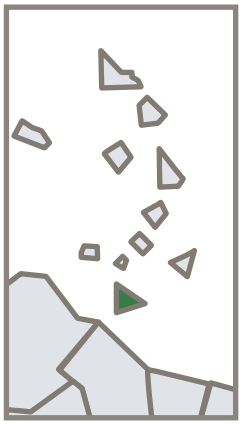
REGIONAL EVALUATION MUNICIPAL SOLID WASTE MANAGEMENT SERVICES



COUNTRY ANALYTICAL REPORT TRINIDAD AND TOBAGO / EVALUATION 2002

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1. EXECUTIVE SUMMARY

The importance of reliable information for system development and planning in solid waste management cannot be underscored. Ever since the 1980s when solid waste management gained some prominence in national planning in Trinidad and Tobago, the parameters for scientifically developing information on the operation and maintenance of the various components were not introduced and enforced. Demographic shifts and increased multi-lateral collaborations have since placed new demands on the management and physical systems of the industry. As a result reformation of the environment and health sectors have become a consistent challenge in the absence of reliable data. The situation requires a national initiative to address the ills of the existing system through incisive assessment and analysis resulting in the development of a database that would inform the formulation of solutions.

The twin-island state of Trinidad and Tobago has earned a reputation as an investment location for multinational business with natural gas being the leading performer over the last four years. The Government of Trinidad and Tobago (GOTT) has also signaled its intention to promote Tobago as a tourist destination given the alternative considerations adopted by many visitors since the September 11th, occurrence in the United States. The success of these industries demands that appropriate policies, plans and programmes be put in place to address environmental management. Undoubtedly national initiatives have been taken to upgrade waste management systems, and to introduce new technologies that would parallel the rate of development of industries and expansion of the tourism thrust. This has been evident since the introduction of the Solid Waste Management Study in 1979, followed by the development of a Master Plan in 1980.

Unfortunately these initiatives have not been sustained or further advanced in the last two decades. Disposal sites are still not operated at a sanitary level, collection systems while indicating 100% national coverage does lack in efficiency in some areas, no specific solid waste management legislation exists, public education and awareness are not prominent and institutional arrangements still require clarity. Many of these deficiencies have been attributed to the level of funding provided for the functions, particularly the collection and disposal aspect. Despite the challenges of meeting the annual budget demands for this sector, the issue of sustainability relative to its revenue-earning and cost recovery potential has not been fully explored.

The Litter Act of 1973 and the Public Health Act of 1950 with accompanying regulations are the two major pieces of legislation governing solid waste management in the country. The solid waste management function in Trinidad and Tobago by law falls under the Ministry of Local Government through the Regional Corporations (RCs). At the local government level the municipal corporations are charged with the function under these two acts in addition to the Municipal Corporation Act of 1990. Under the Municipal Corporations Act, the respective corporations have the responsibility for the disposal of garbage from private and public property, the development and maintenance of sanitary landfills and the abatement of public nuisances

A national policy for solid waste management has not been developed resulting systems that are operated in the absence of specific regulations, and also in the absence of a strategic profile as to the way forward.

In Trinidad the management of the three major disposal sites of Beetham, Forres Park and Guanapo is the responsibility of the Trinidad and Tobago Solid Waste Management Company Limited (SWMCOL) that reports to the Ministry of Public Utilities and the Environment (MOPUE). Smaller unofficial sites at Toco and Point Fortin fall under the jurisdiction of the respective RCs. The RCs also have responsibility for municipal waste collection that is administered mainly by private haulers, and for the sweeping function that is done directly by the corporation's employees and also by a few contractors. The Tobago Studley Park site, the only official disposal site on the island, is operated by the Tobago House of Assembly (THA).

Both the Unemployment Relief Programme (URP) and the Community-based Environmental Protection and Enhancement Programme (CEPEP) are relief programmes that address environmental issues. They are intended to complement the collection responsibilities of the RCs by addressing the esthetic and infrastructure aspects at the community levels. NGOs and private sector also contribute to some level of environmental enhancement through landscape maintenance projects and support for clean-up campaigns.

Budget allocations are made for solid waste management functions through the Ministry of Local Government (MOLG) to the RCs, for collection and sweeping operations and for those who operate small unofficial disposal sites. Monies are also allocated through the MOPUE for the SWMCOL for the management of the three major disposal sites in the country, namely Beetham, Forres Park and Guanapo. The THA receives funds directly from the central Government.

A 100% waste collection rate enjoyed by the country, has contributed positively to the control of the health risk factor. Health risk attributed to communicable diseases, diseases of the circulatory system and neoplasm is estimated at 41.2; 269.9 and 90.6 respectively per 100,000 population adjusted by age. Infant mortality rate per 1,000 live births for the year 2000 stood at 17. The under-five mortality rate per 1,000 live births for the year 2000 was at 20. The maternal mortality ratio reported per 100,000 live births for the period 1985 to 1999 stood at 70.

Despite the control on the health risks, there is the increasing concern that salvaging at landfills by adults and children could increase the health factor over time. In spite of a Gross Domestic Product of USD 3740 per capita, unemployment is up to 10.8% (2002) and the proportion of the population living below the poverty line stands at 21%. These conditions have undoubtedly pushed a percentage of the population towards waste retrieval activities, mainly at the disposal sites around the country. These informal activities do not take into consideration the health risk associated with the practice of rummaging through waste.

From a review of the strengths and weaknesses of the system and an understanding of the critical factors, several recommendations need to be address. These include:

(a) An update of the National Solid Waste Management Study done in 1979 as a medium to long-term measure addressing the following components:

- Policy, plans, programmes and projects
- Disposal and collection systems
- Institutional Arrangements and Strengthening
- Legislation
- Public Education and Awareness
- Waste diversion/minimization (recovery, reuse, reduction and recycling)
- System financing and sustainability
- Training and capacity building.

(b) Immediate upgrade of existing disposal sites addressing the necessary infrastructure in addition to the development of clear operation and maintenance plans, supported by appropriate budgetary allocations.

2. INTRODUCTION

System evaluation plays a critical role in status determination and in developing key considerations for strategic planning. This evaluation 2002(for the year 2001) exercise coordinated by the Pan American Health Organization (PAHO) provides an opportunity to develop scientific data that has not been formally documented since the Trinidad and Tobago Solid Waste Management Study was done in 1979 and the waste characterization studies by the SWMCOL in 1996. While PAHO/WHO, IDB, the World Bank and the USAID have all supported efforts to effect sectoral analysis in solid waste, the practice of information development and management has not become the culture in Trinidad and Tobago. Demographic shifts coupled with economic activity changes have introduced increased generation rates and new types of waste items that have placed unplanned demands on the existing waste management systems. Industrial development in the energy sectors, which is associated with complex technologies and processes, has contributed to added demands for environmental management. Waste generation from these industries has resulted in waste types and volumes far different from the traditional characteristics of municipal waste. It is within this context that an understanding of the current situation needs to be assessed, and the information used to facilitate the development of updated waste management policies, plans and strategies.

Consideration for the improvement of solid waste management has attracted the attention of many national entities. As early as 1979 the Trinidad and Tobago Government (GOTT) had commissioned a consulting firm to undertake a countrywide survey of existing practices in solid wastes handling, leading to development of a Master Plan for solid wastes management. In 1995 the Organisation of Eastern Caribbean States (OECS) of Antigua and Barbuda, the Commonwealth of Dominica, Grenada, St. Vincent and the Grenadines, St. Lucia, St. Kitts and Nevis embarked on a solid waste and ship-generated waste management project with the overall objective of protecting public health and maintaining the integrity of the terrestrial and marine environments. The Government of Barbados in 1994, made a commitment to undertake an integrated waste management system. These initiatives signaled the concerns of national entities as it relates to basic sanitation services and the potential impacts they could have on public health and the environment, in the English-speaking Caribbean.

There is no doubt that these initiatives identified solid waste management as one of the major items in national sectoral planning. As the country seeks to attract foreign investments as part of its industrial development, it cannot ignore the fact that many of the multinational corporations require specific infrastructure, policies and legislation that would facilitate approved practices sanctioned by international auditing institutions. Some of the emerging issues involve the growing concerns for public health and the environment and the implications they may bring as a result of poor waste storage, collection and disposal practices. Other concerns include the challenges of identifying and selecting new disposal sites and/or technologies, the increasing introduction of new types of non-biodegradable and hazardous wastes that require waste diversion strategies and the introduction of costly waste processing systems.

Public health and environment issues in Trinidad and Tobago have been associated with water pollution from agricultural chemicals, industrial wastes, raw sewage, and oil pollution of beaches.[1] Incidence of dengue fever during the wet season has been linked with the improper disposal of derelict vehicles, tires, and spent containers. Questions have also been raised about the association of some level of respiratory diseases experienced by residents of the Sea Lots and Beetham Estate with the occurrence of fires at the Beetham landfill. The ineffective introduction of hazardous/industrial waste management practices have failed to control the discharge of industrial wastes from many industries.

[1] CIA - The World Factbook 2002 - Trinidad and Tobago

There are no sanitary landfills in the country. While the existing sites may have been designated as the official landfills, they are not operated as **"sanitary"** landfill sites. Some level of control is exercised by the SWMCOL at the three major sites of Beetham, Forres Park and Guanapo, but these efforts are limited to site user control, minimal maintenance of infrastructure and some information collection and compilation. Other smaller sites in the country are operated by the RCs that place major emphasis on the provision of equipment for the spreading and compaction of incoming wastes. Site selection criteria are not formulated as a matter of policy and as a result site operations most often commence in the absence of a sound assessment process.

Such a situation requires a national initiative to address the ills of the existing system through incisive assessment and analysis resulting in the development of a database that would inform the formulation of solutions. This data collection and evaluation exercise provide the prerequisite for sound policy, plan, programme and project development at both the national and regional levels, as new appropriate and indigenous mechanisms are derived for successful implementation.

3. BACKGROUND

The twin state of Trinidad and Tobago is situated in the southern most end of the chain of Caribbean islands between the Caribbean Sea and the North Atlantic Ocean, northeast of Venezuela. Its geographic coordinates are 11 00 N, 61 00 W and it has a total landmass of 5,128 sq. km. The 2000 national census puts the population at 1,262,366, with an estimate for 2001 at 1,266,797. The islands are generally flat with some hills and low mountains in the northern, central and southern sectors in the case of Trinidad and towards the interior in the case of Tobago. The climate is generally tropical with a distinct rainy season between June and December.

The state has earned a reputation as an investment location for multinational business with natural gas being the leading performer over the last four years. Tourism is also enjoying some level of growth, particularly in Tobago, though not at the levels of other Caribbean states. The 2001 estimated gross domestic product - real growth rate, was at 4%. The gross domestic product composition by sector reflects 2% for agriculture, 43% for industry and 55% for services (2000 estimate). Petroleum, natural gas and asphalt are the natural resources with petroleum, chemicals, tourism, food processing, cement, beverages and cotton textiles as the main industries. Import commodities are machinery, transportation equipment, manufactured goods, food and live animals with the total estimates for 2001 registering TT$3.5 billion (f.o.b.). The export commodities are petroleum and petroleum products, chemicals, steel products, fertilizer, sugar, cocoa, coffee, citrus and flowers, estimating TT$4.1 billion (f.o.b.) in the year 2001.

Based on the United Nations Development Programme Human Development Index (HDI) 1985, Trinidad and Tobago ranked 50 among the international community with an index of 0.774. The HDI is a composite index measuring average achievement in three basic dimensions of human development, a long and healthy life, knowledge and a decent standard of living.

Infant mortality rate (per 1,000 live births) for the year 2000 stood at 17. The under-five mortality rate (per 1,000 live births) for the year 2000 was at 20. The maternal mortality ratio reported (per 100,000 live births) for the period 1985 to 1999 stood at 70.

Public expenditure on education as a percent of GNP was 4.4% for the period 1995-97. The adult literacy rate (% age 15 and above) for the year 2000, registered 93.8 while the youth literacy rate(% age 15-24) for the year 2000 stood at 97.5.

Homicide rates have also shown a marked increase. Recent research has indicated a murder rate of 14.7 per 100,000 persons. As of October 2003 there were 191 murders reported, and based on Central Statistical Office figures of a population of 1.3 million, there is one murder for every 6,608 persons in the countries.

As of the year 2001, the low birth weight incidence was 10.2, with the registered cases of tuberculosis numbering 152, and the registered cases of AIDS 397.Self-reported Diabetes Mellitus was 11% in the adult population 35 years old and older, with mortality rates increasing from 48.6 per 100,000 population in 1977 to 80.5 in 1990. It is the third-ranking cause of death for males and the second-ranking cause of death for females.

Solid waste management gained prominence in the country as a result of the development of a Solid Waste Master Plan in 1979 and the formation of the SWMCOL in 1980 as a state institution charged with the mandate to address national waste management issues. This thrust enhanced the industry through the introduction of new technologies and systems, and also through an increase in the education and awareness of the population regarding improved waste management habits. The existing waste disposal practices moved from the "open dump" concept to a more controlled and sanitary operation. The practice of the burning of waste was reduced considerably, with the increased utilization of cover material on a regular basis as part of new engineering techniques. This was evident at the three major sites of Beetham in the north, Forres Park in the south

and Guanapo in the east, which were managed by SWMCOL. The local government bodies continued to operate the smaller regional sites around the country also being cognizant of new sanitation practices.

Collection systems had also shown an improvement in technologies. The traditional manual roll-top systems were gradually replaced by automated rear and side-loading compaction systems that were able to move larger volumes of wastes from the collection routes to the disposal sites. The industry also attracted more private sector involvement bringing increased investments in new technologies such as bulk bin systems for the movement of commercial and industrial wastes, and stationary compactors for storage locations that required some level of secured isolation of the waste generated. Storage practices at households also showed improvement. The use of one-way disposal plastic storage bags continued to replace the traditional storage drum. Improved collection frequency and reliability resulted in the capture of a greater volume of municipal waste generated at the household levels. This rapid introduction of mechanized systems was primarily driven by the private sector.

Some waste recovery initiatives were formalized to include the identification of overseas markets and the utilization of the most economic shipping arrangements. In addition to uncontrolled salvaging of wastes from the landfill sites, items such as glass, plastic, paper and cardboard were retrieved on a more formal basis from the waste stream for processing and delivery to local and external markets relative to established world prices.

A national public education and awareness programme was also introduced to sensitize the community to the need for improved waste management practices. This education and awareness drive coupled with improved hardware and infrastructure brought new consciousness to the targeted public about new ways of addressing sanitation. The general public to include primary and secondary schools were targeted for the delivery of the messages designed to influence a change in culture.

While these improvements were seen as a derivative of the initiatives taken in the early 1980s they have not been sustained. A change in national priority has resulted in inadequate levels of investments in solid waste management, when compared to other sectors of the economy. Public expenditure in health and environment stood at 2.5% of GDP in 1990, compared to 4.4% of GDP for education in the period 1995-1997.

4. FUNCTIONAL OPERATIONAL STRUCTURE

4.1 Legislation

Under the present legislation the responsibility for the collection and disposal of solid wastes is designated to the MOLG. The MOLG is the central coordinating agency for the fourteen (14) Municipal Corporations, comprising.

- Two (2) City Corporations - Port of Spain and San Fernando
- Three (3) Borough Corporations - Arima, Point Fortin and Chaguanas
- Nine (9) Regions - Couva/Tabaquite/Talparo; Diego Martin; Mayaro/Rio Claro; Penal/Debe; Princes Town; San Juan/Laventille; Sangre Grande, Siparia and Tunapuna/Piarco.

The THA reports directly to the Central Government governed by the Tobago House of Assembly Act.

While the SWMCOL was formed as a state limited liability company with a clear mandate from cabinet for the management of the country's wastes, a legal instrument has not been established to permit the institution to act as a national authority responsible for the function.

Figure 4.0 presents the institutional arrangement for the solid waste management in the country.

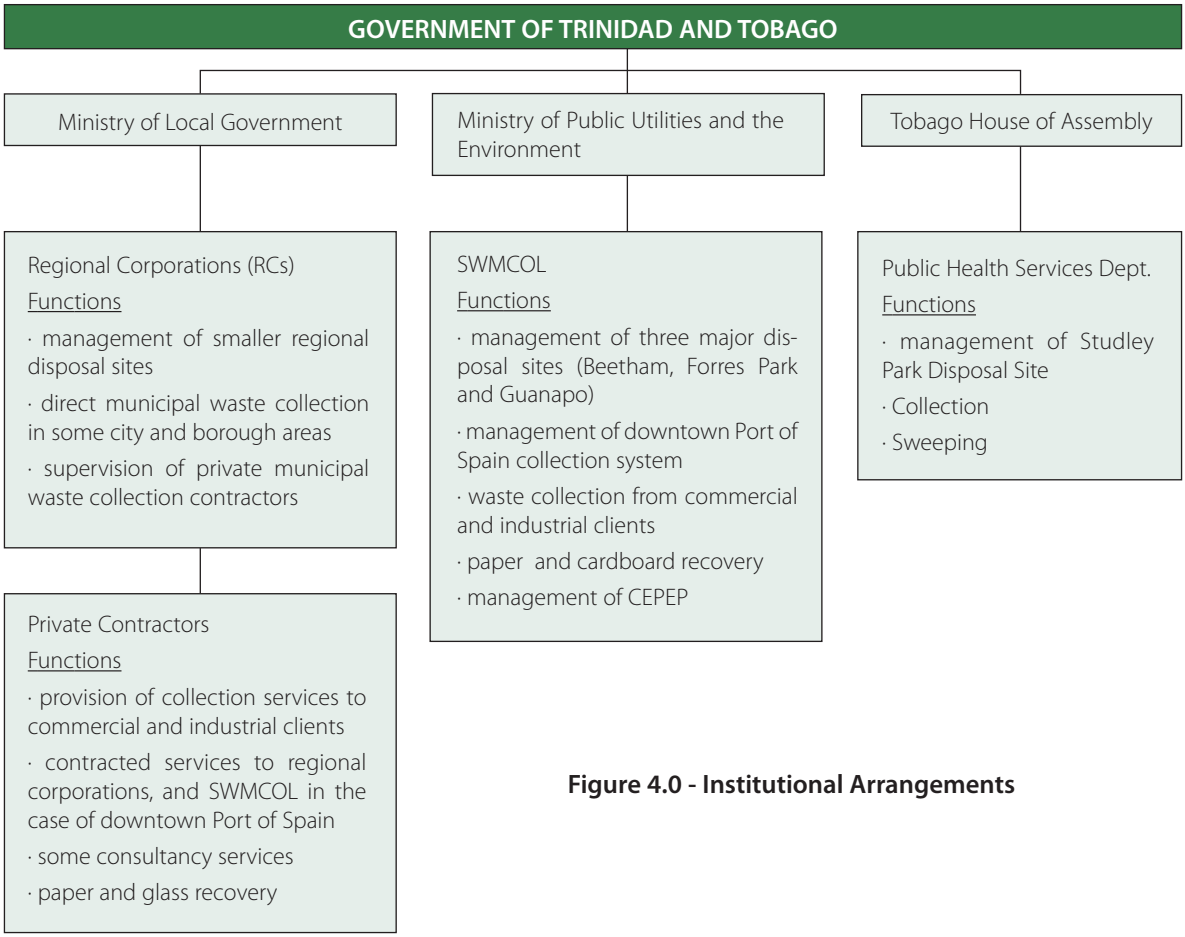

Figure 4.0 - Institutional Arrangements

A map outlining the municipal boundaries is included at Annex 5. These boundaries are also used to define the municipal waste collection areas

The Litter Act of 1973 and the Public Health Act of 1950 with accompanying regulations are the two major pieces of legislation governing solid waste management in the country. At the local government level the municipal corporations are charged with the function under these two acts in addition to the Municipal Corporation Act of 1990. Under the Municipal Corporations Act, the respective corporations have the responsibility for the disposal of garbage from private and public property, the development and maintenance of sanitary landfills and the abatement of public nuisances. There are at least three Acts of Parliament administered by three separate Government departments that control the manufacture, use or sale of hazardous substances. These are the Pesticides and Toxic Chemicals Act, 1979 and Act No. 11 of 1986, which regulate the importation, storage, manufacture, sale, use and transportation of pesticides and toxic chemicals, the Occupational Health and Safety at Work Act concerned mainly with the workplace; and the Environmental Management Act of 2000 which deals with the environment.

Under the Environmental Management Act No. 3, the Environmental Management Authority (EMA) was formed in March 1995, with a mandate to write and enforce laws and regulations for environmental management, to educate the public about the nation's environmental issues, to control and prevent pollution, as well as conserve natural resources. Producers of hazardous waste are subject to periodic inspections by the EMA, concerning collection and transport operations also relative to origin and destination. Documentary evidence of management operations must be supplied to the EMA on request.

4.2 National Policy

There is no national policy that specifically addresses solid waste management. However the issue is addressed as a subsection in the National Environmental Policy, June 1998(NEP). The policy is based on the principles of reduction, reuse and recycling and states that Government will:

- Encourage the prevention or reduction of waste production and its harmfulness, particularly through the development of clean technologies, and techniques for the final disposal of dangerous substances in waste destined for recovery, and the development and marketing of products designed to have minimal environmental impact by nature of their manufacture, use or final disposal;
- Encourage the recovery of waste, including recycling, reuse or reclamation, and the use of waste as a source of energy;
- Ensure that waste is recovered or disposed of without endangering human health and without using processes or methods which could harm the environment, and in particular without risk to air, soil and plants and animals, without causing a nuisance through noise or odors, and without adversely affecting the landscape;
- Prohibit the abandonment, dumping or uncontrolled disposal of waste;
- Establish an integrated and adequate network of waste disposal installations.

The NEP also addresses hazardous waste through the Environmental Management Authority (EMA) requiring the development of a list of hazardous waste, establishment of requirements for their handling and disposal, establishment of standards and design criteria for hazardous waste handling and disposal facilities, and enforcement of these requirements through licensing and permitting requirements. Legislation is to be developed to give effect to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. A pollution control policy also deals with substances generated as wastes and discharged into the environment.

4.3 Allocation of Resources

The municipal waste collection systems are financed solely by the central government through the MOLG. Municipal taxes are collected and deposited as part of the consolidated fund and re-allocated as a financing mechanism for the services. Nominal tipping fees are charged by SWMCOL to the industrial sector for the disposal of condemned items. Annual budgets are submitted by the RCs and subsequent allocations are made for the direct sweeping, collection and final disposal operations by the corporations and for the financing of collection contractors. Contractors are selected on a tendering basis. The total annual budget allocated to the regional corporations for contracted collection services for the year 2001 was US$14,345,368. (US$13,597,868 for Trinidad and US$747,500 for Tobago.) This total figure represents 2-5% of Total Municipal Annual Budget.

Allocations are also made to SWMCOL through the MOPUE for the management of the three major disposal sites of Beetham, Forres Park and Guanapo. In 2002 this allocation was US$2.5M.

4.4 Analysis of Local Plans and Strategies

The country continues to receive proposals from local and international private sector companies for studies, plans and strategies for the development of the solid waste management services, in the absence of a clear strategy from the GOTT. One of the comprehensive proposals addresses a national transfer station system with a central sanitary landfill site at Forres Park. Transfer stations are proposed at Beetham, Arima, Point Fortin and Rio Claro. The proposal identifies these transfer stations as satellite collection locations at which some processing and recovery operations would be undertaken prior to final disposal at the centralized Forres Park site. While informal efforts are made to address environmental enhancement issues there are no major sectoral projects in place to address national solid waste management policies, plans, programmes and projects.

5. DELIVERY OF SOLID WASTE MANAGEMENT SERVICES

A 100% collection coverage is reported for all of the RCs. This coverage is attributed to the continuing supervision by the field staff of the RCs in addition to the efficiency of the operations of the private contractors. The private sector has made significant investments in equipment acquisition and maintenance that is evident by the minimal downtime on collection routes. This sector also provides service to industry, small and large commercial clients and the seaports at Port of Spain and Point Lisas. While the coverage has been effectively addressed the quality of coverage still needs to be upgraded. This is evident by the presence of unauthorized dumps around the country, particularly in the rural areas. The quality of coverage is further eroded by insecure storage practices that allow bagged and uncontained waste to be rummaged by homeless person and stray animals. This is prevalent in the urban and suburban areas where items are stored for curbside collection. Effective monitoring and enforcement by Litter Wardens also needs to be addressed so as to re-enforce the existing regulations under the Litter Act.

The THA has the responsibility for the supervision of collection contractors and for the sweepers engaged by the Assembly. The THA provides direct collection in one (1) area and the other thirteen (13) areas are done by private contractors by way of service contracts.

Collection frequency in the city of Port of Spain is registered at twice (2) per day in the Town Centre, seven (7) days per week in the San Fernando area, and an average of five(5) days per week in the other town centres of Point Fortin, Couva/Tabaquite/Talparo, Princes Town and Penal/Debe. All other residential areas show a three (3) or (4) times per week frequency. The town center markets in all the RCs are done on an average of seven (7) days per week with the exception of the San Juan/Laventille area which has registered a twice per day collection, seven (7) days per week. In Tobago, collection is done five (5) days per week for the residential areas and seven (7) days per week in the Scarborough town centre and market area.

Special services utilising flatbed open tray vehicles are also provided by the City of Port of Spain directly and by the private contractors in the respective RCs as part of their contracted responsibilities. These services include the collection of green waste (garden trimmings and tree cuttings) and white goods (refrigerators, stoves etc.), on request in the case of Port of Spain, and as part of a scheduled service in the case of the private contractors. Such services are occasionally provided as part of a corporation or national clean up campaign initiative.

Collection is performed mainly by contracted collectors consisting of crews of one (1) driver and two (2) loaders. Contracted collectors total approximately 1137, with San Juan/Laventille (213), Tunapuna/Piarco (135), Diego Martin(123), Chaguanas (150) and Couva/Tabaquite/Talparo (114) registering the highest numbers of contracted collectors.

Equipment is primarily rear-loading compaction systems that target the curbside collection areas. The city centres and boroughs have retained employees for collection with the Port of Spain Corporation registering about 171 employees, San Fernando -27, Arima -30 and Tobago-12.

The sweeping function is also dominated by employed staff, mainly in the town centres and boroughs. These areas experience high-density populations who are either transient at the peak business hours or permanent in the case of highly populated suburban areas. The City of Port of Spain employs the highest number of employees totaling 197, with the next highest being San Juan/Laventille with 84. Contracted sweeper operations are used in some of the RCs with Tunapuna/Piarco engaging the highest total of 12 persons. An average of 4 contracted sweepers are utilized by the RCs of San Fernando, Chaguanas, Mayaro/Rio Claro, Princes Town and Siparia. While the sweeping operation provides a fairly effective service, the issue of timely collection of stockpiles remains a challenge. This occurrence reduces the effect of the sweeping impact as wind, rain, animal and human activities scatter the waste, requiring repeated stockpiling on a daily basis.

All sites are operated by the state except in the case of Point Fortin where a private contractor has recently leased the site from the borough and conducts operations as a private disposal site. Final disposal of over 70% of the wastes is accommodated at the three major sites of Beetham, Forres Park and Guanapo. The remaining 30 % of the wastes is disposed in smaller unofficial sites within RC's jurisdiction, as in the case of Toco, or is deposited in unauthorized disposal locations.

The quality of operations at each of these sites do not meet international sanitary landfill standards resulting in infrastructure that lacks leachate systems, protective liners, cover material in some instances, monitoring wells and other required design parameters. The sites also lack operations plans resulting in unplanned tipping with no appreciation for projected landfill elevations for the various disposal cells.

Financial management for the system is done by the relevant institutions charged with the function. Annual and quarterly financial statements are submitted for auditing purposes by the Auditor General's office in the case of the Ministries. SWMCOL as a state organization is also required to submit annual and quarterly statements but may select an independent auditor following the invitation of bids and the evaluation of tenders. These audited statements are subject to further review at the Public Accounts Committee of Parliament. Government allocations are identified as separate subvention items as opposed to revenue earned from other activities.

5.1 Cost analysis and rates for collection

Table 4.0 provides representation of the collection cost per tonne and percentage budget allocations for the various RCs. Cost per tonne for collection is calculated from the estimate of solid waste generation and the annual fee paid to the collection contractors. The generation rate for Port of Spain varied between 1.3 kg/person/ day when the transient population of 300,000 was included and 5.0 kg/person /day when the transient population was omitted.

These cost per tonne figures show a great disparity among RCs. Some of the reasons that may be attributed to this disparity include:

- Level of accuracy and consistency in data collection parameters,
- Travel time costs for contractors given the distance between collection routes and the disposal site. This could be applied in the case of Mayaro/Rio Claro, Princes Town and Sangre Grande where official disposal sites are located some distance from the final point on a collection route.
- Higher maintenance costs associated with distance travel relative to bullet #2.
- Difference in system and equipment types (mechanized systems as opposed to non-mechanised collection vehicles, inclusion of bulk bin systems on collection routes, level of special services offered as part of contract obligation)

Table 4.0 - Cost per tonne and Percentage Budget Allocations

Regional Corporation	% of annual budget forC SWM with respect to municipal total budget	ost per tonne(US$)
Tunapuna /Piarco	4.06	15.50
Couva/Tabaquite/Talparo	2.40	23.40
Diego Martin	2.40	58.70
San Juan/Laventille	4.73	17.20
Borough of Chaguanas	3.29	13.80
City of San Fernando	1.09	17.80
Penal/Debe	2.30	22.20
Princes Town	1.61	40.40
Sangre Grande	2.39	47.60
Siparia	1.98	8.00
Tobago	Not available	10.60
Borough of Arima	0.64	12.90
Borough of Point Fortin	1.21	24.80
City of Port of Spain	0.67	11.30[1]
Mayaro/Rio Claro	1.64	71.00

1. Do not include factors of transient population and waste volumes collected directly by City.

5.2 Modalities

The solid waste management function falls under the jurisdiction of the MOLG in Trinidad, and the THA in Tobago. The MOLG administers national responsibility for collection, sweeping and some disposal through the RCs by responding to budget submissions on an annual basis. The delivery of collection services is done primarily by private contractors under a service contract. In the case of Port of Spain direct municipal services are provided in parts of the city center and some of the suburban areas. Arima also provides limited services in the town center and market area. The sweeping function is performed primarily by employees of the various RCs. The THA is responsible for the management of the Studley Park site and for the engagement and supervision of collection contractors and sweepers.

The SWMCOL is provided with a budget through the MOPUE for the management of the three major disposal sites of Beetham, Forres Park and Guanapo. These sites are further contracted to private companies for the provision of the equipment and for the supply of cover material as in the case of Beetham. SWMCOL performs a management function by developing the various reporting profiles for accountability to the MOPUE.

Participatory management occurs informally with other Government assisted community programmes, and also NGO activities. Some of the waste collection and litter control functions are shared by social employment initiatives such as the existing URP, the recently introduced CEPEP and Environment Tobago. These programmes complement the existing efforts of the RCs by addressing some sweeping functions, clearing of unauthorized dumps and littered drains and the general cleaning and enhancement of areas overgrown with shrubs, in urban, suburban and rural sectors. The URP also addresses small community infrastructural works. CEPEP administers various community micro-enterprises that are selected through a tendering process.

NGO activities are evident both in scheduled clean-up exercises, maintenance functions and as activists and pressure groups. NGOs support clean-up exercises as part of national environmental enhancement programmes or informal efforts for the recovery of items, mainly glass which is delivered to the glass processing

plant, Carib Glassworks Specialists Ltd. The Rotary Club, Lions Cultural Group, Environment Tobago and commercial banks such as First Citizen Bank, Republic Bank and Scotia Bank also support clean-up initiatives as well as maintain the landscaping of certain traffic roundabouts and selected grassed areas. Some pressure groups such as Friends of Fishermen of the Seas (FOFOS) do some monitoring of environmental activities and the impacts they may have on the natural resources.

Small to medium businesses also provide inputs to the waste management function mainly in the supply of environmental products and the provision of some services such as special waste handling, waste remedial processing and lab analysis. These businesses target mainly the industrial sector where various types of effluents and byproducts are generated as a result of product processing. They operate mainly as private enterprises in a competitive market and are not engaged on any contractual basis by the state or representatives at the RC level.

Municipal development continues with limited reference to solid waste management planning. The Local Government ordinance requires some adherence to development practices with respect to nature and layout of structures, but commercial and residential areas are developed with little relevance to waste centroids and disposal sites. Waste management plans are not an integral part of municipal development. Some waste disposal issues are addressed in the form of Environmental Impact Assessments from larger projects and industries. This is a requirement of the Ministry of Planning.

Human resource development occurs at the request of the various institutions. SWMCOL has provided some level of training to the RCs on an ad hoc request basis over the last ten(10) years. This training is not in response to a specific needs assessment, and lacks consistency in its application.

Research and development is not normally reflected as part of the budget structure for the various institutions. There is no structured collaboration between the tertiary and technical/vocational academic institutions such as the University of the West Indies, the John Donaldson and San Fernando Technical Institutes regarding technology development appropriate to local conditions. Packaged technology is imported as needed with the appropriate modification made to adhere to local traffic specifications and regulations.

A summary of key indicators for the RCs is included at Annex 1.

6. STRENGTHS AND CRITICAL ASPECTS

Following the solid waste management study in 1979, national initiatives have been characterized by clean-up exercises and general efforts to maintain the existing arrangements and systems. Some minor institutional changes have been effected regarding the SWMCOL that had moved from the Ministry of Local Government to the Ministry of the Environment in 1999. No major infrastructural inputs have been made to the national system that continues to be operated in the absence of clear compliance standards and legislation. Table 5.0 provides a listing of some of the strengths and weaknesses emerging from the situation analysis.

6.1 Critical Factors

There are several factors that limit the effectiveness and efficiency of the solid waste management services. Some of these factors include institutional, technical and financial aspects.

Solid waste management requires prominence at the level of annual national infrastructural planning. In a twin-state that is considerably industrialized as in the case of Trinidad and one that emphasizes tourism as in the case of Tobago, solid waste management should be seen as playing a critical role in the success of these industries. In today's environment of changing technologies and the increased investments and presence by international companies, countries need to have a designated institution addressing the specific issues of waste management. The existing institutional arrangements limit the extent and importance of efforts required to effectively and efficiently address the function. Many of the RCs have a wide range of social services that have traditionally competed with allocations for sanitation services. In the absence of a specific institution, this function would lack strategic planning and development in the areas of physical systems conceptualization and implementation, technology research and adaptation, public education and awareness, policy development and, operations and maintenance management. The existing SWMCOL that was intended to fill the role of a national authority, does not have the legal designation to effect its mandate.

Technically, private enterprise has addressed some of the void in response to a demand for treatment and disposal services. However these initiatives are stifled in the absence of clear compliance regulations and limited monitoring and enforcement practices. The existing practice of landfilling all types of waste also threatens the life of the existing disposal sites as waste diversion efforts are not formalized or facilitated with the introduction of disincentives and incentives. Mechanisms such as disposal fees and deposit-refund incentives and environmental levies on potentially harmful items would have to be considered to introduce control and by extension facilitate some level of sustainability.

Deposit-refund legislation has been introduced in draft form by the EMA. Labeled the "Bottle Bill" the proposed legislation places a mandatory deposit on all beverage containers. The consumer would be required to pay a small deposit on each container of beverage bought, the container is returned to a collection agency or the retailer to retrieve the deposit and the recovered items are either shipped for recycling or dumped when low market prices prohibit viability once shipping is included.

Table 6.0: Strengths and Weaknesses of System

Strengths	Weakness
· General awareness of current technologies among industry stakeholders. · Significant participation of private sector in the collection function. · Private sector initiatives in waste recovery and recycling. · 100% coverage for waste collection with adequate frequency using primarily mechanized systems. · Waste treatment and supply services initiatives progressively undertaken by the private sector · Some self-regulation efforts exist among larger industries. · Waste management efforts introduced and enhanced at the community level. · Some level of environmental education conducted at schools.	· Lacks national policy and plans. · Some duplication of institutional responsibility still exists. · Absence of licensing and certification of collection contractors. · The absence of a national institution with the authority that could bring the prominence needed for solid waste management · Poorly operated disposal sites as a result of insufficient financial allocations for operations. · The absence of appropriate legislation. · Insufficient public education and awareness programmes. · Lack of sustainability of the national system. · Absence of ongoing structured training programmes for human resources.

It should also be noted that all disposal sites lack critical environmental engineering infrastructure such as leachate management systems, gas vents, surface and ground water monitoring wells and protective liners. These sites have become potential pollution points as various types of wastes are deposited in what has been designated as municipal disposal sites.

The absence of operational data also affects short, medium and long-term planning for the systems. Reliable data on waste characterization and audits need to be developed and appropriate systems and technologies adopted to respond to the particular demand.

Financially, the function continues to depend on Government allocations that are inadequate when compared to the level of service required to meet the demands of a growing industrial country. Approximately US$14M is allocated for collection and transport and US$2.5M through SWMCOL for disposal. These funds, collected as taxes are re-distributed from the consolidated fund that is subject to the demands of several other public services that may enjoy more of a priority depending on the policy of the government of the day. In the absence of accurate operations and maintenance costs data, allocations are made based on an annual reproduction of budgets that are not guided by previous scientific data collection and analysis. The lack of sustainability of the function given the absence of independent revenue or cost recovery streams threatens the efficiency and effectiveness of the systems as the country develops as an industrial base and a tourism destination.

Finally in the absence of appropriate legislation, effective and continuous public education and awareness, and scheduled capacity building, the efficiency of solid waste management services would continue to be lacking as new economic activities place demands for stronger policy, plans and mechanisms.

7. HEALTH, ENVIRONMENT, AND SOCIAL DEVELOPMENT

Proper solid waste management practices have become an integral part of public health and environment control strategies. While no major studies have been done regarding the impact on public health and the environment, some air quality analysis was done in the vicinity of the Beetham Disposal Site in 1996 to measure the impact of the fires on the respiratory system of residents adjacent to the site. Improper solid waste disposal operations may cause air pollution, ground and surface water pollution and destruction of ecological species or their habitat. Figure 6.0 comprehensively represents the impact of poor waste disposal practices.

The public health threat arising from improper waste disposal is greater in tropical countries than in temperate regions, since biological degradation rates and conditions for growth of disease-carrying organisms are greater. Figure 6.1 outlines the pathways of transmission that can result in human disease, disability or malnutrition.

The Occupational Health and Safety Act does address the compliance of employers regarding employee health, but enforcement is not evident. The larger industries and commercial operators have adopted health and safety as an integral part of human resource management. The use of protective gear coupled with scheduled health examinations have begun to be an integral part of management planning. In many cases this compliance is in response to the requirements of the main corporate office in the case of multi-national companies, or in response to a pre-requisite for ISO Certification.

The solid waste management collection services heavily driven by the private contractors enjoy considerable coverage, field data reflecting 100%. The general adherence to collection frequencies by contractors has controlled the potential health threat as poor and lengthy storage of solid wastes at residential and commercial generators are addressed.

While coverage has shown considerable improvement over the last ten years, the quality, efficiency and effectiveness of the disposal function have not developed to support this claim. The existing disposal sites are not operated as sanitary landfills and no immediate concrete plans are in place for improvement. Some of these results are directly attributed to the allocations for the operations that are not based on clearly determined cost parameters. The country continues to develop a strong industrial sector but the waste management systems that are required to address the waste items generated by these industries have not been introduced. Socially efforts are placed on infrastructural support such as housing and also for the provision of relief programmes. Health and the environment continue to occupy limited priority in national budgeting and planning, creating a position that could develop into alarming public health implications in the absence of monitoring and control by the relevant institutions.

Public health impacts can also be attributed to illegal dumping and the non-servicing of unauthorized dumps around the country. A build up of special wastes items such as tyres, derelict vehicles and white goods have increased the potential for insect-borne diseases as the wet season deposits large volumes of water into these items, providing a breeding ground for mosquitoes. Bulky waste collection services are not always scheduled in the rural areas resulting in a build up of unsightly accumulations of waste items.

Drain maintenance has also affected the human health aspect. Poor maintenance of underground drains adds to an accumulation of debris that obstructs waterways resulting in flooding during the wet season and stagnated water filled with items such as polyethylene terephthalate (PET) bottles and styrofoam containers during the dry season.

8. PARTICIPATORY MANAGEMENT

Community mobilization and organization is done on a self-initiated and self-regulated basis. Mainly driven by private enterprise residential areas would occasionally undertake a clean-up initiative as a citizen effort. Municipal support may come in the form of equipment, material and manpower depending on the extent and the source of the effort, which in many cases would be a Government institution.

On-going programmes involving the community and Government include the URP and the recently introduced CEPEP. This programme was established to: 1) protect and enhance the environment, 2) create jobs to improve the environment 3) start-up environmentally related businesses and 4) contribute to the alleviation of social ills.

Waste recovery and recycling has been generally informal. Waste recovery is done both at source and by salvaging at the landfill sites. The traditional practice of rummaging through waste by men, women and children still exists as significant numbers salvagers (as much as 75 salvagers are know to operate at the Beetham Site on a daily basis) seek items for economic gains and reuse creating the potential for disease transmission to families and communities. Items such as metals, glass, and cardboard are targeted for specific local markets. In the case of cardboard and some metals, these items are further processed for shipment to overseas markets. Waste collections crews also engage in some level of waste recovery targeting mainly the glass items. Concerns have also been raised about the public health impact on the society, as food items are retrieved for use, or as sale items in certain parts of the city centres.

Formal waste recovery is also done by small to medium entrepreneurs. Items such as paper, cardboard and metals are also recovered at source and delivered for sale to processing locations. These initiatives are driven mainly by market prices. Some of the NGOs in association with Carib Glassworks Specialists Limited have previously been involved in glass recovery. SWMCOL and ACE Recycling Limited, a private company, are also involved in paper recovery, accessing most of the post consumer items from sources such as banks, insurance companies, paper processors and printers.

SWMCOL provides annual medical examinations for its staff involved in direct handling of wastes and also have developed safety manuals for the facility and also for the operations of the various types of equipment. This level of hygiene and occupational programmes does not exist at the RC, probably because of the high level of contracted collection services.

FOFOS does have a participatory role in sensitizing the public to environmental issues that may emerge. As an NGO, it keeps check on implementation of environmental policy and regulations by the state and the level of adherence and compliance to these policies and regulations by the industrial sector and the general business sector. Other NGOs providing participatory service include Environment Tobago, Rotary Club and commercial entities such as banks and insurance companies.

It should be noted that there is no national programme of environmental education and sensitization of the magnitude of the "Charlie Programme" that was conducted in the 1980s. Public awareness initiatives are limited to environmental messages and activities highlighted as short-term clean-up exercises by NGOs, commercial banks, insurance companies, international agencies and some members of the industrial sector. Environmental education, while it may be topical at some institutions, has not been established as a fixed item in the school curriculum for both primary and secondary schools.

9. FUTURE PROSPECTIVES

Solid waste management in Trinidad and Tobago needs to be urgently addressed as part of national infrastructural planning. The desire of the country to attract foreign investments and to strengthen the tourism industry in Tobago, signals the opportunity to update the plans and considerations that have already been formulated. The results of these updates would undoubtedly result in increased investments and operating expenditures as new systems and technologies would have to be introduced to meet the demands of a growing economy. Proper policies, plans, programmes and projects would have to be developed in consultation with all the key stakeholders. Strategic thinking has to ensure that while the state develops as a regional economic destination, this development does not result in a series of negative environmental impacts and health implications.

Institutional arrangements also need to be addressed. An institution needs to be identified, with the specific solid waste management responsibility supported by the legal instruments. This would give the industry the attention it needs to respond to global demands as the country encourages international partnerships in business. Capacity building has to be an integral part of the reorganization efforts. A needs assessment should precede the development of a relevant training programme together with a human resource management plan that would address succession planning and the transition from the old practices to the new strategies and mechanisms. While the RCs would continue to play an operational role, they must be guided by the policies and management principles established by a governing body.

The physical systems should also be developed to respond to the findings of an updated study that would inform the structuring of policy and plans. Where the sanitary landfill is the preferred option, all of the engineering infrastructure and management should be included to facilitate sound environmental practices in its operations and maintenance, and to determine clear costs for disposal. Waste diversion strategies should be developed as part of an integrated waste management system. Collection route management systems should be revisited to determine the efficiency of the existing system and to set the stage for the development of a more reliable cost per tonne for collection.

The extent of private sector participation in waste management should be evaluated. The indications are that many of the existing companies have demonstrated their ability to fulfill the contract requirements. This approach should in no way reduce the responsibility for the designated solid waste management entities to plan and supervise the delivery of solid waste collection services. The secret to maintaining the required level of service is to write specifications that assure continuity in the services needed, at prices that are equitable. At a minimum plans and licensing should occur, and at a maximum, contracts should be the mechanism for providing collection services. Efficiency, effectiveness, economic pricing and the protection of public health and the environment should form the foundation for the use of private service providers.

In the absence of reliable national costs for solid waste management it is fairly difficult to determine clear estimates to achieve the effectiveness and efficiency envisaged. The national study done in 1979 did identify some cost projections but these costs are not current, and systems around which these costs were developed were not implemented.

One recent study done in year 2000[2], followed by a build, operated and transfer proposal estimated US$11,000.00 as a monthly operating cost for a National Sanitary Landfill and Transfer Station System. These operating costs are expected to increase by 41% by year fifteen.

[2] Marshall Macklin and Monaghan - Trinidad and Tobago Solid Waste Management System - Outline Business Plan - July 17, 2000.

9.1 Recommendations

Medium to Long-term(2-3 years)

(1) Update the National Solid Waste Management Study with a view to recognising new economic and social parameters. A clear plan/strategy should be developed addressing:

- Policy, plans, programmes and projects
- Disposal and collection systems
- Institutional Arrangements and Strengthening
- Legislation
- Public Education and Awareness
- Waste diversion/minimization (recovery, reuse, reduction and recycling)
- System financing and sustainability

Short-Term (1 year)

(2) Upgrade existing disposal sites addressing infrastructure (access roads, security fencing, etc.), security and management practices, and prepare operation and maintenance plans. Appropriate financial allocations should be provided to ensure that the components identified in the operation and maintenance plans are implemented.

REGIONAL CORPORATIONS	GENERATION RATE	$/TONNE FOR	% COVERAGE		SWEEPERS		COLLECTORS		NO. OF COLLECTION AREAS	COLLECTION FREQUENCY/WK	
	(kg./person/day)	COLLECTION	Collection	Sweeping	Contracted employed	Corporation	Contracted	Corporation employed		Residential	Town Centre/Market
City of Port of Spain	5.1[2]	11.30*	100	3.4	0	197	12	171	3[3]	5	13
City of San Fernando	1.3	17.80	100	55	6	54	16	27	19	3	7
Arima Borough	1.1	12.00	100	2.1	0	28	18	30	8	5	9
Point Fortin Borough	1.4	24.80	100	2.4	0	9	15	9	7	4	7
Chaguanas Borough	2.8	13.80	100	0.8	4	4	150	0	22[1]	6	7
Diego Martin	0.7	58.70	100	0.9	0	2	123	8	7	3	Not applicable
Couva/Tabaquite/Talparo	0.7	23.40	100	0.6	0	20	114	0	30	3	7
Mayaro/Rio Claro	0.5	71.00	100	1.0	4	8	36	0	12	3	7
Penal/Debe	0.7	22.20	100	2.8	0	7	47	6	16	3	6
Princes Town	0.4	40.40	100	0.8	2	4	69	0	22	3	7
San Juan/Laventille	3.2	17.20	100	68	0	84	213	0	14	4	7
Sangre Grande	0.7	47.60	100	2.7	0	20	90	0	14	3	7
Siparia	2.5	8.00	100	2.8	3	15	75	3	24	5	7
Tunapuna/Piarco	2.2	15.50	100	3.1	12	-	135	-	20	4	7
Tobago	2.2	10.60	100	55	0	26	27	12	14	5	7

Notes

1. Includes both Chaguanas and Cunupia markets.
2. Does not include transient population.
3. Town center areas.

* Do not include factors of transient population and waste volumes collected by City.

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11. ACRONYMS

CEPEP	Community-based Environmental Protection and Enhancement Programme
FOFOS	Friends of Fishermen of the Seas
GOTT	Government of Trinidad and Tobago
HDI	Human Development Indicators
IDB	Inter-American Development Bank
MOLG	Ministry of Local Government
MOPUE	Ministry of Public Utilities and the Environment
NEP	National Environmental Policy
OECS	Organization of Eastern Caribbean States
RC	Regional Corporation
SWMCOL	Trinidad and Tobago Solid Waste Management Company Limited
THA	Tobago House of Assembly
USAID	United States Agency for International Development
URP	Unemployment Relief Programme

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