents released from manufacturing and tourism related activities to the illicit dumping of a growing array of consumer items. Within Trinidad and Tobago, existing solid waste management systems, especially in urban areas, have proven to be inadequate in dealing with the growing population which has propelled current waste generation levels of commercial, industrial and household waste. While waste collection has exhibited considerable improvement over the years, the quality, efficiency and effectiveness of waste disposal strategies have remained underdeveloped. Socially, efforts remain focused on infrastructural development while health and the environment continue to occupy limited priority in national budgeting and planning. As a result, the chosen solution for managing waste within the country must be one which harmonizes economic, social and environmental needs such that sustainability can be achieved. The following recommendations are made with the objective of initiating change towards more sustainable waste management within Trinidad and Tobago:

Legislative and Institutional Framework

- ★ The development, strengthening and/or updating of waste management laws, regulations and policies in a manner that is relevant to the country's modern situation and environment and which reflects international best practices. This would include the incorporation of special waste types such as e-waste and biomedical waste into waste policies and legislation.

- ✱ Review, restructuring and streamlining of all agencies and institutions vested with waste management responsibilities such that there is a clear delineation of functions thereby ensuring that there is no duplication/lack of efforts in discharging responsibilities. The establishment of a single institution/body to deal exclusively with the management of waste within Trinidad and Tobago should also be considered.

Waste Management

- ✱ Hazardous waste management needs to be included in the country's overall waste management system with all aspects being addressed i.e. generation, storage, transport, treatment and disposal. The draft waste management rules (2008) addresses these issues and so precedence needs to be given to the implementation of these rules.
- ✱ Planning for effective waste disposal and waste diversion strategies necessitates on-going data collection and subsequent establishment of adequate information systems to aid in establishing waste management needs and so effectively inform subsequent waste-related decisions. This should incorporate intensive studies of local industries with regard to the quantity and quality of hazardous waste generated as well as on-going data gathering at landfills. Feasibility studies should also be carried out so as to determine the success of implementing certain initiatives. For example, a feasibility study may be conducted to determine the feasibility of installing landfill gas recovery and electrical generation at the Beetham and Guanapo sites. Utilization of such landfill gas will not only reduce GHG emissions but also serve as a lucrative economical endeavour.
- ✱ Mandatory reporting should be established for larger quantity generators producing particularly hazardous streams and operating in close proximity to socially and environmentally sensitive areas. Such reporting may be considered as a conditional requirement in the issuance of the Certificate of Environmental Clearance (CEC).
- ✱ Implementation of a monitoring and enforcement system for the regulation of generators, collectors, landfill site operators and recycling operators.

Public Awareness and Education

- ✱ Increased efforts in promoting public awareness as it relates to waste management issues with specific focus on the 4R concept i.e. reduce, reuse, recycle and recover.
- ✱ Educational programmes should be geared towards and so tailored to fit specific target groups. For example, waste generators should be aware of their role in eliminating indiscriminate dumping while administrators must have a thorough understanding of the integration of all the various components in the waste management system.
- ✱ Implementation of a national-level public awareness and education programme on hazardous waste, with a specific focus on small and medium-size enterprises especially those within the informal sectors. Such a programme would encompass sensitisation regarding best-practices in treatment, storage and disposal; importance of proper record-

keeping and how this should be done and the effects of improperly disposed hazardous waste on the environment.

Waste Diversion

- * Household recycling programmes focused on dry recyclables such as paper, cardboard, plastics, glass and metals should be set up whereby households are required to sort and bag these items prior to collection. At present, there is evidence of some bins being located throughout the country which provide for the disposal of certain recyclables e.g. Plastikeep provides bins for the disposal of plastics. However, there is a greater need for more of these bins at more strategic and convenient locations so as to encourage participation and also to accommodate other recyclables.
- * The development and provision of economic incentives or disincentives so as to encourage waste reduction amongst consumers. These may take the form of variable waste disposal fees, deposit-refund systems and financial bonuses.
- * Development of a national organic waste management plan aimed at utilizing organic materials emanating from both ICI and household sources as a source of renewable energy or as environmental.
- * The importance of the informal sector in waste recovery and recycling needs to be recognised and incorporated into the national waste management system envisaged for the country. Such incorporation includes regularisation through the organisation of cooperatives, provision of personal protective equipment (PPE) to salvagers, improvements in working conditions and the development of systems so as to facilitate successful participation.

ANNEX I: TABLE ILLUSTRATING TOTAL HAZARDOUS WASTE GENERATED WITHIN TRINIDAD AND TOBAGO FOR ALL WASTE STREAMS FOR THE PERIOD 2004-2008

| Y Code | 2004 | | 2005 | | 2006 | | 2007 | | 2008 | | 5-year totals by island | | | | | | 5-year totals National level | |
|-----------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|-------------------------|---------------------------|---|--------------------|---------------------------|---|---------------------------------|---------------|
| | Trinidad | Tobago | Trinidad | Tobago | Trinidad | Tobago | Trinidad | Tobago | Trinidad | Tobago | Trinidad | | | Tobago | | | Amount (tonnes) | % of Total |
| | Amount (tonnes) | Amount (tonnes) | Amount (tonnes) | Amount (tonnes) | Amount (tonnes) | Amount (tonnes) | Amount (tonnes) | Amount (tonnes) | Amount (tonnes) | Amount (tonnes) | Amount (tonnes) | % Contrib. to Total | % Contrib. to Waste Stream Total | Amount (tonnes) | % Contrib. to Total | % Contrib. to Waste Stream Total | | |
| Y1 | 63.65 | 5.86 | 63.51 | 5.86 | 72.46 | 5.98 | 64.99 | 6.35 | 66.44 | 184.31 | 331.05 | 0.2 | 61.4 | 208.35 | 0.9 | 38.6 | 539.40 | 0.31 |
| Y2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.27 | 0.00 | 0.0 | 0.0 | 0.27 | 0.0 | 100.0 | 0.27 | 0.00 |
| Y3 | 52.40 | 0.01 | 52.40 | 0.01 | 52.40 | 0.01 | 52.41 | 0.25 | 52.60 | 0.04 | 262.22 | 0.2 | 99.9 | 0.32 | 0.0 | 0.1 | 262.55 | 0.15 |
| Y4 | 2.91 | 0.06 | 1.02 | 61.61 | 0.12 | 61.61 | 1.34 | 61.61 | 2.51 | 62.02 | 7.90 | 0.0 | 3.1 | 246.91 | 1.1 | 96.9 | 254.81 | 0.15 |
| Y5 | 0.22 | 0.00 | 0.32 | 0.00 | 0.32 | 0.00 | 0.32 | 0.00 | 0.32 | 0.00 | 1.52 | 0.0 | 100.0 | 0.00 | 0.0 | 0.0 | 1.52 | 0.00 |
| Y6 | 85.62 | 41.39 | 85.58 | 41.35 | 87.84 | 41.38 | 87.97 | 42.69 | 88.07 | 26.25 | 435.07 | 0.3 | 69.3 | 193.06 | 0.9 | 30.7 | 628.13 | 0.37 |
| Y7 | 0.001 | 0.00 | 0.001 | 0.00 | 0.001 | 0.00 | 0.001 | 0.00 | 0.001 | 0.00 | 0.01 | 0.0 | 100.0 | 0.00 | 0.0 | 0.0 | 0.01 | 0.00 |
| Y8 | 0.60 | 32.79 | 0.35 | 33.01 | 0.42 | 36.83 | 11.70 | 44.69 | 34.26 | 36.94 | 47.33 | 0.0 | 20.4 | 184.25 | 0.8 | 79.6 | 231.58 | 0.13 |
| Y9 | 25,299.37 | 3,034.46 | 25,329.78 | 3,321.25 | 25,498.22 | 3,349.06 | 28,898.52 | 3,534.88 | 33,794.95 | 4,757.48 | 138,820.83 | 93.0 | 88.5 | 17,997.14 | 79.5 | 11.5 | 156,817.97 | 91.18 |
| Y10 | 0.11 | 4.39 | 0.11 | 4.96 | 0.11 | 4.98 | 0.11 | 13.44 | 3.55 | 9.73 | 3.99 | 0.0 | 9.6 | 37.51 | 0.2 | 90.4 | 41.49 | 0.02 |
| Y12 | 38.77 | 11.47 | 39.77 | 10.94 | 40.69 | 11.14 | 41.54 | 13.15 | 44.43 | 12.07 | 205.20 | 0.1 | 77.7 | 58.76 | 0.3 | 22.3 | 263.97 | 0.15 |
| Y13 | 0.29 | 0.05 | 0.27 | 0.05 | 0.77 | 0.05 | 0.77 | 0.05 | 0.77 | 0.05 | 2.86 | 0.0 | 91.8 | 0.26 | 0.0 | 8.2 | 3.12 | 0.00 |
| Y14 | 24.88 | 0.00 | 24.88 | 0.00 | 24.88 | 0.00 | 24.88 | 0.00 | 24.88 | 0.06 | 124.38 | 0.1 | 100.0 | 0.06 | 0.0 | 0.0 | 124.44 | 0.07 |
| Y15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 7.86 | 0.00 | 0.0 | 0.0 | 7.86 | 0.0 | 100.0 | 7.86 | 0.00 |
| Y16 | 27.19 | 0.10 | 27.11 | 0.10 | 27.11 | 0.10 | 26.67 | 0.10 | 26.70 | 0.02 | 134.78 | 0.1 | 99.7 | 0.42 | 0.0 | 0.3 | 135.20 | 0.08 |
| Y17 | 0.07 | 0.02 | 0.07 | 0.02 | 0.07 | 0.02 | 0.08 | 0.02 | 0.08 | 0.00 | 0.37 | 0.0 | 82.6 | 0.08 | 0.0 | 17.4 | 0.44 | 0.00 |
| Y18 | 0.16 | 0.00 | 0.16 | 1.09 | 0.16 | 1.09 | 0.16 | 1.09 | 0.16 | 1.09 | 0.78 | 0.0 | 15.1 | 4.36 | 0.0 | 84.9 | 5.14 | 0.00 |
| Y19 | 0.23 | 0.00 | 0.21 | 0.00 | 0.21 | 0.00 | 0.21 | 0.00 | 0.21 | 0.00 | 1.05 | 0.0 | 100.0 | 0.00 | 0.0 | 0.0 | 1.05 | 0.00 |
| Y21 | 0.00 | 0.00 | 2.24 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.24 | 0.0 | 100.0 | 0.00 | 0.0 | 0.0 | 2.24 | 0.00 |
| Y22 | 276.89 | 0.36 | 307.96 | 0.61 | 0.06 | 0.62 | 0.06 | 0.88 | 0.06 | 11.75 | 585.03 | 0.4 | 97.6 | 14.22 | 0.1 | 2.4 | 599.25 | 0.35 |
| Y23 | 12.46 | 0.00 | 94.86 | 0.00 | 0.06 | 0.00 | 0.06 | 0.00 | 198.66 | 0.00 | 306.08 | 0.2 | 100.0 | 0.00 | 0.0 | 0.0 | 306.08 | 0.18 |
| Y24 | 0.01 | 0.00 | 0.01 | 0.00 | 22.09 | 0.00 | 0.01 | 0.00 | 7.38 | 0.00 | 29.50 | 0.0 | 100.0 | 0.00 | 0.0 | 0.0 | 29.50 | 0.02 |
| Y26 | 0.10 | 0.16 | 0.10 | 0.19 | 5.20 | 0.34 | 0.10 | 1.02 | 0.09 | 7.60 | 5.59 | 0.0 | 37.5 | 9.31 | 0.0 | 62.5 | 14.90 | 0.01 |

| Y29 | 10.62 | 0.64 | 10.13 | 0.74 | 13.57 | 0.81 | 11.80 | 1.94 | 15.50 | 7.28 | 61.63 | 0.0 | 84.4 | 11.41 | 0.1 | 15.6 | 73.04 | 0.04 |
|--------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|-------------------------|---------------------------|---|--------------------|---------------------------|---|---------------------------------|---------------|
| Y Code | 2004 | | 2005 | | 2006 | | 2007 | | 2008 | | 5-year totals by island | | | | | | 5-year totals National level | |
| | Trinidad | Tobago | Trinidad | Tobago | Trinidad | Tobago | Trinidad | Tobago | Trinidad | Tobago | Trinidad | | | Tobago | | | Amount (tonnes) | % of Total |
| | Amount (tonnes) | Amount (tonnes) | Amount (tonnes) | Amount (tonnes) | Amount (tonnes) | Amount (tonnes) | Amount (tonnes) | Amount (tonnes) | Amount (tonnes) | Amount (tonnes) | Amount (tonnes) | % Contrib. to Total | % Contrib. to Waste Stream Total | Amount (tonnes) | % Contrib. to Total | % Contrib. to Waste Stream Total | | |
| Y31 | 0.03 | 0.01 | 0.03 | 0.01 | 0.02 | 0.01 | 0.03 | 0.11 | 0.00 | 0.17 | 0.11 | 0.0 | 26.9 | 0.30 | 0.0 | 73.0 | 0.41 | 0.00 |
| Y33 | 0.10 | 0.01 | 0.10 | 0.01 | 0.11 | 0.01 | 0.11 | 0.01 | 0.11 | 0.00 | 0.53 | 0.0 | 94.8 | 0.03 | 0.0 | 5.2 | 0.56 | 0.00 |
| Y34 | 52.31 | 1.99 | 73.38 | 68.48 | 66.20 | 68.48 | 65.77 | 68.48 | 67.00 | 72.22 | 324.66 | 0.2 | 53.7 | 279.66 | 1.2 | 46.3 | 604.32 | 0.35 |
| Y35 | 64.16 | 541.37 | 65.40 | 544.17 | 85.80 | 543.22 | 79.00 | 592.33 | 86.77 | 52.03 | 381.13 | 0.3 | 14.4 | 2,273.11 | 10.0 | 85.6 | 2,654.24 | 1.54 |
| Y36 | 0.00 | 0.00 | 19.55 | 0.00 | 0.00 | 0.00 | 5.00 | 0.00 | 0.00 | 0.00 | 24.55 | 0.0 | 100.0 | 0.00 | 0.0 | 0.0 | 24.55 | 0.01 |
| Y37 | 0.49 | 200.13 | 0.49 | 200.13 | 0.49 | 200.13 | 0.49 | 200.13 | 0.49 | 200.13 | 2.46 | 0.0 | 0.2 | 1,000.64 | 4.4 | 99.8 | 1,003.10 | 0.58 |
| Y38 | 0.00 | 0.00 | 0.001 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.02 | 0.0 | 100.0 | 0.00 | 0.0 | 0.0 | 0.02 | 0.00 |
| Y39 | 0.09 | 0.20 | 0.09 | 0.25 | 0.09 | 0.25 | 0.09 | 0.26 | 0.09 | 0.26 | 0.43 | 0.0 | 25.9 | 1.22 | 0.0 | 74.1 | 1.64 | 0.00 |
| Y40 | 0.60 | 0.21 | 0.60 | 0.21 | 0.60 | 0.21 | 0.60 | 0.21 | 0.60 | 0.21 | 3.00 | 0.0 | 73.8 | 1.07 | 0.0 | 26.2 | 4.07 | 0.00 |
| Y41 | 0.35 | 3.74 | 0.35 | 3.97 | 0.37 | 6.23 | 0.37 | 7.36 | 0.41 | 8.63 | 1.84 | 0.0 | 5.8 | 29.92 | 0.1 | 94.2 | 31.77 | 0.02 |
| Y42 | 10.12 | 0.00 | 8.40 | 0.00 | 6.73 | 0.00 | 5.62 | 0.00 | 4.23 | 0.05 | 35.08 | 0.0 | 99.8 | 0.05 | 0.0 | 0.2 | 35.14 | 0.02 |
| Y44 | 0.002 | 0.00 | 0.002 | 0.00 | 0.002 | 0.00 | 0.002 | 0.00 | 0.002 | 0.00 | 0.01 | 0.0 | 100.0 | 0.00 | 0.0 | 0.0 | 0.01 | 0.00 |
| Y45 | 0.004 | 0.00 | 0.004 | 0.00 | 0.004 | 0.00 | 0.004 | 0.00 | 0.004 | 0.00 | 0.02 | 0.0 | 100.0 | 0.00 | 0.0 | 0.0 | 0.02 | 0.00 |
| A1160 | 1,037.44 | 12.85 | 1,153.26 | 12.85 | 1,180.00 | 12.85 | 1,506.77 | 11.34 | 1,544.64 | 9.89 | 6,422.11 | 4.3 | 99.1 | 59.76 | 0.3 | 0.9 | 6,481.87 | 3.77 |
| A1180 | 27.90 | 3.89 | 63.17 | 4.70 | 28.47 | 4.64 | 27.35 | 7.26 | 60.44 | 10.63 | 207.32 | 0.1 | 86.9 | 31.12 | 0.1 | 13.1 | 238.44 | 0.14 |
| A2030 | 125.30 | 0.00 | 127.30 | 0.00 | 0.00 | 0.00 | 18.00 | 0.00 | 283.30 | 0.00 | 553.90 | 0.4 | 100.0 | 0.00 | 0.0 | 0.0 | 553.90 | 0.32 |
| Total | 27,215.42 | 3,896.14 | 27,552.94 | 4,316.57 | 27,215.63 | 4,350.05 | 30,932.86 | 4,609.62 | 36,409.71 | 5,479.05 | 149,326.56 | 100.0 | 86.8 | 22,651.42 | 100.0 | 13.2 | 171,977.98 | 100.00 |

DELINEATION OF Y CODES (as stipulated by the Basel Convention)⁶²:

Y1 Clinical wastes from medical care in hospitals, medical centres and clinics

Y2 Wastes from the production and preparation of pharmaceutical products

Y3 Waste pharmaceuticals, drugs and medicines

Y4 Wastes from the production, formulation and use of biocides and phytopharmaceuticals

Y5 Wastes from the manufacture, formulation and use of wood preserving chemicals

Y6 Wastes from the production, formulation and use of organic solvents

Y7 Wastes from heat treatment and tempering operations containing cyanides

Y8 Waste mineral oils unfit for their originally intended use

Y9 Waste oils/water, hydrocarbons/water mixtures, emulsions

Y10 Waste substances and articles containing or contaminated with polychlorinated biphenyls (PCBs) and/or polychlorinated terphenyls (PCTs) and/or polybrominated biphenyls (PBBs)

Y12 Wastes from production, formulation and use of inks, dyes, pigments, paints, lacquers, varnish

Y13 Wastes from production, formulation and use of resins, latex, plasticizers, glues/adhesives |

Y14 Waste chemical substances arising from research and development or teaching activities which are not identified and/or are new and whose effects on man and/or the environment are not known

Y15 Wastes of an explosive nature not subject to other legislation

Y16 Wastes from production, formulation and use of photographic chemicals and processing materials

Y17 Wastes resulting from surface treatment of metals and plastics

Y18 Residues arising from industrial waste disposal operations

WASTES HAVING AS CONSTITUENTS:

Y19 Metal carbonyls

Y21 Hexavalent chromium compounds

Y22 Copper compounds

Y23 Zinc compounds

Y24 Arsenic; arsenic compounds

Y26 Cadmium; cadmium compounds

Y29 Mercury; mercury compounds

Y31 Lead; lead compounds

Y33 Inorganic cyanides

⁶² United Nations Environment Programme (UNEP). "Basel Convention on the transboundary movements of hazardous wastes and their disposal." *Protocol on liability and compensation for damage resulting from transboundary movements of hazardous wastes and their disposal: Texts and Annexes*. 2011.

Y34 Acidic solutions or acids in solid form

Y35 Basic solutions or bases in solid form

Y36 Asbestos (dust and fibres) **Y37** Organic phosphorus compounds

Y38 Organic cyanides

Y39 Phenols; phenol compounds including chlorophenols

Y40 Ethers

Y41 Halogenated organic solvents

Y42 Organic solvents excluding halogenated solvents

Y44 Any congener of polychlorinated dibenzo-p-dioxin

Y45 Organohalogen compounds other than substances referred to in this Annex (e.g. Y39, Y41, Y42, Y43, Y44)

A1 METAL AND METAL-BEARING WASTES:

A1160 Waste lead-acid batteries, whole or crushed

A1180 Waste electrical and electronic assemblies or scrap (excluding scrap assembly from electric power generation) containing components such as accumulators and other batteries included on list A of the Basel Convention Waste Category Listing, mercury-switches, glass from cathode-ray tubes and other activated glass and PCB- capacitors, or contaminated with Annex I constituents (e.g., cadmium, mercury, lead, polychlorinated biphenyl) to an extent that they possess any of the characteristics contained in Annex III of the Basel Convention Waste Category Listing.

A2 WASTES CONTAINING PRINCIPALLY INORGANIC CONSTITUENTS, WHICH MAY CONTAIN METALS AND ORGANIC MATERIALS

A2030 Waste catalysts but excluding such wastes specified on list B of the Basel Convention's Waste Categories Listing

**PART B: ACTIVITIES, ACCOMPLISHMENTS AND PLANS OF THE
EMA**

1.0 ORGANISATIONAL STRUCTURE

The Authority is governed by a Board of Directors comprising a Chairman and nine other members, appointed by the President of the Republic of Trinidad and Tobago. The Managing Director/ CEO who is appointed by the Board, is an *ex-officio* member of the Board. The Board must appoint a Corporate Secretary who must be an employee of the EMA. The Manager of Corporate Services within the EMA currently serves as the Corporate Secretary.

The Chairman and the Board of Directors report to the Minister with responsibility for the Environment. The Members of the Board and Board Committees are detailed in Appendix 1.

The Authority itself is organised into five responsibility centres:

1.1 CEO's Office

The Office of the Managing Director/ CEO is responsible for coordinating and managing all aspects of the work of the EMA. Some specific areas include:

- The fulfilment by the EMA of the objectives detailed in the NEP and the EM Act;
- The implementation and enforcement of the subsidiary legislation arising out of the EM Act, including monitoring conditions in permits and licenses granted pursuant to legislation;
- The development of environmental awareness among the citizenry of Trinidad and Tobago;
- The development of an organisational image that projects a strong, professional organization and engenders confidence in the Authority by members of the public;
- Maintenance of the focus on sustainable development while engaging in environmental enhancement and preservation activity;
- To lead, guide, coach and inspire a team of managers towards the achievement of the highest level of performance;
- To promote a productive work atmosphere that would elicit high standards of performance from staff;
- Ensuring that the programmes and projects of the authority are implemented consistent with budgetary allocations;
- Developing and delivering on EMA's overall strategic and operating plans;
- Advising the Board of Directors on all matters relating to the operations of the Authority;
- Advancing the work of the Authority through meaningful interaction with the political directorate, and other similar regional and international bodies;

- Developing mutually beneficial relationships with participating national agencies that perform various environmental management functions so that the coordination function is effectively achieved;
- Ensuring that the day-to-day operations of the Authority are effectively managed;

The Environmental Police Unit (EPU) also falls under the CEO's Office. Formed in 1999, the EPU comprises Special Reserve Police officers from the Trinidad and Tobago Police Service. Their responsibilities include patrolling highways, serving Notices of Violation and monitoring noise variations. They also police environmentally sensitive areas and monitor the protection of environmentally sensitive species designated under the EM Act.

According to the EPU's 2010 statistics, 224 Fixed Penalty Notices were issued for offences ranging from excessive smoke, loud music and other traffic offences such as transporting garbage and goods without a secured cover, defective fittings (e.g. lights, wipers etc.) and unnecessary discharge of lubricant. The EPU made eight arrests, conducted 152 CEC investigations, served 66 Notices of Violation, investigated 219 noise complaints and monitored 333 events with respect to noise pollution control.

These officers are appointed as Environmental Inspectors under the EM Act and have the power to enforce legislation outside the EM Act (Motor Vehicles and Road Traffic Act, Minerals Act, Litter Act,) in addition to pollution monitoring and responding to environmental complaints. The Unit falls under the jurisdiction of the Commissioner of Police but, as facilitated by the EMA, they receive day-to-day work assignments from, and submit reports to the EMA.

The Human Resource Unit falls under the CEO's office and is responsible for the following:

- Manpower Planning
- Succession Planning
- Recruitment / Selection
- Performance Management
- Training
- Industrial Relations
- Compensation and Benefits
- Employee Relations

1.2 Legal Services

A full range of legal services are provided to the Authority, these include, but are not restricted to, the following:

- Drafting and development of subsidiary legislation under the EM Act;
- Enforcement of the EM Act and its subsidiary legislation;
- Litigation/representation at the Environmental Commission, Court of Appeal, High Court and other Courts in this jurisdiction;
- Provision of timely and sound legal advice and opinions on the applicability of environmental law to issues affecting the Authority, other governmental entities and the general public;
- Formulation and review of internal policies to ensure that the Authority's activities and operations are consistent with its legislative mandate, national policies and programmes, international environmental law and best practices.
- Resolution of matters using non-litigious methods, e.g. Negotiations and Alternative Dispute Resolution (ADR)/ Mediation;
- Drafting, reviewing, negotiating, and providing advice on the implementation of all legal documents, agreements, contracts and other formal arrangements for operational activities of the Authority with other governmental and non-governmental entities.
- Working in conjunction with Technical Services for the issuing of CECs and Noise Variations.

1.3 Corporate Relations and Public Education

The Corporate Relations and Public Education (CR/PE) Department is responsible for ensuring that the Authority establishes itself as a continuing presence and influences national consciousness. CR/PE has the responsibility within the EMA to “promote educational and public awareness programmes on the environment” as well as to assist with fulfillment of the mandate to “establish and co-ordinate institutional linkages locally, regionally and internationally.

One of the ways in which the EMA executes its mandate involves making the public more aware and concerned about environmental issues. In focusing on environmental improvement, the EMA develops special public education and outreach initiatives to change attitudes and behaviours towards a range of issues including Air Pollution, Water Pollution, Noise Pollution, Waste Disposal and Ecosystem conservation.

- Every year, in collaboration with the Ministry of Education, the EMA coordinates two school competitions namely, the Primary Schools' Hands-On Environmental Programme and the Secondary Schools' Eco-Song competition.

- The EMA delivers lectures, conducts workshops and develop programmes on environmental issues for the benefit of Government Agencies and Ministries, Community Groups and Non-Governmental Organisations, Corporate and Industrial Sector entities, Civic society groups, Faith Based organisations and Educational Institutions.
- The EMA also supports the creation of environmental clubs in primary and secondary schools, was well in communities.
- The Authority is also a clearing house for environmental information. Its in-house Information Centre houses a specialized environmental reference collection that includes journals, environmental science texts, copies of legislation and newspaper clippings on environmental issues.
- The National Registers for the CEC and Noise Pollution Control Rules (NPCR) are also available at the Information Centre.
- The EMA also collaborates with other governmental agencies, statutory bodies in the execution of their environmental education campaigns. The Corporate Relations function remains critical as it is responsible for:
 - Creating awareness of the EMA's mandates
 - Generating a body of public opinion favourable to the EMA and its mandates
 - Building and maintaining a sound corporate image/identity
 - Fostering good relationships with internal and external publics
 - Creating a mutually beneficial relationship with the Media

1.4 Technical Services

The Technical Services Department is responsible for the implementation of the technical and administrative processes relating to the following:

- CEC
- Water Pollution Management
- Waste Management
- Management of Hazardous substances
- Emergency Incidents Response
- Complaints Investigation
- Site Remediation
- Biodiversity Protection and Conservation
- Market Based Instruments
- Environmental Monitoring and Research
- Inspection and Compliance Monitoring
- Noise Pollution Management
- Strategic Environmental Management

The EMA is charged with the responsibility of implementing subsidiary legislation under the EM Act, Chapter 35:05. This includes the Noise Pollution Control Rules (NPCR), the Environmentally Sensitive Species Rule (ESSR), the Environmentally Sensitive Areas Rules (ESAR), the CEC Rules and most recently the Water Pollution Rule (WPR) (amendments to which were prepared on December 18, 2006 and submitted to Parliament for consideration). In addition to implementation of the foregoing, the EMA designs the framework and provides legal and technical instructions for proposed legislation.

1.5 Corporate Services

The Corporate Services Department is responsible for the following functions:

- Financial Accounting
- Fund/Treasury Management
- Procurement and Asset Maintenance
- Information Technology
- Secretarial Services to the Board
- General Administration
- Health, Safety and the Work Environment

Corporate Services serves to ensure the implementation of good governance and accountability. It has the primary responsibility for providing logistical support to the organisation and making available, timely, accurate and complete information on the financial performance and status of the Authority for sound decision making.

2.0 EMA'S ACTIVITIES AND ACCOMPLISHMENTS FOR 2011

In 2011 the EMA continued to pursue its work in accordance with the Environmental Management Act (EM Act) Chapter 35:05. In its efforts towards promoting and enforcing responsible environmental management within the country, the EMA has accomplished the following as it pertains to its Strategic Plan 2010-2014.

2.1 Strategic Goals

TO PROTECT AND RESTORE THE WATER QUALITY OF INLAND AND COASTAL WATERS TO SAFEGUARD HUMAN HEALTH AND ECOSYSTEMS HEALTH

Source Registration (SR)

For the period 2007-2011 the EMA processed 742 SR applications, conducted 601 site visits throughout Trinidad and Tobago and issued 492 SR Certificates (SRC). As expected, more applications were received from highly developed industrial and commercial centres particularly within the East West Corridor, the Point Lisas and South Western Peninsula of Trinidad and the South Western area of Tobago.

Table 1 provides an overview of the SR process for 2011.

Table 1: Source Registration Statistics 2011

| Source Registration process | Form A received | Site visits conducted | Form C issued |
|-----------------------------|-----------------|-----------------------|---------------|
| Initial | 39 | 37 | 46 |
| Renewal | 98 | 93 | 90 |
| Total | 137 | 130 | 136 |

The increase in statistics for 2011 when compared to 2008 to 2010 is attributed primarily to the source registration renewal process. The Renewal notification system is ongoing and for 2011, 102 notification letters were issued for SRC expiring in 2011.

Permitting

In determining which facilities are to be notified for a Water Pollution Permit (WPP), the following factors are considered:

1. Facilities located in highly vulnerable watersheds to surface water pollution;
2. Facilities with discharge data in excess of the permissible levels as specified in Schedule II of the WPR;
3. Proximity to sensitive receiving environments for example, areas declared as Environmentally Sensitive Species and Areas, public water supply intakes, coral reefs, recreational areas;
4. Complaints and compliance history

Based on an analysis of facility discharge characteristics (comparison of actual levels vs. the permissible levels) 159 facilities have been prioritized for permit notification and as at the end of 2011 twenty nine (29) facilities have been notified for permits of which 20 have been issued, ten (10) issued in 2011.

In 2011, the following sectors were investigated for permitting, Food and Meat processing, Iron and Steel, Petrochemicals, Paint manufacture and Oil and gas downstream industries (battery tank farms).

Permit notifications were issued to these sectors with the exception of the oil and gas sector as many already have permits under the Certificate of Environmental Clearance (CEC) Rules. A comprehensive investigation of the facilities in Point Lisas was conducted in April 2011 to identify facilities for permitting. Based on PLIPDECO's online 2011 tenant listing there are 91 facilities, 42 facilities so far have applied for SR with 36 issued with certificates. The remaining 49 facilities comprise primarily of fabricating shops, service companies and administrative

offices. Of the registered facilities 16 were identified for permits, of which six (6) facilities have CECs and the remaining three (3) have been notified for permits (see Table 3).

TO PROTECT COMMUNITIES AND ECOSYSTEMS FROM THE HEALTH CONSEQUENCES OF HAZARDOUS CHEMICALS SPILLS AND THE UNSAFE HANDLING AND DISPOSAL OF SOLID AND HAZARDOUS WASTES

Remediation of Lead Contaminated Site

Remediation works commenced on August 9, 2011 at Food Crop Trace, Guayaguayare. This involved the excavation of the contaminated soil, on site stabilization, verification analysis, off site transportation for further treatment and final disposal. Clean fill (soil) was used to backfill the excavated pits and works were completed on August 26, 2011. Table 6 provides an overview of the remediation project.

Competent Authority Functions under the Basel Convention on the control of transboundary movements of hazardous wastes and their disposal

As the designated competent authority for the Basel Convention on the control of transboundary movements of hazardous wastes and their disposal (Basel Convention), the EMA manages the notification process as defined by the convention. The EMA processed five (5) notifications for export (Venezuela, three (3) for Peru/Panama and Singapore/Panama).

Strategic Approach to International Chemicals Management (SAICM) Project – Strengthening Legislative, Regulatory and Enforcement capacity of Small Island Developing States for Hazardous Wastes and other Wastes

In 2007 the Ministry of Public Utilities and the Environment, submitted to the United Nations Environmental Programme (UNEP)/Secretariat of Basel Convention (SBC) a project proposal aimed at strengthening the capacity of SIDS in the Caribbean in implementing their obligations under the Basel Convention, and as appropriate the Stockholm and Rotterdam Conventions. The Cabinet of Trinidad and Tobago approved the project in 2008 and a Memorandum of Understanding (MoU) was signed in 2009 between the EMA as the implementing agency and the SBC as the executing agency.

The project aimed at strengthening the legislative, regulatory and enforcement capacity of Trinidad and Tobago to implement and comply with international obligations under the Basel Convention and as appropriate, the Stockholm Convention on Persistent Organic Pollutants and the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade.

The project was implemented over an 18-month period in three phases and successfully completed in accordance with the project work plan in August 2011.

Phase I: Gaps and needs analysis

Phase I commenced in January 2010 and was completed in October 2010. The contracted expert consultants (Dr. George Sammy and Dr. Winston McCalla, technical and legal consultants respectively) reviewed and adapted existing tools to conduct a “gaps and needs analysis”. Subsequently, the consultants conducted a national analysis in close consultation with the Government using these tools, focusing primarily on obligations under the Basel Convention but also addressing the Stockholm Convention and, as appropriate, the Rotterdam Convention. A national workshop was also held on October 13, 2010. The analysis of gaps and needs will be used to identify legislative and regulatory measures, as well as institutional capacity (for example, implementation and enforcement), and would take into account life-cycle aspects of waste management for example, legislative, administrative or other measures addressing:

- waste prevention;
- waste minimisation;
- phase-out (production and use);
- reporting and inventorying wastes (for example, waste stockpiles and waste products and articles);
- provisions for handling, storage, transport and disposal of wastes;
- financial provisions for implementing the legislation.

Phase II: Strengthening of regulatory framework and legislative measures pursuant to the results of Phase I by drafting implementing legislation or regulatory measures for the participant country

Phase II commenced in October 2010 and was completed at the end of February 2011. This phase involved the review and adapting of existing guidance materials and tools to address the gaps and needs identified under Phase I. A national workshop was also held on February 16, 2011.

Phase III: Enforcement of implementation and enforcement capacity

Phase III commenced in February 2011 with the preparation of draft training materials, taking into account existing materials, aimed specifically at the various national agencies engaged in implementation and enforcement of the Basel Convention and related multilateral environmental agreements. A regional workshop was conducted in Trinidad on July 5 & 6, 2011 whereby lessons learnt and experiences gained from the earlier phases of the project were shared. The participants for the workshop included Basel Convention competent authorities and focal points and representatives from the legal profession and Customs & Excise.

Subsequent to the conduct of the workshop, reports and materials produced under the project were finalized and disseminated to regional participants.

TO PROTECT, CONSERVE AND/OR RESTORE SELECTED ECOSYSTEMS AND SPECIES TO ENSURE THAT THE BIODIVERSITY OF TRINIDAD & TOBAGO IS SUSTAINED

The Aripo Savannas Implementation Programme

The significance of Aripo Savannas and its biodiversity has been recognised for many years as part of the larger Long Stretch Forest Reserve declared in 1934, as a proposed Scientific Reserve in 1980, and as a Prohibited Area in 1987. The ten open savanna communities characterise the ‘savannas’ which have low growing herbaceous vegetation caused by an impervious hardpan layer a few centimetres below the soil surface. The project is guided by the plans developed by the Caribbean Natural Resources Institute (CANARI).

In 2011, community-based fire management training was completed. Fires have been identified as an on-going threat to the Aripo Savannas Environmentally Sensitive Area (ASESA). In fact, it has been identified as the most significant threat to the ecosystem of the ASESA. Protectors of the Environment, a Community Based Organisation (CBO) based in Lopinot facilitated the two-day training.

Wilderness Injury Management Training was also conducted in 2011 in the Aripo Savannas. The training was facilitated by Dr. Carol Alexis-Thomas and Mr. Shawn Kalloo. This training equipped persons with the relevant skills to handle injuries in the field.

A ten minute video documentary on the Aripo Savannas was also completed in 2011. It was aired on local Television and on YouTube. This is the first in the series of the four documentaries.

The conceptualisation and design of a Visitor Centre and Related Facilities was initiated with the Office of the Chief Architect, Ministry of Works and Infrastructure (MoWI). The topographic survey was completed in September 2011. This survey generated the required topographic data which informed the draft preliminary designs.

In 2011, the University of the West Indies (UWI) and the Trinidad and Tobago Orchid Society (TTOS) conducted research in the Aripo Savannas. The UWI project is entitled the “Conduct of a Comprehensive Biological Survey of the Aripo Savannas Scientific Reserve.” The main objective is to execute a comprehensive biological survey on the Aripo Savannas Scientific Reserve in a participatory manner. execute the work. UWI submitted its Mid-Term Report of the Baseline Botanical Survey of the Aripo Savannas Environmentally Sensitive Area in November 2011.

Figure 1: Research Team and project site UWI Project



The Trinidad and Tobago Orchid Society’s project commenced in 2009 and is entitled “Orchid Conservation in the Aripo Savannas: Protocol for *ex situ* propagation and re-introduction of endangered orchid species *Cyrtopodium parviflorum*.” The overall goal is to develop management strategies to enhance population size and distribution of *Cyrtopodium parviflorum* including *ex-situ* conservation measures and re-introduction into the Aripo Savannas. The TTOS submitted its Final Report to the EMA in October 2011.

Figure 2: Selected Orchids in the Aripo Savannas



TO BALANCE ENVIRONMENTAL PROTECTION AND ECONOMIC DEVELOPMENT THROUGH APPLYING AND ENHANCING THE EFFECTIVENESS, EFFICIENCY AND TIMELINESS OF THE CEC PROCESS

The types of CEC applications received and processed in 2011 include; mid to large farm applications, desalination plants, waste-water treatment plants, concrete and asphalt batching plants, sawmills and residential developments. Many required significant guidance on the CEC process. The EMA received 342 CEC applications in 2011 and this can be further dissected into 126 Energy related applications and 216 Non-energy related applications.

TO PROTECT HUMAN HEALTH AND THE NATURAL ENVIRONMENT FROM THE IMPACTS OF NOISE, AND THE MAINTENANCE OF THE FUNDAMENTAL RIGHTS OF AN INDIVIDUAL TO THE ENJOYMENT OF PROPERTY, WHILST STILL ALLOWING REASONABLE SOCIAL, CULTURAL AND ECONOMIC ACTIVITY

For the period January – December, 2011 a total of 307 noise variations were processed. In 2010, a total of 192 noise variations were processed. When compared to 2011 figures, this shows an increase by eighty percent (80%) in the total number of variations being processed. Eight (8)

applications were withdrawn during 2011 and there were no refusals. Therefore a total of 323 noise variations were granted in 2011.

During this period there were several changes with respect to the handling of noise matters within the EMA. A Noise Committee was established with the objective to have an integrated approach to the handling of noise matters. The EMA began attending the occasional Liquor License hearings at the Port of Spain Magistrates' Court at the invitation of the Chairperson of the Licensing Committee. The EMA makes recommendations to the court with respect to the decibel level of events. This is based on the First Schedule of the Noise Pollution Control Rules as well as any noise variations that have been granted. In March 2011, the EMA played a role in the renewal of annual licenses. Persons who lodged complaints at the EMA against these establishments were informed of the procedure for lodging objections. There were three (3) trials for annual licenses 2011. In each instance, the EMA was asked to be present to recommend decibel levels which were further written into the license.

In 2011, a session was hosted by the EMA geared towards event promoters. This focused on the Noise Pollution Control Rules (NPCR) and the noise variation process. The session was well received by those who participated and the questions asked at this forum fuelled the proposal for a FAQ booklet concentrating on noise variation issues to be published.

Greater enforcement of the conditions of granted variations also began in 2011. Several applicants were required to submit monitoring reports to the EMA after the event. This condition was very rarely adhered to in the past, however, it was communicated to the applicants that this condition has to be satisfied.

TO PROTECT HUMAN HEALTH AND THE NATURAL ENVIRONMENT THROUGH THE TIMELY ENFORCEMENT OF STATUTES, ENSURING COMPLIANCE WITH PERMIT AND LICENSE CONDITIONS, AND THE PROMOTION OF ENVIRONMENTAL STEWARDSHIP

Notices of Violation (NOV) Served

Breach of the CEC Rules

- A total of forty-nine (49) NOVs were served for the year 2011

Breach of the Noise Pollution Control Rules

- A total of twelve (12) NOVs were served for the year 2011

Administrative Orders (AO) Served

- A total of one (1) AO was served for 2011

Consent Agreements

- A total of eight (8) Consent Agreements were executed for 2011

Court Matters

- A total of three (3) court matters commenced in 2011:
 1. **EAA 001 of 2011** – EMA v Niko Resources (Trinidad & Tobago) Ltd;
 2. **EAA 002 of 2011** – EMA v Michael Trestrail; and
 3. **EAP 003 of 2011** – T.N. Ramnauth & Co. Ltd.

EAP 008/2010 – EMA v. NATIONAL GAS COMPANY OF TRINIDAD AND TOBAGO

On July 29, 2011, the EC gave its ruling in this matter in favour of the EMA. It was also ruled that NGC pay the EMA's costs in the matter to be agreed by the parties, failing which costs to be assessed by the Registrar of the Commission.

2.2 Enabling Strategies

MODIFY AND/OR DEVELOP LEGISLATION, POLICIES, PROCEDURES AND SYSTEMS TO FACILITATE THE WORK OF THE EMA

Beverage Containers Bill, 2011

- On January 4, 2011, Managing Director/CEO, Dr. Singh signed off on the Beverage Container Bill 2011 and the Bill was forwarded for the attention of the Minister of Housing and Environment.
- A Stakeholder session was held on February 7, 2011 to present and discuss the Bill being proposed by the EMA. Session chaired by Honourable Minister Moonilal, presentation by Dr. Singh and involved TTMA, Supermarkets' Association, etc. By virtue of this stakeholder session, a further list of revisions is being considered by the EMA to take into account the Bill proposed by TTMA and other stakeholder concerns.
- On October 28, 2011 upon instructions from the MD/CEO final revisions were made to the draft Beverage Container Bill 2011. The relevant documents were finalized and sent via the MD/CEO's office to the Honourable Minister of Housing and the Environment, as at October 31, 2011.
- At request of the Minister of Housing & Environment, EMA prepared a Cabinet Note to accompany updated BCB which was provided to MHE on November 11, 2011.

Air Pollution Rules

- Meeting attended at the Office of the Chief Parliamentary Counsel (CPC) to discuss the draft APR. CPC was informed that the Authority is in the process of finalizing the draft Air Pollution Fees Regulations and same shall be submitted in due course as well as a few changes to the draft APR being undertaken by the technocrats at the EMA.

- Legislative Review Committee (LRC) Meeting attended at the Ministry of the Attorney General on December 14th 2011 to provide a status report on the draft Air Pollution Rules. It was explained that the APR was before the CPC for vetting and the APR Fees Regulations were being concluded by the EMA

CULTIVATE POSITIVE ATTITUDES TO ENVIRONMENTAL PROTECTION AND CONSERVATION THROUGH AWARENESS BUILDING, EDUCATION AND EFFECTIVE COMMUNICATION

Film Festival – Sept 2011

The EMA held its first National Film Festival Competition titled, “*360 Degrees On All Things Forest*” to commemorate the International Year of Forests (IYF) 2011 and its theme “*Forests For People*”. The EMA adopted this avenue of environmental education to encourage a fun and entertaining learning experience for others.

The EMA received 23 submissions from students, first-time film-makers and independent film-makers throughout Trinidad and Tobago. The submissions ranged from comical animated films to thought-provoking short films, all with different but environmentally educational messages.

Some of the messages included: man’s role as guardian of our forests, the human ability to go from a disregard for nature to an understanding of the need to preserve it, and the importance of preserving our forests for future generations. Films were well researched and showed linkages between human activity, climate and the importance of forests.

Public viewings of these environmental films were held throughout the country.

Eco-Song 2011

The EMA together with the Ministry of Housing and the Environment, the Ministry of Education and the Forestry Division, hosted the fourth annual Secondary Schools’ Eco-Song Competition from September 2011 to November 2011. Couva West Secondary School emerged victorious as the winner of both the Forms 1-3 and Forms 4-6 Categories.

This EMA event brought to life the topic of the United Nations (UN) designated theme for 2011, ‘*Forests for People*’. The EMA also used the opportunity to award the winners of its first National Film Festival which focused on ‘*360 degrees On All Things Forest*’ in commemoration on the *International Year of Forests (IYF)*.

Youth camp - 2011

On July 17th - July 23rd, the EMA hosted its fourth annual Youth Workshop for Form Six students at Asa Wright Nature Centre in Arima. The six day live-in workshop focused on the

2011 International Year of Forests theme “Forests for People”, and addressed the key role of forests and sustainable forest management. At the end of the workshop, students were able to demonstrate a thorough understanding of the theme by way of environmental articles, art and dramatic performances.

Over the years, the Youth Workshop has been used as an important tool used by the EMA to encourage a sense of environmental consciousness in the participants. The main goal of this camp was to promote the understanding of the relationship between people and the environment (environmental management) and youth involvement in environmental decision-making in T&T.

International Coastal Cleanup 2011

This year the EMA focused its cleanup efforts on the Manzanilla beach while promoting responsible environmental practices when visiting our various beaches. This annual event is first and foremost a data collection exercise which helps planners at the local, regional, national, and international levels tackle marine debris effectively. In Trinidad and Tobago, all glass and plastic bottles collected as part of the ICC exercise are recycled keeping these bottles out of the local landfills.

The ICC which started in 1986 is the world’s largest volunteer event of its kind which allows people to remove garbage from the beaches and waterways, whilst identifying the sources of the garbage. This is all done with the hope of changing the behaviours that cause the pollution.

Primary Schools Programme 2011

The EMA has collaborated with the Ministry of Education and the Forestry Division to spearhead a pilot Primary Schools’ Environmental Programme entitled, “Bringing Nature to You”, in commemoration of International Year of Forests, 2011.

Standard Three students from 27 schools in the Victoria Education District were involved in this exciting programme which exposed them to classroom activities, as well as field trips. This geographical location was selected because it is particularly vulnerable to environmental mismanagement which contributes to flooding, the spread of vector-borne diseases, loss of species habitat, as well as poor soil and water quality.

Educators from the EMA and the Forestry Division visited these schools and discussed topics such as: the Importance of Wetlands, Waste Management and Forest Biodiversity. Sessions were designed to give students the opportunity to learn about environment issues related to these topics and to show the effects of these issues on their respective communities. Students gained a better understanding of the integral environmental linkages and adverse impact that environmental mismanagement may have on human health and the social environment.

Green Business Forum –March 2011

In March 2011, the EMA hosted a two-day *Green Business Forum* in an effort to cultivate positive attitudes and action towards the greening of business operations and services. The forum's main objective was to develop viable options for developing a greener economy for Trinidad and Tobago.

This forum was intended to:

- Engage all sectors in developing a way forward for green business
- Promote networking on green initiatives among stakeholders in the business sector
- Streamline business strategies with Government's plans as outlined in the Budget Statement 2011.

The Forum also addressed issues on: *The EMA's Critical Role in Promoting and Sustaining Green Business in T&T; Creating the Right Economic Environment for Green Growth in T&T; Supporting the Green Economy – the Responsibility of the Financial Sector; Increasing Corporate Image by Greening from the Inside; Strengthening the Tourism Industry - New Trends in Responsible Tourism; The Economic Viability of Sustainable Energy; The Green Fund's Support of a Sustainable Economy*

There is tremendous opportunity in Trinidad and Tobago (T&T) for green business, and investment in a green economy will contribute to not only our economic security, but also to our environmental and social sustainability.

Following this forum the EMA established the **Green Business Register** which is an online hub for locating Green Businesses in Trinidad and Tobago.

Green lifestyle Show 2011

On Sunday June 5, 2011 the Environmental Management Authority celebrated its 16th anniversary and commemorated the UN designated WED. The EMA paid tribute to the day by hosting its 2nd annual Green Lifestyle Show at the Grand Ballroom, Trinidad Hilton from 10am to 5pm.

With over 65 exhibition booths, 'green' practitioners displayed their eco-friendly products and services free to the public. The Green Lifestyle Show is the EMA's main WED event and brought together buyers and sellers with the aim of increasing awareness of 'green' alternatives and making wise consumer choices.

The public was exposed to the following green business categories – Health, Beauty and Fashion; Energy, Industry, Transport and Agriculture; Tourism and Recreation; Home, Garden

and Lifestyle; Non-Governmental Organisations and Community-Based Organisations and Government Ministries, Agencies and Diplomatic Missions. The EMA also hosted a children's area featuring face-painting, fun environmental activities and an interactive exhibition courtesy The National Institute of Higher Education, Research, Science and Technology (NIHERST). The talented EMA Youth Ambassadors and Eco-Song finalists also performed pieces on the environment as part of the day's entertainment.

Make a Kid Smile 2011

The annual Make a Kid Smile Christmas Project, is an initiative of the EMA's staff and has become an important part of EMA's corporate social responsibility. This year the EMA visited the Margaret Kistow Children's Home. Staff members usually donate gifts, or money to purchase gifts, which are then distributed to a chosen home or school. Over the years the EMA has donated hundreds of presents to children thanks solely to the generosity and kindness of its staff members.

MAXIMISE SELF-FUNDING OF EMA OPERATIONS

EMA Expands to the East

On 15 December, 2011, the EMA signed the official lease to the new EMA Office which stands on the Corner of St. John's Road and the Eastern Main Road in Tunapuna. This building would represent one of the other two EMA offices located on #8 Elizabeth Street, Port of Spain and on #2 Dumfries Road, La Romain in South Trinidad.

The EMA is committed to providing greater opportunities for improved efficiency and wider scope for the Authority, through expansion and decentralisation of its operations.

3.0 PLANS FOR 2012

Building capacity in Air Pollution management through USEPA partnership

The scope of the works include the revitalization of the MOU between the US and T&T on environmental cooperation, familiarization tour of USEPA Air Pollution Policy and Management, training in Air Pollution modelling, design of ambient air quality monitoring network for T& T, visit by USEPA personnel, mechanism for collecting air quality indices for T&T.

Building capacity in the Compliance Unit to support environmental investigations and Emergency Response - Emergency Response Categorisation, Hazard Identification and Risk Assessment

The objective of the project is to identify hazards and assess the risk of EMA's current ER activities, formally designate categories which require ER from the EMA, develop an Incident Reporting Form to be distributed to stakeholders in all relevant sectors.

Noise Pollution Control Campaign

The objective of this project is to produce a FAQs booklet for distribution to public in order to increase awareness of the NPCR, inclusion of EMA's recommendation as a condition for liquor and dancehall licences, increase noise monitoring of events by members of the TTPS.

APPENDIX 1 - BOARD OF DIRECTORS

- As at December, 2011

1. Kelvin Ramnath - Chairman
2. Mr. Shyam Dyal- Deputy Chairman
3. Mr. Terrence Holmes
4. Mr. John Julien
5. Mr. Michael Rooplal
6. Ms Ashvini Supersad
7. Dr. Lena Brereton-Wolffe
8. Dr. Joth Singh-Managing Director - Ex-officio Member of the Board.

- **Board of Trustees**

1. Mr. Shyam Dyal
2. Mr. Paolo Kernahan
3. Mr. Michael Rooplal
4. Dr. Lena Brereton-Wolffe

- **Co-ordination Committee**

1. Mr. Shyam Dyal (Deputy Chairman)
2. Ms. Ashvini Supersad
3. Mr. Paolo Kernahan

- **Human Resource Committee**

1. Mr. Kelvin Ramnath (Chairman)
2. Mr. John Julien
3. Dr. Vincent Lasse

- **Tenders Committee**

1. Mr. Michael Rooplal
2. Mr. Shyam Dyal (Deputy Chairman)

- **Noise Advisory Committee**

1. Mr. Terrence Holmes (Chairman)
2. Dr. Lena Brereton-Wolffe
3. Dr. Deborah Pinder
4. Dr. Wesley Shim
5. Ms. Gayatri Badri Maharaj
6. Ms. Frances Mitchell Wanliss

PART C: FINANCIAL STATEMENTS

Environmental Trust Fund

Audited Financial Report
for the year ended
September 30, 2011.



REPORT OF THE AUDITOR GENERAL OF THE REPUBLIC OF TRINIDAD AND TOBAGO ON THE FINANCIAL STATEMENTS OF THE ENVIRONMENTAL MANAGEMENT AUTHORITY - ENVIRONMENTAL TRUST FUND FOR THE YEAR ENDED 30 SEPTEMBER 2011

The accompanying Financial Statements of the Environmental Management Authority - Environmental Trust Fund for the year ended 30 September 2011 have been audited. The Statements comprise a Statement of Financial Position as at 30 September 2011, a Statement of Comprehensive Income, a Statement of Movement of Funds and a Statement of Cash Flows for the year ended 30 September 2011 as well as Notes to the Financial Statements numbered 1 to 14.

2. The audit was conducted by a firm of Accountants appointed by the Board of Directors with the written consent of the Auditor General. Their Report dated 27 March 2012 which is attached refers.

SUBMISSION OF REPORT

3. This Report is being submitted to the Speaker of the House of Representatives, the President of the Senate and the Minister of Finance and the Economy in accordance with the provisions of sections 116 and 119 of the Constitution of the Republic of Trinidad and Tobago.

18th January, 2013



Sharmar Otley
SHARMAN OTLEY
AUDITOR GENERAL



Chartered Accountants
& Business Advisors

**ENVIRONMENTAL MANAGEMENT AUTHORITY
ENVIRONMENTAL TRUST FUND**

FINANCIAL STATEMENTS

30 SEPTEMBER 2011



Chartered Accountants
& Business Advisors

ENVIRONMENTAL MANAGEMENT AUTHORITY
ENVIRONMENTAL TRUST FUND

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*Environment
management
authority*

ENVIRONMENT MANAGEMENT AUTHORITY

Statement of Management Responsibilities

It is the responsibility of management to prepare financial statements for each financial year which give a true and fair view of the state of affairs of the Authority as at the end of the financial year and of the operating results of the Authority for the year. It is also management's responsibility to ensure that the Authority keeps proper accounting records which disclose with reasonable accuracy at any time the financial position of the Authority. They are also responsible for safeguarding the assets of the Authority.

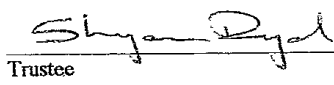
Management is responsible for the preparation and fair presentation of these financial statements in accordance with International Financial Reporting Standards. This responsibility includes designing, implementing and maintaining internal control relevant to the preparation and fair presentation of financial statements that are free from material misstatement, whether due to fraud or error, selecting and applying appropriate accounting policies, and making accounting estimates that are reasonable in the circumstances.

Management accepts responsibility for the annual financial statements, which have been prepared using appropriate accounting policies supported by reasonable and prudent judgments and estimates, in conformity with International Financial Reporting Standards. Management are of the opinion that the financial statements give a true and fair view of the state of the financial affairs of the Authority and of its operating results. Management further accepts responsibility for the maintenance of accounting records which may be relied upon in the preparation of financial statements, as well as adequate systems of internal financial control.

Nothing has come to the attention of Management to indicate that the Authority will not remain a going concern for at least the next twelve months from the date of this statement.


Trustee

Date MARCH 27, 2012


Trustee

Date MARCH 27, 2012



Chartered Accountants
& Business Advisors

INDEPENDENT AUDITORS' REPORT

The Trustees Environmental Management Authority - Environmental Trust Fund

We have audited the accompanying financial statements of Environmental Management Authority – Environmental Trust Fund, which comprise the statement of financial position as at 30 September 2011, the statements of comprehensive income, movement of funds and cash flows for the year then ended, and a summary of significant accounting policies and other explanatory information.

Management's Responsibility for the Financial Statements

Management is responsible for the preparation and fair presentation of these financial statements in accordance with International Financial Reporting Standards, and for such internal control as management determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

Auditors' Responsibility

Our responsibility is to express an opinion on these financial statements based on our audit. We conducted our audit in accordance with International Standards on Auditing. Those standards require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditors' judgement, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditors consider internal control relevant to the entity's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of accounting estimates made by management, as well as evaluating the overall presentation of the financial statements. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Opinion

In our opinion, the financial statements present fairly, in all material respects, the financial position of Environmental Management Authority – Environmental Trust Fund as of 30 September 2011, and of its financial performance and cash flows for the year then ended in accordance with International Financial Reporting Standards.

PKF

**Port of Spain
27 March 2012**

Direct tel (868) 624-4569 | Direct fax (868) 624-4388

Email pkf-trinidad@trinidad.net

PKF | 245 Belmont Circular Road | PO Bag 250 | Belmont | Port-of-Spain | Trinidad | WI

Partners Ainsley A. Mark | Michael G. Toney | Reneé-Lisa Philip | Mark K. Superville

ENVIRONMENTAL MANAGEMENT AUTHORITY
ENVIRONMENTAL TRUST FUND

STATEMENT OF FINANCIAL POSITION

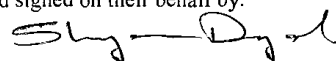
ASSETS

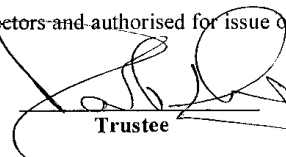
| | <u>Notes</u> | <u>30 September</u> | |
|-------------------------------------|--------------|-----------------------------|-----------------------------|
| | | <u>2011</u> | <u>2010</u> |
| Cash Resources: | | | |
| Cash in hand and at bank | 5 | \$ 34,777,346 | \$ 24,268,984 |
| Short-term investments | 6 | <u>5,790,304</u> | <u>5,670,509</u> |
| Total Cash Resources | | 40,567,650 | 29,939,493 |
| Other Assets: | | | |
| Accounts receivable and prepayments | 7 | 1,778,930 | 2,822,506 |
| Fixed assets | 8 | <u>43,257,828</u> | <u>44,372,996</u> |
| Total Assets | | <u>\$ 85,604,408</u> | <u>\$ 77,134,995</u> |

LIABILITIES AND FUNDS

| | | | |
|------------------------------------|----|-----------------------------|-----------------------------|
| Liabilities: | | | |
| Accounts payable and accruals | 9 | \$ 16,207,176 | \$ 12,752,853 |
| Deferred income | 10 | <u>733,941</u> | <u>1,347,830</u> |
| Total Liabilities | | <u>16,941,117</u> | <u>14,100,683</u> |
| Funds: | | | |
| GORTT Fund | | 46,724,564 | 40,423,598 |
| UNDP Fund | | 292,172 | 505,253 |
| IBRD Fund | | 2,806,990 | 3,051,959 |
| Other Fund | | 857,421 | 1,071,358 |
| NSRCSL Project Fund | | - | - |
| Revaluation surplus | | <u>17,982,144</u> | <u>17,982,144</u> |
| Total Funds | | <u>68,663,291</u> | <u>63,034,312</u> |
| Total Liabilities and Funds | | <u>\$ 85,604,408</u> | <u>\$ 77,134,995</u> |

These financial statements were approved by the Board of Directors and authorised for issue on 27 March 2012 and signed on their behalf by:


Trustee


Trustee

(The accompanying notes form part of these financial statements)

**ENVIRONMENTAL MANAGEMENT AUTHORITY
ENVIRONMENTAL TRUST FUND**

STATEMENT OF COMPREHENSIVE INCOME

| | For the year ended 30 September | |
|------------------------------------|--|--------------------|
| | <u>2011</u> | <u>2010</u> |
| Income: | | |
| GORTT Fund | \$ 43,163,042 | \$ 41,560,523 |
| UNDP Fund | 63,960 | - |
| NSRCSL Project Fund | 1,860,851 | 117,595 |
| Other Fund income | 312,350 | 699,763 |
| Activities income | 1,079,257 | 973,500 |
| Interest income | 129,733 | 207,119 |
| Profit on disposal of fixed assets | - | 123,878 |
| Gain/(loss) on foreign exchange | <u>1,026</u> | <u>(9,200)</u> |
| | 46,610,219 | 43,673,178 |
| Project expenses | <u>(5,245,835)</u> | <u>(2,676,488)</u> |
| Income after project expenditure | <u>41,364,384</u> | <u>40,996,690</u> |

(The accompanying notes form part of these financial statements)

**ENVIRONMENTAL MANAGEMENT AUTHORITY
ENVIRONMENTAL TRUST FUND**

STATEMENT OF COMPREHENSIVE INCOME (CONT'D)

| | For the year ended 30 September | |
|--|--|-----------------------------|
| | <u>2011</u> | <u>2010</u> |
| Expenditure: | | |
| Advertising and promotions | \$ 675,342 | \$ 760,508 |
| Audit fees | 90,250 | 82,119 |
| Contract services | 661,893 | 570,323 |
| Depreciation | 1,553,065 | 1,605,138 |
| Directors' expenses | 64,197 | 53,039 |
| Directors' fees | 544,271 | 428,200 |
| Interest and bank charges | 16,484 | 12,840 |
| Insurance | 407,441 | 486,910 |
| Loss on disposal of fixed assets | 3,451 | - |
| Motor vehicle expenses | 402,875 | 352,059 |
| Maintenance contracts | 483,876 | 408,101 |
| Management fees | 18,000 | 18,000 |
| Office and general expenses | 76,833 | 60,304 |
| Permitting and compliance costs | 784,336 | 1,458,362 |
| Professional fees | 122,284 | 996,576 |
| Publication costs | - | 2,905 |
| Reference and research cost | 241,307 | 193,176 |
| Rent | 1,424,792 | 1,354,976 |
| Repairs and maintenance | 380,863 | 544,144 |
| Salaries and benefits | 24,810,334 | 22,181,091 |
| Security | 788,188 | 759,227 |
| Selection and recruitment costs | 74,174 | 90,273 |
| Supplies | 599,577 | 858,433 |
| Training | 194,418 | 161,912 |
| Travel | 124,546 | 77,932 |
| Utilities | <u>1,190,752</u> | <u>1,120,521</u> |
| | <u>35,733,549</u> | <u>34,637,069</u> |
| Net surplus for the year | 5,630,835 | 6,359,621 |
| Other Comprehensive Income: | | |
| Revaluation surplus | <u>-</u> | <u>17,982,144</u> |
| Total Comprehensive Income for the year | <u>\$ 5,630,835</u> | <u>\$ 24,341,765</u> |

(The accompanying notes form part of these financial statements)

**ENVIRONMENTAL MANAGEMENT AUTHORITY
ENVIRONMENTAL TRUST FUND**

STATEMENT OF MOVEMENT OF FUNDS

For the year ended 30 September 2011

| | GORTT Fund | UNDP Fund | IBRD Fund | Other Fund | NSRCSL Protect Fund | Revaluation Surplus | Total |
|---------------------------------------|----------------------|-------------------|---------------------|-------------------|------------------------|------------------------|----------------------|
| Balance as at 1 October 2009 | \$ 34,058,032 | \$ 720,804 | \$ 3,537,216 | \$ 475,509 | \$ - | \$ - | \$ 38,791,561 |
| Equity adjustment | - | - | - | (99,014) | - | - | (99,014) |
| Funds received | 41,560,523 | - | - | 699,763 | 117,595 | - | 42,377,881 |
| Interest income | 207,119 | - | - | - | - | - | 207,119 |
| Activities income | 973,500 | - | - | - | - | - | 973,500 |
| Profit on disposal of fixed assets | 123,878 | - | - | - | - | - | 123,878 |
| Gain on foreign exchange | (9,200) | - | - | - | - | - | (9,200) |
| Fixed asset revaluation | - | - | - | - | - | 17,982,144 | 17,982,144 |
| Expenditure | <u>(36,490,254)</u> | <u>(215,551)</u> | <u>(485,257)</u> | <u>(4,900)</u> | <u>(117,595)</u> | <u>-</u> | <u>(37,313,557)</u> |
| Balance as at 1 October 2010 | 40,423,598 | 505,253 | 3,051,959 | 1,071,358 | - | 17,982,144 | 63,034,312 |
| Equity adjustment (Note 14) | - | (1,856) | - | - | - | - | (1,856) |
| Funds received | 43,163,042 | 63,960 | - | 312,350 | 1,860,851 | - | 45,400,203 |
| Interest income | 129,733 | - | - | - | - | - | 129,733 |
| Activities income | 1,079,257 | - | - | - | - | - | 1,079,257 |
| Loss on disposal of fixed assets | (3,451) | - | - | - | - | - | (3,451) |
| Gain on foreign exchange | 1,026 | - | - | - | - | - | 1,026 |
| Fixed asset revaluation | - | - | - | - | - | - | - |
| Expenditure | <u>(38,068,641)</u> | <u>(275,185)</u> | <u>(244,969)</u> | <u>(526,287)</u> | <u>(1,860,851)</u> | <u>-</u> | <u>(40,975,233)</u> |
| Balance at 30 September 2011 | <u>\$ 46,724,564</u> | <u>\$ 292,172</u> | <u>\$ 2,806,990</u> | <u>\$ 857,421</u> | <u>\$ -</u> | <u>\$ 17,982,144</u> | <u>\$ 68,663,291</u> |

(The accompanying notes form part of these financial statements)

**ENVIRONMENTAL MANAGEMENT AUTHORITY
ENVIRONMENTAL TRUST FUND**

STATEMENT OF CASH FLOWS

| | For the year ended 30 September | |
|---|--|----------------------------|
| | <u>2011</u> | <u>2010</u> |
| Cash Flows from Operating Activities: | | |
| Net surplus for the year | \$ 5,630,835 | \$ 6,359,621 |
| Adjustments: | | |
| Depreciation | 1,553,065 | 1,605,138 |
| Loss/(gain) on disposal of fixed assets | 3,451 | (123,877) |
| Equity adjustment | <u>(1,856)</u> | <u>(99,014)</u> |
| | 7,185,495 | 7,741,868 |
| Net change in accounts receivable and prepayments | 1,043,576 | (522,624) |
| Net change in accounts payable and accruals | 3,454,323 | 8,356,424 |
| Net change in deferred income | <u>(613,889)</u> | <u>1,347,830</u> |
| Cash provided by Operating Activities | <u>11,069,505</u> | <u>16,923,498</u> |
| Cash Flows from Investing Activities: | | |
| Purchase of fixed assets | (441,348) | (438,336) |
| Proceeds from sale of fixed assets | <u>-</u> | <u>171,956</u> |
| Cash used in Investing Activities | <u>(441,348)</u> | <u>(266,380)</u> |
| Increase in cash and cash equivalents | 10,628,157 | 16,657,118 |
| Cash and cash equivalents, beginning of year | <u>29,939,493</u> | <u>13,282,375</u> |
| Cash and cash equivalents, end of year | <u>\$40,567,650</u> | <u>\$29,939,493</u> |
| Represented by: | | |
| Cash in hand and at bank | \$34,777,346 | \$24,268,984 |
| Short-term investments | <u>5,790,304</u> | <u>5,670,509</u> |
| | <u>\$40,567,650</u> | <u>\$29,939,493</u> |

(The accompanying notes form part of these financial statements)

ENVIRONMENTAL MANAGEMENT AUTHORITY
ENVIRONMENTAL TRUST FUND

NOTES TO THE FINANCIAL STATEMENTS

30 SEPTEMBER 2011

1. Registration and Activities:

The Environmental Management Authority (the Authority) is a Statutory Authority established when Parliament assented to the Environmental Management Act, 1995 on 7 March 1995. The Authority was established to develop and implement institutional arrangements for the regulation and management of the environment in the Republic of Trinidad and Tobago.

The Environmental Trust Fund was established by the Act to fund the operations of the Authority and is administered by five members of the Board of Directors, designated by the President to act as Trustees.

The Environmental Management Act, 1995 was repealed on 8 March 2000 and replaced by the Environmental Management Act, 2000. The new Act changed the financial year end of the Authority to 30 September.

During the twelve month period ended 30 September 2011, the Authority continued its work in enforcing the Noise Pollution Control Rules, 2001; the Noise Pollution Control (Fees) Regulation, 2001; Certificate of Environmental Clearance Rules; the Certificate of Environmental Clearance (Designated Activities) Amendment Order, 2008 & 2007; Certificate of Environmental Clearance (Designated Activities) Order, 2001; the Certificate of Environmental Clearance (Fees and Charges) Regulations, 2001; the Environmental Commission Rules of Practice and Procedure; Water Pollution (Amendment) Rules, 2006; Water Pollution Rules, 2001; Water Pollution (Amendment) Fees; Water Pollution (Fees) Regulations, the Environmentally Sensitive Areas Rules, 2001; and Environmentally Sensitive Species Rules, 2001.

The draft Beverage Container Bill and Air Pollution and Hazardous & Non Hazardous and Waste Rules are also at various stages of development.

2. Summary of Significant Accounting Policies:

(a) Basis of financial statements preparation -

These financial statements are prepared in accordance with International Financial Reporting Standards (IFRS), and are stated in Trinidad and Tobago dollars. The historical cost basis is used, except for the measurement at fair value of available-for-sale investments and certain other financial instruments.

**ENVIRONMENTAL MANAGEMENT AUTHORITY
ENVIRONMENTAL TRUST FUND**

NOTES TO THE FINANCIAL STATEMENTS (CONTINUED)

30 SEPTEMBER 2011

2. Summary of Significant Accounting Policies (Cont'd):

(b) New Accounting Standards and Interpretations -

- i) The Authority has not applied the following International Financial Reporting Interpretations Committee (IFRIC) interpretation that became effective during the current year, as they do not apply to the activities of the Authority:

IFRIC 20 Stripping Costs in the Production Phase of a Surface Mine.

- ii) The Authority has not applied the following International Accounting Standards (IASs), International Financial Reporting Standards (IFRSs) and specific amendments that have been issued but are not yet effective, as they either do not apply to the activities of the Authority or have no material impact on its financial statements, except for IFRS 9 Financial Instruments:

IFRS 1 First-time Adoption of International Financial Reporting Standards – Replacement of “fixed dates” for certain exceptions with “the date of transition to IFRSs” (effective for accounting periods beginning on or after 1 July 2011).

IFRS 1 First-time Adoption of International Financial Reporting Standards – Additional exemption for entities ceasing to suffer from hyperinflation (effective for accounting periods beginning on or after 1 July 2011).

IFRS 7 Financial Instruments: Disclosure – Amendments enhancing disclosure about transfers of financial assets (effective for accounting periods beginning on or after 1 July 2011).

IFRS 9 Financial Instruments: Classification and Measurement (effective for accounting periods beginning on or after 1 January 2015).

IFRS 9 Financial Instruments: Accounting for Financial Liabilities and Derecognition (effective for accounting periods beginning on or after 1 January 2015).

IFRS 10 Consolidated Financial Statements (effective for accounting periods beginning on or after 1 January 2013).

IFRS 11 Joint Arrangements (effective for accounting periods beginning on or after 1 January 2013).

IFRS 12 Disclosure of Interest in Other Entities (effective for accounting periods beginning on or after 1 January 2013).

ENVIRONMENTAL MANAGEMENT AUTHORITY
ENVIRONMENTAL TRUST FUND

NOTES TO THE FINANCIAL STATEMENTS (CONTINUED)

30 SEPTEMBER 2011

2. Significant Accounting Policies (Cont'd):

(b) **New Accounting Standards and Interpretations (cont'd) -**

ii) (cont'd) -

- IFRS 13 Fair Value Measurement (effective for accounting periods beginning on or after 1 January 2013).
- IAS 1 Presentation of Financial Statements – Amendments to revise the way other comprehensive income is presented (effective for accounting periods beginning on or after 1 July 2012).
- IAS 12 Income Taxes – Limited scope amendment - recovery of underlying assets (effective for accounting periods beginning on or after 1 January 2012).
- IAS 19 Employee Benefits – Amended standard resulting from the Post-Employment Benefits and Termination Benefits projects (effective for accounting periods beginning on or after 1 January 2013).
- IAS 27 Consolidated and Separate Financial Statements – Reissued as IAS 27 Separate Financial Statements (effective for accounting periods beginning on or after 1 January 2013).
- IAS 28 Investments in Associates – Reissued as IAS 28 Investments in Associates and Joint Ventures (effective for accounting periods beginning on or after 1 January 2013).
- IAS 32 Financial Instruments; Presentation – Amendments to application guidance on the offsetting of financial assets and financial liabilities (effective for accounting periods beginning on or after 1 January 2014).
- IAS 34 Interim Financial Reporting – Amendments resulting from May 2010 Annual Improvements to IFRSs (effective for accounting periods beginning on or after 1 January 2011).

The adoption of IFRS 9 Financial Instruments may result in significant changes in the Authority's classification and presentation of financial instruments.

**ENVIRONMENTAL MANAGEMENT AUTHORITY
ENVIRONMENTAL TRUST FUND**

NOTES TO THE FINANCIAL STATEMENTS (CONTINUED)

30 SEPTEMBER 2011

2. Significant Accounting Policies (Cont'd):

(c) Fixed assets and depreciation -

Land and building comprise offices occupied by the Authority and include land purchased for construction of new offices in Trincity. A valuation was completed on the building at #8 Elizabeth Street, St. Clair by independent valuer G. A. Farrell & Associates Limited. The effective date of the valuation was 4 January 2010 and the value of **TTS\$26 million** was determined after consideration and use of one of more of the following approaches: the Direct Sales Comparison Approach; the Income Approach; and the Cost Approach. Land and building are stated at historical cost/valuation, less depreciation in the case of building. Historical cost includes expenditure that is directly attributable to the acquisition of the items.

Subsequent costs are included in the asset's carrying amount or recognised as a separate asset, as appropriate, only when it is probable that future economic benefits associated with the item will flow to the Authority and the cost of the item can be measured reliably. All other repairs and maintenance are charged to the Statement of Comprehensive Income during the financial period in which they are incurred.

Depreciation is calculated on the reducing balance method to write off the cost of assets to their residual values over their estimated useful life as follows:

| | | |
|---------------------------------------|---|--------------------|
| Building | - | 2% - 20% per annum |
| Furniture and fittings | - | 10% per annum |
| Office equipment | - | 20% per annum |
| Motor vehicles and computer equipment | - | 25% per annum |
| Library/Information | - | 10% per annum |

Land is not depreciated as it is deemed to have an indefinite life.

Where the carrying amount of an asset is greater than its estimated recoverable amount, it is written down immediately to its recoverable amount.

Gains and losses on disposal of property, plant and equipment are determined by reference to their carrying amounts and are included in the Statement of Comprehensive Income.

ENVIRONMENTAL MANAGEMENT AUTHORITY
ENVIRONMENTAL TRUST FUND

NOTES TO THE FINANCIAL STATEMENTS (CONTINUED)

30 SEPTEMBER 2011

2. Summary of Significant Accounting Policies (Cont'd):

(d) **Foreign currency -**

Monetary assets and liabilities denominated in foreign currencies are expressed in Trinidad and Tobago dollars at rates of exchange ruling at the Statement of Financial Position date. All revenue and expenditure transactions denominated in foreign currencies are translated at the rates of exchange ruling at the date of the transaction and the resulting profits and losses on exchange from trading activities are recorded in the Statement of Comprehensive Income.

(e) **Taxation -**

The Authority is exempt from taxation under the Environmental Management Act of 2000, Part VII Section 76. According to Section 76:-

'...The Fund and the Authority shall be exempted from stamp duty, corporation tax, customs duties, value added taxes, motor vehicle taxes, fees, charges, assessments, levies and imposts on any income or profits or on assets which are acquired for use by the Fund or the Authority...'

(f) **Use of estimates -**

The preparation of the financial statements in conformity with International Financial Reporting Standards, requires management to make estimates and assumptions that affect the reported amount of assets and liabilities. Also required is the disclosure of contingent assets and liabilities at the date of the financial statements and the reported amounts of revenue and expenses during the reporting period. Actual results could differ from those estimates.

(g) **Financial instruments -**

Financial assets and financial liabilities are recognised on the Authority's Statement of Financial Position when the Authority becomes a party to the contractual provisions of the instrument.

Cash and cash equivalents

Cash and cash equivalents consist of highly liquid investments with original maturities of three months or less and are carried at cost, which approximates market value.

Trade payables

Trade payables are stated at amounts due.

ENVIRONMENTAL MANAGEMENT AUTHORITY
ENVIRONMENTAL TRUST FUND

NOTES TO THE FINANCIAL STATEMENTS (CONTINUED)

30 SEPTEMBER 2011

2. Summary of Significant Accounting Policies (Cont'd):

(h) **Income and funding -**

Funding was provided to the Environmental Management Authority Environmental Trust Fund as follows:

- (i) Proceeds of a loan of US\$6.25 million from the IBRD to the Government of the Republic of Trinidad and Tobago (GORTT). The loan facility closed on 31 December 2000.
- (ii) Ongoing funding from the GORTT to cover recurrent and development programme expenditure. Government Grants are accounted for using the income approach. Under this approach, the grant is recognised in profit or loss on a systematic basis over the periods in which the entity recognises as expenses, the related costs for which the grant is intended to compensate.
- (iii) Grant funds are provided by the United Nations Development and Environment Programmes (UNDP and UNEP) to fund specific activities that are set out in the relevant multilateral agreements. The main projects administered by the Environmental Management Authority Environmental Trust Fund during the financial year ended 30 September 2011 are the Second National Communication to the Convention on Climate Change; Phase V of the Institutional Strengthening Programme for the Phase-out of Ozone Depleting Substances; and Phase II of the Terminal Management Plan for the Phase-out of CFC's.
- (iv) A Memorandum of Agreement was signed on 20 April 2010 with the Minister of Planning, Housing and the Environment acting on behalf of the GORTT to receive funding from the Green Fund to continue with the Nariva Swamp Restoration, Carbon Sequestration and Livelihoods Project (NSRCSL Project). The project duration is from 20 April 2010 to 31 March 2017. Upon signing of the agreement, the first tranche of **TT\$8.471 million** was received. The total amount to be disbursed over the period is **TT\$68.545 million**. Future disbursements will be made based on approved progress reports.

(i) **Comparative information -**

Where necessary, comparative amounts have been adjusted to conform with changes in presentation in the current year.

ENVIRONMENTAL MANAGEMENT AUTHORITY
ENVIRONMENTAL TRUST FUND

NOTES TO THE FINANCIAL STATEMENTS (CONTINUED)

30 SEPTEMBER 2011

3. **Financial Risk Management:**

Financial risk factors

The Authority is exposed to liquidity risk, currency risk, operational risk, compliance risk and reputational risk arising from the financial instruments that it holds. The risk management policies employed by the Authority to manage these risks are discussed below:

(a) **Liquidity risk -**

Liquidity risk is the risk that arises when the maturity of assets and liabilities do not match. An unmatched position potentially enhances net surplus for the year, but can also increase the risk of losses. The Authority has procedures with the object of minimising such losses such as maintaining sufficient cash and other highly liquid current assets.

(i) **Risk management**

The matching and controlled mismatching of the maturities and interest rates of assets and liabilities are fundamental to the management of the Authority. The Authority employs various asset/liability techniques to manage liquidity gaps. Liquidity gaps are mitigated by the liquid nature of a substantial amount of the Authority's assets as well as securing sufficient cash from the Government of the Republic of Trinidad and Tobago.

To manage and reduce liquidity risk the Authority's management actively seeks to match cash inflows with liability requirements.

(b) **Currency risk -**

Currency risk is the risk that the value of financial instruments will fluctuate due to changes in foreign exchange rates. Currency risk arises when future commercial transactions and recognised assets and liabilities are denominated in a currency that is not the Authority's measurement currency. The Authority is exposed to foreign exchange risk arising from various currency exposures primarily with respect to the United States dollar. The Authority's management monitors the exchange rate fluctuations on a continuous basis and acts accordingly.

(c) **Operational risk -**

Operational risk is the risk that derives from deficiencies relating to the Authority's information technology and control systems, as well as the risk of human error and natural disasters. The Authority's systems are evaluated, maintained and upgraded periodically.

ENVIRONMENTAL MANAGEMENT AUTHORITY
ENVIRONMENTAL TRUST FUND

NOTES TO THE FINANCIAL STATEMENTS (CONTINUED)

30 SEPTEMBER 2011

3. **Financial Risk Management (Cont'd):**

(d) **Compliance risk -**

Compliance risk is the risk of financial loss, including fines and other penalties, which arise from non-compliance with laws and regulations of the State.

(e) **Reputational risk -**

The risk of loss of reputation arising from the negative publicity relating to the Authority's operations (whether true or false) may result in a reduction in its revenue from government funding.

4. **Critical Accounting Estimates and Judgements:**

The preparation of financial statements in accordance with International Financial Reporting Standards requires management to make judgements, estimates and assumptions in the process of applying the Authority's accounting policies.

Estimates and judgements are continually evaluated and are based on historical experience and other factors, including expectations of future events that are believed to be reasonable under the circumstances. The Authority makes estimates and assumptions concerning the future and actual results could differ from those estimates as the resulting accounting estimates will, by definition, seldom equal the related actual results. The estimates and assumptions that have a significant risk of causing a material adjustment to the carrying amounts of assets and liabilities within the next financial year are discussed below:

Changes in accounting estimates are recognised in the Statement of Comprehensive Income in the period in which the estimate is changed, if the change affects that period only. If the change affects a prior period, the Authority recognizes this change in the Statement of Movement of Funds in the current period.

The critical judgement, apart from that involving estimations, which has the most significant effect on the amounts recognised in the financial statements, is as follows:-

1. Which depreciation method for building and equipment is used.
2. Whether fixed assets are measured at cost or revalued amount.

**ENVIRONMENTAL MANAGEMENT AUTHORITY
ENVIRONMENTAL TRUST FUND**

NOTES TO THE FINANCIAL STATEMENTS (CONTINUED)

30 SEPTEMBER 2011

4. Critical Accounting Estimates and Judgements (Cont'd):

The key assumption concerning the future and other key sources of estimation uncertainty at the Statement of Financial Position date (requiring management's most difficult, subjective or complex judgements) that has a significant risk of causing a material adjustment to the carrying amounts of assets and liabilities within the next financial year is with respect to building and equipment. Management exercises judgement in determining whether future economic benefits can be derived from expenditures to be capitalised and in estimating the useful lives and residual values of these assets.

5. Cash in Hand and at Bank:

| | 30 September | |
|--|-----------------------------|-----------------------------|
| | <u>2011</u> | <u>2010</u> |
| Petty cash | \$ 13,069 | \$ 13,069 |
| Republic Bank Limited - | | |
| Operating account | 17,786,531 | 10,773,419 |
| Nariva Carbon Assessment Grant | 10,581 | 7,757 |
| NSRCL Project Account | 6,513,458 | 8,407,310 |
| Highway Police Surveillance Bays Project Account | 4,817,696 | - |
| First Citizens Bank Limited - | | |
| Permit income account | 4,438,438 | 3,283,560 |
| RBTT Bank Limited - | | |
| Institutional strengthening | 18,167 | 24,278 |
| Other projects | 246,253 | 246,253 |
| Biodiversity | 14,062 | 14,062 |
| Biosafety | 97,490 | 97,490 |
| NCSA | 395,871 | 654,015 |
| UNFCCC | 343,442 | 343,442 |
| Scotiabank Trinidad and Tobago Limited - | | |
| Terminal Phaseout Management Plan | 16,260 | 381,375 |
| Fleet Card | <u>66,028</u> | <u>22,954</u> |
| | <u>\$ 34,777,346</u> | <u>\$ 24,268,984</u> |

ENVIRONMENTAL MANAGEMENT AUTHORITY
ENVIRONMENTAL TRUST FUND

NOTES TO THE FINANCIAL STATEMENTS (CONTINUED)

30 SEPTEMBER 2011

6. **Short-term Investments:**

| | 30 September | |
|--|----------------------------|----------------------------|
| <u>Available-for-Sale:</u> | <u>2011</u> | <u>2010</u> |
| Republic Bank Limited Pool Bond | \$ 2,137,484 | \$ 2,091,037 |
| Trinidad and Tobago Unit Trust Corporation | <u>3,652,820</u> | <u>3,579,472</u> |
| | <u>\$ 5,790,304</u> | <u>\$ 5,670,509</u> |

7. **Accounts Receivable and Prepayments:**

| | 30 September | |
|---------------------|----------------------------|----------------------------|
| | <u>2011</u> | <u>2010</u> |
| Accounts receivable | \$ 44,250 | \$ 16,750 |
| VAT receivable | 1,347,801 | 2,560,646 |
| Other receivables | 73,460 | 135,214 |
| Prepayments | <u>313,419</u> | <u>109,896</u> |
| | <u>\$ 1,778,930</u> | <u>\$ 2,822,506</u> |

ENVIRONMENTAL MANAGEMENT AUTHORITY
ENVIRONMENTAL TRUST FUND

NOTES TO THE FINANCIAL STATEMENTS (CONTINUED)

30 SEPTEMBER 2011

8. Fixed Assets:

| Cost/Valuation | Land | Building | Furniture and fittings | | Office equipment | Motor vehicles | Computer equipment | Library/Information | Total |
|---------------------------------|--------------|---------------|------------------------|--------------|------------------|----------------|--------------------|---------------------|-------|
| | | | | | | | | | |
| Balance as at 1 October 2010 | \$13,729,868 | \$ 26,000,000 | \$ 3,597,751 | \$ 4,500,363 | \$ 2,346,484 | \$ 4,232,703 | \$ 332,331 | \$ 54,739,500 | |
| Additions | - | - | 8,814 | 25,300 | - | 407,234 | - | 441,348 | |
| Disposals | - | - | - | (4,284) | - | - | - | (4,284) | |
| Balance as at 30 September 2011 | 13,729,868 | 26,000,000 | 3,606,565 | 4,521,379 | 2,346,484 | 4,639,937 | 332,331 | 55,176,564 | |
| Accumulated Depreciation | | | | | | | | | |
| Balance as at 1 October 2010 | - | 506,835 | 1,733,882 | 3,160,218 | 1,557,406 | 3,168,281 | 239,882 | 10,366,504 | |
| Charge for the year | - | 591,351 | 187,022 | 257,787 | 197,270 | 310,390 | 9,245 | 1,553,065 | |
| Disposals | - | - | - | (833) | - | - | - | (833) | |
| Balance as at 30 September 2011 | - | 1,098,186 | 1,920,904 | 3,417,172 | 1,754,676 | 3,478,671 | 249,127 | 11,918,736 | |
| Net Book Value | | | | | | | | | |
| Balance as at 30 September 2011 | \$13,729,868 | \$ 24,901,814 | \$ 1,685,661 | \$ 1,104,207 | \$ 591,808 | \$ 1,161,266 | \$ 83,204 | \$ 43,257,828 | |
| Balance as at 30 September 2010 | \$13,729,868 | \$ 25,493,165 | \$ 1,863,869 | \$ 1,340,145 | \$ 789,078 | \$ 1,064,422 | \$ 92,449 | \$ 44,372,996 | |

ENVIRONMENTAL MANAGEMENT AUTHORITY
ENVIRONMENTAL TRUST FUND

NOTES TO THE FINANCIAL STATEMENTS (CONTINUED)

30 SEPTEMBER 2011

8. Fixed Assets (Contd):

| Cost/Valuation | Land | Building | Furniture and fittings | Office equipment | Motor vehicles | Computer equipment | Library/Information | Total |
|---------------------------------|--------------|---------------|------------------------|------------------|----------------|--------------------|---------------------|---------------|
| Balance as at 1 October 2009 | \$13,729,868 | \$ 11,336,082 | \$ 3,530,235 | \$ 4,319,546 | \$ 2,954,639 | \$ 4,041,530 | \$ 332,331 | \$ 40,244,231 |
| Additions | - | - | 67,516 | 180,817 | - | 190,003 | - | 438,336 |
| Revaluation (Note 2 (c)) | - | 17,982,144 | - | - | - | - | - | 17,982,144 |
| Revaluation adjustment | - | (3,318,226) | - | - | - | - | - | (3,318,226) |
| Disposal adjustment | - | - | - | - | - | 1,170 | - | 1,170 |
| Disposals | - | - | - | - | (608,155) | - | - | (608,155) |
| Balance as at 30 September 2010 | 13,729,868 | 26,000,000 | 3,597,751 | 4,500,363 | 2,346,484 | 4,232,703 | 332,331 | 54,739,500 |
| Accumulated Depreciation | | | | | | | | |
| Balance as at 1 October 2009 | - | 3,318,226 | 1,531,401 | 2,852,403 | 1,853,809 | 2,853,049 | 229,610 | 12,638,498 |
| Revaluation adjustment | - | (3,318,226) | - | - | - | - | - | (3,318,226) |
| Charge for the year | - | 506,835 | 202,481 | 307,815 | 263,638 | 314,097 | 10,272 | 1,605,138 |
| Disposal adjustment | - | - | - | - | - | 1,135 | - | 1,135 |
| Disposals | - | - | - | - | (560,041) | - | - | (560,041) |
| Balance as at 30 September 2010 | - | 506,835 | 1,733,882 | 3,160,218 | 1,557,406 | 3,168,281 | 239,882 | 10,366,504 |
| Net Book Value | | | | | | | | |
| Balance as at 30 September 2010 | \$13,729,868 | \$ 25,493,165 | \$ 1,863,869 | \$ 1,340,145 | \$ 789,078 | \$ 1,064,422 | \$ 92,449 | \$ 44,372,996 |
| Balance as at 30 September 2009 | \$13,729,868 | \$ 8,017,856 | \$ 1,998,834 | \$ 1,467,143 | \$ 1,100,830 | \$ 1,188,481 | \$ 102,721 | \$ 27,605,733 |

ENVIRONMENTAL MANAGEMENT AUTHORITY
ENVIRONMENTAL TRUST FUND

NOTES TO THE FINANCIAL STATEMENTS (CONTINUED)

30 SEPTEMBER 2011

9. Accounts Payable and Accruals:

| | 30 September | |
|--|----------------------|----------------------|
| | <u>2011</u> | <u>2010</u> |
| Accounts payable | \$ 656,852 | \$ 1,568,963 |
| Other payables | 27,442 | 31,009 |
| Accruals | 1,868,593 | 465,457 |
| Violations payable | 1,977,405 | 1,907,184 |
| Ministry of Public Utilities and the Environment | | |
| - National Forest Inventory Project | 340,797 | 426,782 |
| NSRCSL Project | 6,518,491 | 8,353,458 |
| Highway Police Surveillance Bays Project | <u>4,817,596</u> | <u>-</u> |
| | <u>\$ 16,207,176</u> | <u>\$ 12,752,853</u> |

10. Deferred Income:

| | 30 September | |
|--|-------------------|---------------------|
| | <u>2011</u> | <u>2010</u> |
| Records and Information Management (RIM) Project | \$ 554,477 | \$ 988,900 |
| UWI Aripo Savannah Biological Survey | <u>179,464</u> | <u>358,930</u> |
| | <u>\$ 733,941</u> | <u>\$ 1,347,830</u> |

**ENVIRONMENTAL MANAGEMENT AUTHORITY
ENVIRONMENTAL TRUST FUND**

NOTES TO THE FINANCIAL STATEMENTS (CONTINUED)

30 SEPTEMBER 2011

11. Funding:

Funds received during the year ended 30 September 2011 are as follows:

| | | 30 September | |
|-------------------------|------|---------------------|--------------------|
| | | <u>2011</u> | <u>2010</u> |
| External Funding | | | |
| UNDP | TT\$ | \$ 63,960 | \$ - |
| Other | TT\$ | 312,350 | 699,763 |
| Core Funding | | | |
| GORTT | TT\$ | 42,549,153 | 42,908,353 |
| Activities Income | TT\$ | 1,079,257 | 973,500 |
| NSRCSL Project | TT\$ | 1,860,851 | 117,595 |

12. Fair Values:

Fair value is the amount for which an asset could be exchanged, or a liability settled between knowledgeable, willing parties in an arm's length transaction. The existence of published price quotation in an active market is the best evidence of fair value. Where market prices are not available, fair values are estimated using various valuation techniques, including using recent arm's length market transactions between knowledgeable, willing parties, if available, current fair value of another financial instrument that is substantially the same and discounted cash flow analysis.

The following methods have been used to estimate the fair values of various classes of financial assets and liabilities:

Current assets and liabilities -

The carrying amounts of current assets and liabilities are a reasonable approximation of the fair values because of their short-term nature.

**ENVIRONMENTAL MANAGEMENT AUTHORITY
ENVIRONMENTAL TRUST FUND**

NOTES TO THE FINANCIAL STATEMENTS (CONTINUED)

30 SEPTEMBER 2011

13. Related Party Transactions:

Parties are considered to be related if one party has the ability to control the other party or exercise significant influence over the other party in making financial decisions.

Key management personnel are those persons having the authority and responsibility for planning, directing and controlling the activities of the Authority.

A number of transactions are entered into with related parties in the normal course of business. These transactions were carried out on commercial terms at market rates.

Balances and transactions with related parties and key management personnel during the year were as follows:

| | 30 September | |
|------------------------------------|---------------------|--------------------|
| | <u>2011</u> | <u>2010</u> |
| Other expenses | | |
| Directors' fees | \$ 544,271 | \$ 428,200 |
| Directors' expenses | 64,197 | 53,039 |
| Key management compensation | | |
| Short-term benefits | \$ 2,503,233 | \$ 1,810,947 |

14. Equity Adjustment:

The equity adjustment of \$1,856 represents a refund to the United Nations Development Programme (UNDP) for expenditure incurred for the Institutional Strengthening Project Phase IV.

PART D: FINANCIAL ASSISTANCE OR OTHER SUPPORT

There are no qualifying activities under Section 14 (1d) of the Environmental Management Act, Chapter 35:05, for the year 2011.



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