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# WHAT A WASTE

## A Global Review of Solid Waste Management



THE WORLD BANK





Cover photo on right and on this page: Conakry landfill, Guinea (Charles Peterson photographer).

Cover photo on far left: separate containers for recyclables and non-recyclables, Barcelona, Spain (Perinaz Bhada-Tata photographer).

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# **WHAT A WASTE**

## A Global Review of Solid Waste Management

**Daniel Hoornweg and Perinaz Bhada-Tata**

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# Urban Development Series

Produced by the World Bank's Urban Development and Local Government Unit of the Sustainable Development Network, the **Urban Development Series** discusses the challenge of urbanization and what it will mean for developing countries in the decades ahead. The Series aims to explore and delve more substantively into the core issues framed by the World Bank's 2009 Urban Strategy **Systems of Cities: Harnessing Urbanization for Growth and Poverty Alleviation**. Across the five domains of the Urban Strategy, the Series provides a focal point for publications that seek to foster a better understanding of (i) the core elements of the city system, (ii) pro-poor policies, (iii) city economies, (iv) urban land and housing markets, (v) sustainable urban environment, and other urban issues germane to the urban development agenda for sustainable cities and communities.

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# FOREWORD

Photo: ©Simone D. McCourtie/World Bank

**Solid waste management is the one thing just about every city government provides for its residents. While service levels, environmental impacts and costs vary dramatically, solid waste management is arguably the most important municipal service and serves as a prerequisite for other municipal action.**

Currently, world cities generate about 1.3 billion tonnes of solid waste per year. This volume is expected to increase to 2.2 billion tonnes by 2025. Waste generation rates will more than double over the next twenty years in lower income countries. Globally, solid waste management costs will increase from today's annual \$205.4 billion to about \$375.5 billion in 2025. Cost increases will be most severe in low income countries (more than 5-fold increases) and lower-middle income countries (more than 4-fold increases).

The global impacts of solid waste are growing fast. Solid waste is a large source of methane, a powerful GHG that is particularly impactful in the short-term. The recycling industry, with more

than two million informal waste pickers, is now a global business with international markets and extensive supply and transportation networks. Locally, uncollected solid waste contributes to flooding, air pollution, and public health impacts such as respiratory ailments, diarrhea and dengue fever. In lower income country cities solid waste management is usually a city's single largest budgetary item.

The report you have before you is an important one that provides a quick snapshot of the state of today's global solid waste management practices. A credible estimate is made for what the situation will look like in 2025. The findings are sobering. Improving solid waste management, especially in low income countries, is an urgent priority. Hopefully, this report will contribute to the dialogue that leads to much-needed action.

**▲ ITC landfill and recycling center, Ankara, Turkey**

**Rachel Kyte**  
Vice President and Head of Network,  
Sustainable Development  
The World Bank

◀ **Ghabawi landfill, Amman, Jordan**

Photo: Perinaz Bhada-Tata

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Photo: Ron Perry/Oki Golf

# EXECUTIVE SUMMARY

**As the world hurtles toward its urban future, the amount of municipal solid waste (MSW), one of the most important by-products of an urban lifestyle, is growing even faster than the rate of urbanization. Ten years ago there were 2.9 billion urban residents who generated about 0.64 kg of MSW per person per day (0.68 billion tonnes per year). This report estimates that today these amounts have increased to about 3 billion residents generating 1.2 kg per person per day (1.3 billion tonnes per year). By 2025 this will likely increase to 4.3 billion urban residents generating about 1.42 kg/capita/day of municipal solid waste (2.2 billion tonnes per year).**

Municipal solid waste management is the most important service a city provides; in low-income countries as well as many middle-income countries, MSW is the largest single budget item for cities and one of the largest employers. Solid waste is usually the one service that falls completely

within the local government's purview. A city that cannot effectively manage its waste is rarely able to manage more complex services such as health, education, or transportation.

▲ **Golf course:  
post closure use  
of landfill site**

Poorly managed waste has an enormous impact on health, local and global environment, and economy; improperly managed waste usually results in down-stream costs higher than what it would have cost to manage the waste properly in the first place. The global nature of MSW includes its contribution to GHG emissions, e.g. the methane from the organic fraction of the waste stream, and the increasingly global linkages of products, urban practices, and the recycling industry.

This report provides consolidated data on MSW generation, collection, composition, and disposal by country and by region. Despite its importance, reliable global MSW information is not typically available. Data is often inconsistent, incomparable and incomplete; however as suggested in this report there is now enough MSW information to estimate

global amounts and trends. The report also makes projections on MSW generation and composition for 2025 in order for decision makers to prepare plans and budgets for solid waste management in the coming years. Detailed annexes provide available MSW generation, collection, composition, and disposal data by city and by country.

Globally, waste volumes are increasing quickly – even faster than the rate of urbanization. Similar to rates of urbanization and increases in GDP, rates of MSW growth are fastest in China, other parts of East Asia, and parts of Eastern Europe and the Middle East. Municipal planners should manage solid waste in as holistic a manner as possible. There is a strong correlation between urban solid waste generation rates and GHG emissions. This link is likely similar with other urban inputs/outputs such as waste water and total energy use. Reviewing MSW in an integrated manner with a more holistic approach, focusing on urban form and lifestyle choice may yield broader benefits.

**Men pick up used cardboard boxes to sell for recycling in the San Joaquin open-air market in Salvador, Brazil**

Pollution such as solid waste, GHG emissions and ozone-depleting substances are by-products of urbanization and increasing affluence.

Improving MSW is one of the most effective ways to strengthen overall municipal management and is usually a prerequisite for other, more complicated, municipal services. Waste workers, both formal and informal, have a significant impact on overall MSW programming. While in more affluent countries ageing workers are a growing challenge, the effective integration of waste pickers, particularly in low-income countries, is critical.

This report is a follow-up to *What a Waste: Solid Waste Management in Asia*, a Working Paper Published by the East Asia and the Pacific Region Urban and Local Government Sector of the World Bank in 1999. The report has been expanded to include the entire world, given data availability and increased inter-dependence between nations and linkages in global trade, particularly that of secondary materials.

Photo: Alejandro Lipszyc/World Bank



## Abbreviations and Acronyms

|                          |  |
|--------------------------|--|
| <b>AFR</b>               | Africa region  |
| <b>C&amp;D</b>           | Construction and demolition                              |
| <b>CDM</b>               | Clean Development Mechanism                              |
| <b>EAP</b>               | East Asia and Pacific region                             |
| <b>ECA</b>               | Europe and Central Asia region                           |
| <b>GDP</b>               | Gross Domestic Product                                   |
| <b>GHG</b>               | Greenhouse gas   |
| <b>HIC</b>               | High-income country                                      |
| <b>ICI</b>               | Industrial, commercial, and institutional                |
| <b>IPCC</b>              | Intergovernmental Panel on Climate Change                |
| <b>ISWM</b>              | Integrated solid waste management                        |
| <b>Kg/capita/day</b>     | kilograms per capita per day                             |
| <b>LCR</b>               | Latin America and the Caribbean region                   |
| <b>LIC</b>               | Low-income country                                       |
| <b>LMIC</b>              | Lower middle-income country                              |
| <b>MENA</b>              | Middle East and North Africa region                      |
| <b>METAP</b>             | Mediterranean Environmental Technical Assistance Program |
| <b>MRF</b>               | Materials recovery facility                              |
| <b>MSW</b>               | Municipal solid waste                                    |
| <b>mtCO<sub>2</sub>e</b> | Million tonnes of carbon dioxide equivalent              |
| <b>OECD</b>              | Organisation for Economic Co-operation and Development   |
| <b>PAHO</b>              | Pan-American Health Organization                         |
| <b>RDF</b>               | Refuse-derived fuel                                      |
| <b>SAR</b>               | South Asia region  |
| <b>SWM</b>               | Solid waste management                                   |
| <b>tCO<sub>2</sub>e</b>  | Tons of carbon dioxide equivalent                        |
| <b>UMIC</b>              | Upper middle-income country                              |

## Country Classification According to Region

| Africa (AFR)             | East Asia & Pacific (EAP) | Eastern & Central Asia (ECA) | Latin America & the Caribbean (LAC) | Middle East & North Africa (MENA) | Organisation for Economic Co-operation and Development (OECD) | South Asia (SAR) |
|--------------------------|---------------------------|------------------------------|-------------------------------------|-----------------------------------|---|------------------|
| Angola                   | Brunei Darussalam         | Albania                      | Antigua and Barbuda                 | Algeria                           | Andorra   | Bangladesh       |
| Benin                    | Cambodia                  | Armenia                      | Argentina                           | Bahrain                           | Australia   | Bhutan           |
| Botswana                 | China                     | Belarus                      | Bahamas, The                        | Egypt, Arab Rep.                  | Austria   | India            |
| Burkina Faso             | Fiji                      | Bulgaria                     | Barbados                            | Iran, Islamic Rep.                | Belgium   | Maldives         |
| Burundi                  | Hong Kong                 | Croatia                      | Belize                              | Iraq                              | Canada  | Nepal            |
| Cameroon                 | Indonesia                 | Cyprus                       | Bolivia                             | Israel                            | Czech Republic  | Pakistan         |
| Cape Verde               | Lao PDR                   | Estonia                      | Brazil                              | Jordan                            | Denmark   | Sri Lanka        |
| Central African Republic | Macao, China              | Georgia                      | Chile                               | Kuwait                            | Finland   |                  |
| Chad                     | Malaysia                  | Latvia                       | Colombia                            | Lebanon                           | France  |                  |
| Comoros                  | Marshall Islands          | Lithuania                    | Costa Rica                          | Malta                             | Germany   |                  |
| Congo, Dem. Rep.         | Mongolia                  | Macedonia, FYR               | Cuba                                | Morocco                           | Greece  |                  |
| Congo, Rep.              | Myanmar                   | Poland                       | Dominica                            | Oman                              | Hungary   |                  |
| Cote d'Ivoire            | Philippines               | Romania                      | Dominican Republic                  | Qatar                             | Iceland   |                  |
| Eritrea                  | Singapore                 | Russian Federation           | Ecuador                             | Saudi Arabia                      | Ireland   |                  |
| Ethiopia                 | Solomon Islands           | Serbia                       | El Salvador                         | Syrian Arab Republic              | Italy   |                  |
| Gabon                    | Thailand                  | Slovenia                     | Grenada                             | Tunisia                           | Japan   |                  |
| Gambia                   | Tonga                     | Tajikistan                   | Guatemala                           | United Arab Emirates              | Korea, South  |                  |
| Ghana                    | Vanuatu                   | Turkey                       | Guyana                              | West Bank and Gaza                | Luxembourg  |                  |
| Guinea                   | Vietnam                   | Turkmenistan                 | Haiti                               |                                   | Monaco  |                  |
| Kenya                    |                           |                              | Honduras                            |                                   | Netherlands   |                  |
| Lesotho                  |                           |                              | Jamaica                             |                                   | New Zealand   |                  |
| Liberia                  |                           |                              | Mexico                              |                                   | Norway  |                  |
| Madagascar               |                           |                              | Nicaragua                           |                                   | Portugal  |                  |
| Malawi                   |                           |                              | Panama                              |                                   | Slovak Republic   |                  |
| Mali                     |                           |                              | Paraguay                            |                                   | Spain   |                  |
| Mauritania               |                           |                              | Peru                                |                                   | Sweden  |                  |
| Mauritius                |                           |                              | St. Kitts and Nevis                 |                                   | Switzerland   |                  |
| Mozambique               |                           |                              | St. Lucia                           |                                   | United Kingdom  |                  |
| Namibia                  |                           |                              | St. Vincent and the Grenadines      |                                   | United States   |                  |
| Niger                    |                           |                              | Suriname                            |                                   |   |                  |
| Nigeria                  |                           |                              | Trinidad and Tobago                 |                                   |   |                  |
| Rwanda                   |                           |                              | Uruguay                             |                                   |   |                  |
| Sao Tome and Principe    |                           |                              | Venezuela, RB                       |                                   |   |                  |
| Senegal                  |                           |                              |                                     |                                   |   |                  |
| Seychelles               |                           |                              |                                     |                                   |   |                  |
| Sierra Leone             |                           |                              |                                     |                                   |   |                  |
| South Africa             |                           |                              |                                     |                                   |   |                  |
| Sudan                    |                           |                              |                                     |                                   |   |                  |
| Swaziland                |                           |                              |                                     |                                   |   |                  |
| Tanzania                 |                           |                              |                                     |                                   |   |                  |
| Togo                     |                           |                              |                                     |                                   |   |                  |
| Uganda                   |                           |                              |                                     |                                   |   |                  |
| Zambia                   |                           |                              |                                     |                                   |   |                  |
| Zimbabwe                 |                           |                              |                                     |                                   |   |                  |

## Country Classification According to Income

| Lower Income (LI) | Lower Middle Income (LMI) | Upper Middle Income (UMI)      | High Income (HIC)    |
|-------------------|---------------------------|--------------------------------|----------------------|
| Chad              | Bulgaria                  | Colombia                       | Barbados             |
| Comoros           | Cameroon                  | Costa Rica                     | Belgium              |
| Congo, Dem. Rep.  | Cape Verde                | Cuba                           | Brunei Darussalam    |
| Eritrea           | China                     | Dominica                       | Canada               |
| Ethiopia          | Congo, Rep.               | Dominican Republic             | Croatia              |
| Gambia            | Cote d'Ivoire             | Fiji                           | Cyprus               |
| Ghana             | Ecuador                   | Gabon                          | Czech Republic       |
| Guinea            | Egypt, Arab Rep.          | Georgia                        | Denmark              |
| Haiti             | El Salvador               | Grenada                        | Estonia              |
| Kenya             | Guatemala                 | Jamaica                        | Finland              |
| Lao PDR           | Guyana                    | Latvia                         | France               |
| Liberia           | Honduras                  | Lebanon                        | Germany              |
| Madagascar        | India                     | Lithuania                      | Greece               |
| Malawi            | Indonesia                 | Malaysia                       | Hong Kong, China     |
| Mali              | Iran, Islamic Rep.        | Mauritius                      | Hungary              |
| Mauritania        | Iraq                      | Mexico                         | Iceland              |
| Mongolia          | Jordan                    | Myanmar                        | Ireland              |
| Mozambique        | Lesotho                   | Namibia                        | Israel               |
| Nepal             | Macedonia, FYR            | Panama                         | Italy                |
| Niger             | Maldives                  | Peru                           | Japan                |
| Rwanda            | Marshall Islands          | Poland                         | Korea, South         |
| Senegal           | Morocco                   | Romania                        | Kuwait               |
| Serbia            | Nicaragua                 | Russian Federation             | Luxembourg           |
| Sierra Leone      | Nigeria                   | Seychelles                     | Macao, China         |
| Tanzania          | Pakistan                  | South Africa                   | Malta                |
| Togo              | Paraguay                  | St. Kitts and Nevis            | Monaco               |
| Uganda            | Philippines               | St. Lucia                      | Netherlands          |
| Vanuatu           | Sao Tome and Principe     | St. Vincent and the Grenadines | New Zealand          |
| Vietnam           | Solomon Islands           | Suriname                       | Norway               |
| Zambia            | Sri Lanka                 | Tajikistan                     | Oman                 |
| Zimbabwe          | Sudan                     | Uruguay                        | Portugal             |
|                   | Swaziland                 | Venezuela, RB                  | Qatar                |
|                   | Syrian Arab Republic      |                                | Saudi Arabia         |
|                   | Thailand                  |                                | Singapore            |
|                   | Tonga                     |                                | Slovak Republic      |
|                   | Tunisia                   |                                | Slovenia             |
|                   | Turkey                    |                                | Spain                |
|                   | Turkmenistan              |                                | Sweden               |
|                   | West Bank and Gaza        |                                | Switzerland          |
|                   |                           |                                | Trinidad and Tobago  |
|                   |                           |                                | United Arab Emirates |
|                   |                           |                                | United Kingdom       |
|                   |                           |                                | United States        |



## 1

## Introduction

In 1999 the World Bank published *What a Waste: Solid Waste Management in Asia* (Hoornweg and Thomas 1999), with an estimate of waste quantities and composition for Asia. In the intervening decade more accurate and comprehensive data became available for most regions of the world. OECD-country estimates are typically reliable and consistent—added to these were comprehensive studies for China and India and the Pan-American Health Organization's study for Latin America. Therefore a global update of the 1999 report is possible, and timely.

Municipal solid waste managers are charged with an enormous task: get the waste out from underfoot and do so in the most economically, socially, and environmentally optimal manner possible. Solid waste management is almost always the responsibility of local governments and is often their single largest budget item, particularly in developing countries. Solid waste management and street sweeping is also often the city's single largest source of employment.<sup>1</sup> Additionally, solid waste is one of the most pernicious local pollutants — uncollected solid waste is usually the leading contributor to local flooding and air and water pollution. And if that task were not large enough, local waste management officials also need to deal with the integrated and international aspects of solid waste, and increasingly with demographic change in the work force, employment generation, and management of staff — both formal and informal.

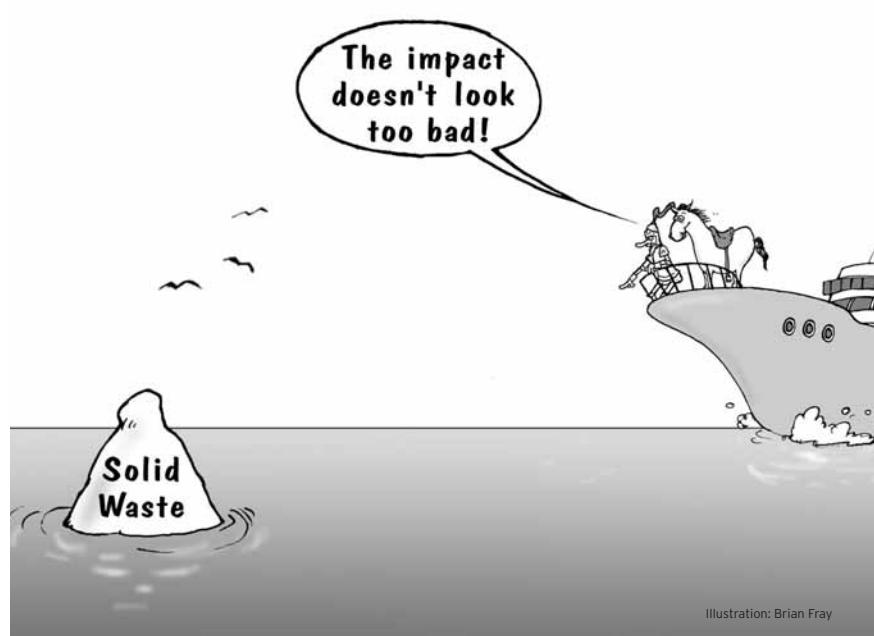
Managing municipal solid waste is an intensive service. Municipalities need capacities in procurement, contract management, professional and often unionized labor management, and ongoing expertise in capital and operating budgeting and finance. MSW also requires a strong social contract between the municipality and community. All of these skills are prerequisites for other municipal services.

The original What a Waste Report provided waste estimates for South and East Asia. This waste stream represents about 33% of the world's total quantities. Most growth predictions made in *What a Waste: Solid Waste Management in Asia* were reasonably accurate and in most cases, even taking into account the recent economic contraction, waste growth estimates were conservative. This is especially true in China. In 2004, China surpassed the US as the world's largest waste generator. In 2030, China will likely produce twice as much municipal solid waste as the United States.

The main objective of this updated *What a Waste* Report is to provide current municipal solid waste

<sup>1</sup> Solid waste management — formal and informal — represents 1% to 5% of all urban employment. As formality increases so do issues of labor organization, health and safety, ageing demographics (solid waste workers tend to be younger), the friction between 'sanctioned' and 'unsanctioned' recycling, and producer pay arguments and apportioning costs and responsibilities.

◀ Ferry men parking their boats on Buriganga River, Dhaka.  
Photo taken as part of Development 360 project.



# BOX 1

## **What a Waste 1999: What's Changed (and What Hasn't) in the Last Decade**

- ▶ *What a Waste* (1999) predicted that by 2025 the daily MSW generation rate in Asia would be 1.8 million tonnes per day. These estimates are still accurate. At present, the daily generation rate in South Asia and East Asia and the Pacific combined is approximately 1 million tonnes per day.
- ▶ Low-income countries continue to spend most of their SWM budgets on waste collection, with only a fraction going toward disposal. This is the opposite in high-income countries where the main expenditure is on disposal.
- ▶ Asia, like much of the world, continues to have a majority of organics and paper in its waste stream: The combined totals are 72% for EAP and 54% for SAR. Growth in waste quantities is fastest in Asia.
- ▶ There is a greater emphasis on labor issues: in high-income countries, demographics and immigration are critical factors; in low-income countries working conditions and integration of waste pickers has gained in importance.
- ▶ Rates of recycling are increasingly influenced by global markets, relative shipping costs, and commodity prices.

Lisbon, Portugal, used aluminum cans are deposited into a container for recycling



©Bigstock Photo

generation, composition, collection, and disposal data by country and by region. Both developing and developed countries are included. This report makes projections on MSW generation and composition on a country and regional level for 2025. This should provide decision makers with a sufficient foundation on which to base waste management policy decisions. In most cases further local analysis will be needed, but this report is intended to provide a broad global review. For a summary on the main differences between the data presented in the 1999 publication and this publication, please refer to Box 1.

Solid waste is inextricably linked to urbanization and economic development. As countries

urbanize, their economic wealth increases. As standards of living and disposable incomes increase, consumption of goods and services increases, which results in a corresponding increase in the amount of waste generated. This report estimates that at present almost 1.3 billion tonnes of MSW are generated globally every year, or 1.2 kg/capita/day. The actual per capita rates, however, are highly variable, as there are considerable differences in waste generation rates across countries, between cities, and even within cities.

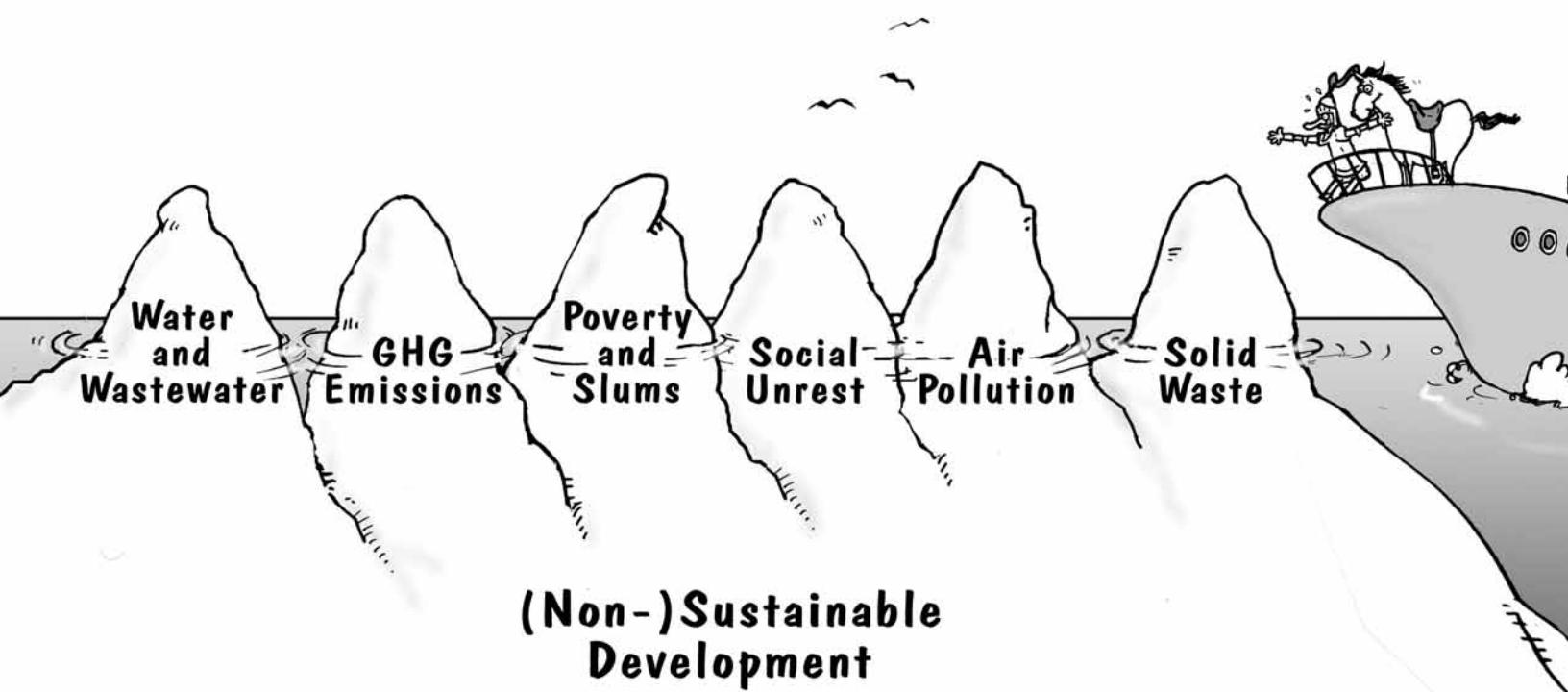
Solid waste is generally considered an ‘urban’ issue. Waste generation rates tend to be much lower in rural areas since, on average, residents are usually poorer, purchase fewer store-bought

items (which results in less packaging), and have higher levels of reuse and recycling. Today, more than 50 percent of the world's population lives in cities, and the rate of urbanization is increasing quickly. By 2050, as many people will live in cities as the population of the *whole world* in 2000. This will add challenges to waste disposal. Citizens and corporations will likely need to assume more responsibility for waste generation and disposal, specifically, product design and waste separation. Also likely to emerge will be a greater emphasis on 'urban mining' as the largest source of materials like metal and paper may be found in cities.

Waste is mainly a by-product of consumer-based lifestyles that drive much of the world's economies. In most cities, the quickest way to reduce waste volumes is to reduce economic activity—not

generally an attractive option. Solid waste is the most visible and pernicious by-product of a resource-intensive, consumer-based economic lifestyle. Greenhouse gas emissions, water pollution and endocrine disruptors are similar by-products to our urban lifestyles. The long term sustainability of today's global economic structure is beyond the scope of this paper. However, solid waste managers need to appreciate the global context of solid waste and its interconnections to economies and local and global pollution.

This report makes projections for MSW generation in 2025, based on expected population and economic growth rates. As countries, particularly India and China, continue their rapid pace of urbanization and development, global solid waste quantities are projected to increase considerably.



# 2

## Global Waste Management Practices

### At a Glance:

- ▶ In solid waste management there is no throwing ‘away’.
- ▶ The organic fraction of waste, collection vehicles, and waste disposal methods contribute to GHG emissions.
- ▶ The last two decades have brought a new challenge for waste management: the growing vagaries of global secondary materials markets.

In solid waste management there is no ‘away’. When ‘throwing away’ waste, system complexities and the integrated nature of materials and pollution are quickly apparent. For example, waste incineration is expensive and poses challenges of air pollution and ash disposal. Incineration requires waste placed outside for collection to be

containerized to stay dry, and much of the waste stream is not combustible. Landfills require land availability, and siting is often opposed by potential neighboring residents. Solving one problem often introduces a new one, and if not well executed, the new problem is often of greater cost and complexity.

# Box 2

### Definitions of Municipal Solid Waste

**By OECD:** Municipal waste is collected and treated by, or for municipalities. It covers waste from households, including bulky waste, similar waste from commerce and trade, office buildings, institutions and small businesses, yard and garden, street sweepings, contents of litter containers, and market cleansing. Waste from municipal sewage networks and treatment, as well as municipal construction and demolition is excluded.

**By PAHO:** Solid or semi-solid waste generated in population centers including domestic and, commercial wastes, as well as those originated by the small-scale industries and institutions (including hospital and clinics); market street sweeping, and from public cleansing.

**By IPCC:** The IPCC includes the following in MSW: food waste; garden (yard) and park waste; paper and cardboard; wood; textiles; nappies (disposable diapers); rubber and leather; plastics; metal; glass (and pottery and china); and other (e.g., ash, dirt, dust, soil, electronic waste).

Photo: ©Simone D. McCourt/World Bank

ITC landfill and recycling center, Ankara, Turkey ▶



**TABLE 1**Comparison of Solid Waste Management Practices by Income Level (adapted from *What a Waste 1999*)

| Activity             | Low Income   | Middle Income   | High Income  |
|----------------------|--|---|--|
| Source Reduction     | No organized programs, but reuse and low per capita waste generation rates are common.   | Some discussion of source reduction, but rarely incorporated into an organized program.   | Organized education programs emphasize the three 'R's' – reduce, reuse, and recycle. More producer responsibility & focus on product design.   |
| Collection           | Sporadic and inefficient. Service is limited to high visibility areas, the wealthy, and businesses willing to pay. High fraction of inerts and compostables impact collection—overall collection below 50%.  | Improved service and increased collection from residential areas. Larger vehicle fleet and more mechanization. Collection rate varies between 50 to 80%. Transfer stations are slowly incorporated into the SWM system.   | Collection rate greater than 90%. Compactor trucks and highly mechanized vehicles and transfer stations are common. Waste volume a key consideration. Aging collection workers often a consideration in system design.   |
| Recycling            | Although most recycling is through the informal sector and waste picking, recycling rates tend to be high both for local markets and for international markets and imports of materials for recycling, including hazardous goods such as e-waste and ship-breaking. Recycling markets are unregulated and include a number of 'middlemen'. Large price fluctuations. | Informal sector still involved; some high technology sorting and processing facilities. Recycling rates are still relatively high. Materials are often imported for recycling. Recycling markets are somewhat more regulated. Material prices fluctuate considerably.   | Recyclable material collection services and high technology sorting and processing facilities are common and regulated. Increasing attention towards long-term markets.  |
| Composting           | Rarely undertaken formally even though the waste stream has a high percentage of organic material. Markets for, and awareness of, compost lacking.   | Large composting plants are often unsuccessful due to contamination and operating costs (little waste separation); some small-scale composting projects at the community/ neighborhood level are more sustainable. Composting eligible for CDM projects but is not widespread. Increasing use of anaerobic digestion.   | Becoming more popular at both backyard and large-scale facilities. Waste stream has a smaller portion of compostables than low- and middle-income countries. More source segregation makes composting easier. Anaerobic digestion increasing in popularity. Odor control critical.                       |
| Incineration         | Not common, and generally not successful because of high capital, technical, and operation costs, high moisture content in the waste, and high percentage of inerts.   | Some incinerators are used, but experiencing financial and operational difficulties. Air pollution control equipment is not advanced and often by-passed. Little or no stack emissions monitoring. Governments include incineration as a possible waste disposal option but costs prohibitive. Facilities often driven by subsidies from OECD countries on behalf of equipment suppliers. | Prevalent in areas with high land costs and low availability of land (e.g., islands). Most incinerators have some form of environmental controls and some type of energy recovery system. Governments regulate and monitor emissions. About three (or more) times the cost of landfilling per tonne.     |
| Landfilling/ Dumping | Low-technology sites usually open dumping of wastes. High polluting to nearby aquifers, water bodies, settlements. Often receive medical waste. Waste regularly burned. Significant health impacts on local residents and workers.   | Some controlled and sanitary landfills with some environmental controls. Open dumping is still common. CDM projects for landfill gas are more common.   | Sanitary landfills with a combination of liners, leak detection, leachate collection systems, and gas collection and treatment systems. Often problematic to open new landfills due to concerns of neighboring residents. Post closure use of sites increasingly important, e.g. golf courses and parks. |
| Costs (see Annex E)  | Collection costs represent 80 to 90% of the municipal solid waste management budget. Waste fees are regulated by some local governments, but the fee collection system is inefficient. Only a small proportion of budget is allocated toward disposal.   | Collection costs represent 50% to 80% of the municipal solid waste management budget. Waste fees are regulated by some local and national governments, more innovation in fee collection, e.g. included in electricity or water bills. Expenditures on more mechanized collection fleets and disposal are higher than in low-income countries.  | Collection costs can represent less than 10% of the budget. Large budget allocations to intermediate waste treatment facilities. Up front community participation reduces costs and increases options available to waste planners (e.g., recycling and composting).                                      |

Locally, waste collection vehicles are large sources of emissions and both incineration and landfilling contribute GHG emissions. Uncollected waste can provide breeding areas and food to potentially disease carrying vectors such as insects and rodents, with their associated health and nuisance issues. Waste management cannot be effectively managed without due consideration for issues such as the city's overall GHG emissions, labor market, land use planning, and myriad related concerns.

Despite progress in solid waste management practices in the decade since the original *What a Waste Report* was published, fundamental institutional, financial, social, and environmental problems still exist. Although each country and city has their own site-specific situations, general observations can be made across low-, middle-, and high-income countries, as delineated in Table 1.

The average city's municipal waste stream is made up of millions of separate waste items. For a compilation of the different definitions for Municipal Solid Waste, please refer to Box 2. In many cases, items in a city's waste stream originated from other countries that have countless factories and independent producers. Some of the larger waste fractions, such as organics (food and horticultural waste) and paper are easier to manage, but wastes such as multi-laminates, hazardous (e.g. syringes), and e-waste, pose disproportionately large problems. Industry programs, such as voluntary plastic-type labeling, are largely ineffective (no facilities exist to differentiate containers by numbers, either mechanically or by waste-worker) and deposit-return systems often meet industry and consumer resistance. Hybrid, ad hoc, and voluntary take-back programs are emerging, however they are generally inefficient

and municipalities are often forced to subsidize the disposal costs of these items.

In the last ten to twenty years an additional challenge has emerged for the waste manager: the growing global vagaries of secondary materials markets. Many municipal recycling programs in Europe and North America were started with the recycling markets relatively close to source. More recently, marketing of secondary-materials has emerged as a global business. The price paid per tonne of waste paper in New York City is often based on what the purchase price is in China. The majority of waste recycled in Buenos Aires, for example, is shipped to China. The volatility of secondary materials prices has increased, making planning more difficult. The price is often predictive of economic trends, dropping significantly during economic downturns (when a city is least able to afford price drops). There are some hedging opportunities for materials pricing, however secondary materials marketing does not have the same degree of sophistication as other commodities (largely due to issues of reliability, quality, externalities, and the sheer number of interested parties).

In the years that have passed since the original *What a Waste report* was released, two comprehensive World Bank studies on India and China have been prepared (Hanrahan et al 2006 and Hoornweg et al 2005). Additionally, OECD and PAHO have released MSW data for Latin America and the Caribbean. This version of *What a Waste* includes the data presented by these reports.

MSW, as defined in this report, encompasses residential, industrial, commercial, institutional, municipal, and construction and demolition (C&D) waste. Table 2 gives sources and types of waste generated.

**TABLE 2**  
**Generators and**  
**Types of Solid Waste**  
(adapted from  
*What a Waste 1999*)

| Source                      | Typical Waste Generators  | Types of Solid Wastes  |
|-----------------------------|---|--|
| Residential                 | Single and multifamily dwellings  | Food wastes, paper, cardboard, plastics, textiles, leather, yard wastes, wood, glass, metals, ashes, special wastes (e.g., bulky items, consumer electronics, white goods, batteries, oil, tires), and household hazardous wastes (e.g., paints, aerosols, gas tanks, waste containing mercury, motor oil, cleaning agents), e-wastes (e.g., computers, phones, TVs) |
| Industrial                  | Light and heavy manufacturing, fabrication, construction sites, power and chemical plants (excluding specific process wastes if the municipality does not oversee their collection) | Housekeeping wastes, packaging, food wastes, construction and demolition materials, hazardous wastes, ashes, special wastes  |
| Commercial                  | Stores, hotels, restaurants, markets, office buildings  | Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes, e-wastes   |
| Institutional               | Schools, hospitals (non-medical waste), prisons, government buildings, airports   | Same as commercial   |
| Construction and Demolition | New construction sites, road repair, renovation sites, demolition of buildings  | Wood, steel, concrete, dirt, bricks, tiles   |
| Municipal Services          | Street cleaning, landscaping, parks, beaches, other recreational areas, water and wastewater treatment plants   | Street sweepings; landscape and tree trimmings; general wastes from parks, beaches, and other recreational areas, sludge   |

All of the above should be included as municipal solid waste. Industrial, commercial, and institutional (ICI) wastes are often grouped together and usually represent more than 50% of MSW. C&D waste is often treated separately: if well managed it can be disposed separately. The items below are usually considered MSW if the municipality oversees their collection and disposal.

|               |   |  |
|---------------|---|--|
| Process       | Heavy and light manufacturing, refineries, chemical plants, power plants, mineral extraction and processing | Industrial process wastes, scrap materials, off-specification products, slag, tailings   |
| Medical waste | Hospitals, nursing homes, clinics   | Infectious wastes (bandages, gloves, cultures, swabs, blood and body fluids), hazardous wastes (sharps, instruments, chemicals), radioactive waste from cancer therapies, pharmaceutical waste |
| Agricultural  | Crops, orchards, vineyards, dairies, feedlots, farms  | Spoiled food wastes, agricultural wastes (e.g., rice husks, cotton stalks, coconut shells, coffee waste), hazardous wastes (e.g., pesticides)  |

# 3 Waste Generation

## At a Glance:

- ▶ MSW generation levels are expected to double by 2025.
- ▶ The higher the income level and rate of urbanization, the greater the amount of solid waste produced.
- ▶ OECD countries produce almost half of the world's waste, while Africa and South Asia regions produce the least waste.

Current global MSW generation levels are approximately 1.3 billion tonnes per year, and are expected to increase to approximately 2.2 billion tonnes per year by 2025. This represents a significant increase in per capita waste generation rates, from 1.2 to 1.42 kg per person per day in the next fifteen years. However, global averages are broad estimates only as rates vary considerably by region, country, city, and even within cities.

MSW generation rates are influenced by economic development, the degree of industrialization, public habits, and local climate. Generally, the higher the economic development and rate of urbanization, the greater the amount of solid waste produced. Income level and urbanization are highly correlated

and as disposable incomes and living standards increase, consumption of goods and services correspondingly increases, as does the amount of waste generated. Urban residents produce about twice as much waste as their rural counterparts.

## Waste Generation by Region

Waste generation varies as a function of affluence, however, regional and country variations can be significant, as can generation rates within the same city. Annex A. Map of Regions illustrates the regional classification used in this report. Throughout the report, when Africa is mentioned as a region, we refer to Sub-Saharan Africa. Data are particularly lacking for Sub-Saharan Africa.

Waste generation in sub-Saharan Africa is approximately 62 million tonnes per year. Per capita waste generation is generally low in this region, but spans a wide range, from 0.09 to 3.0 kg per person per day, with an average of 0.65 kg/capita/day. The countries with the highest per capita rates are islands, likely due to waste generated by the tourism industry, and a more complete accounting of all wastes generated.

The annual waste generation in East Asia and the Pacific Region is approximately 270 million tonnes per year. This quantity is mainly influenced by waste generation in China, which makes up 70% of the regional total. Per capita waste generation ranges from 0.44 to 4.3 kg per person per day for

Collecting paper  
to be recycled,  
Mumbai, India



Photo: Jeroo Bhadra

| Region | Waste Generation Per Capita (kg/capita/day) |                |         |
|--------|---|----------------|---------|
|        | Lower Boundary                              | Upper Boundary | Average |
| AFR    | 0.09  | 3.0            | 0.65    |
| EAP    | 0.44  | 4.3            | 0.95    |
| ECA    | 0.29  | 2.1            | 1.1     |
| LAC    | 0.11  | 5.5            | 1.1     |
| MENA   | 0.16  | 5.7            | 1.1     |
| OECD   | 1.10  | 3.7            | 2.2     |
| SAR    | 0.12  | 5.1            | 0.45    |

**TABLE 3**  
Current Waste Generation Per Capita by Region  
(see Annex J)

the region, with an average of 0.95 kg/capita/day (Hoornweg et al 2005).

In Eastern and Central Asia, the waste generated per year is at least 93 million tonnes. Eight countries in this region have no available data on waste generation in the literature. The per capita waste generation ranges from 0.29 to 2.1 kg per person per day, with an average of 1.1 kg/capita/day.

Latin America and the Caribbean has the most comprehensive and consistent data (e.g. PAHO's Regional Evaluation of Solid Waste Management, 2005). The total amount of waste generated per year in this region is 160 million tonnes, with per capita values ranging from 0.1 to 14 kg/capita/day, and an average of 1.1 kg/capita/day. Similar to the high per capita waste generation rates on islands in Africa, the largest per capita solid waste generation rates are found in the islands of the Caribbean.

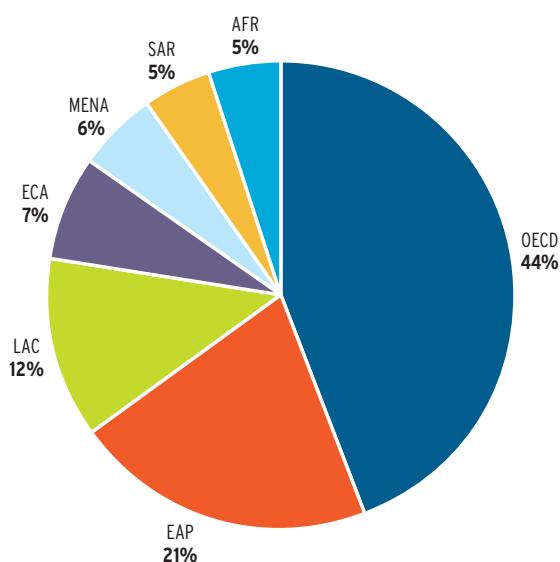
In the Middle East and North Africa, solid waste generation is 63 million tonnes per year. Per capita waste generation is 0.16 to 5.7 kg per person per day, and has an average of 1.1 kg/capita/day.

The OECD countries generate 572 million tonnes of solid waste per year. The per capita values range from 1.1 to 3.7 kg per person per day with an average of 2.2 kg/capita/day.

In South Asia, approximately 70 million tonnes of waste is generated per year, with per capita values ranging from 0.12 to 5.1 kg per person per day and an average of 0.45 kg/capita/day.

Table 3 shows current waste generation per capita by region, indicating the lower boundary and upper boundary for each region, as well as average kg per capita per day of waste generated within each region.<sup>2</sup>

Figure 1 illustrates global waste generation per region, where OECD countries make up almost half



**FIG. 1**  
Waste Generation by Region

**TABLE 4**  
Waste Generation Projections for 2025 by Region

| Region       | Current Available Data            |                        |                             | Projections for 2025        |                            |                       |                  |
|--------------|-----------------------------------|------------------------|-----------------------------|-----------------------------|----------------------------|-----------------------|------------------|
|              | Total Urban Population (millions) | Urban Waste Generation |                             | Projected Population        |                            | Projected Urban Waste |                  |
|              | Per Capita (kg/capita/day)        | Total (tons/day)       | Total Population (millions) | Urban Population (millions) | Per Capita (kg/capita/day) | Total (tons/day)      |                  |
| AFR          | 260                               | 0.65                   | 169,119                     | 1,152                       | 518                        | 0.85                  | 441,840          |
| EAP          | 777                               | 0.95                   | 738,958                     | 2,124                       | 1,229                      | 1.5                   | 1,865,379        |
| ECA          | 227                               | 1.1                    | 254,389                     | 339                         | 239                        | 1.5                   | 354,810          |
| LCR          | 399                               | 1.1                    | 437,545                     | 681                         | 466                        | 1.6                   | 728,392          |
| MENA         | 162                               | 1.1                    | 173,545                     | 379                         | 257                        | 1.43                  | 369,320          |
| OECD         | 729                               | 2.2                    | 1,566,286                   | 1,031                       | 842                        | 2.1                   | 1,742,417        |
| SAR          | 426                               | 0.45                   | 192,410                     | 1,938                       | 734                        | 0.77                  | 567,545          |
| <b>Total</b> | <b>2,980</b>                      | <b>1.2</b>             | <b>3,532,252</b>            | <b>7,644</b>                | <b>4,285</b>               | <b>1.4</b>            | <b>6,069,703</b> |

**TABLE 5**  
Current Waste Generation Per Capita by Income Level

| Income Level | Waste Generation Per Capita (kg/capita/day) |                |         |
|--------------|---|----------------|---------|
|              | Lower Boundary                              | Upper Boundary | Average |
| High         | 0.70  | 14             | 2.1     |
| Upper Middle | 0.11  | 5.5            | 1.2     |
| Lower Middle | 0.16  | 5.3            | 0.79    |
| Lower        | 0.09  | 4.3            | 0.60    |

of the world's waste, while Africa and South Asia figure as the regions that produce the least waste.

Table 4 shows estimates of waste generation for the year 2025 as expected according to current trends in population growth in each region.

### Waste Generation by Country Income Level<sup>3</sup>

High-income countries produce the most waste per capita, while low income countries produce the least solid waste per capita. Although the total waste generation for lower middle income countries is higher than that of upper middle income countries, likely skewed as a result of China's inclusion in the lower middle income

group, the average per capita waste generation amounts for the various income groups reflect the income level of the countries (see Figure 2). The high, upper-middle, lower-middle, and low income designations are somewhat inaccurate as these classifications are country-wide, and in several countries average national affluence can be very different from average affluence of the urban populations. Only the affluence of urban residents is important in projecting MSW rates. For example, India and especially China have disproportionately high urban waste generation rates per capita relative to overall economic status as they have large relatively poor rural populations that tend to dilute national figures. Annex B. Map of Income Distribution illustrates the global classification for income used in this report.

<sup>3</sup> Countries are classified into four income levels according to World Bank estimates of 2005 GNI per capita. High: \$10,726 or above; Upper middle: \$3,466-10,725; Lower middle: \$876-3,465; and Lower: \$875 or less.

Table 5 shows current waste generation per capita by income level, indicating the lower

boundary and upper boundary for each region, as well as average kg per capita per day of waste generated within each group according to country income level.

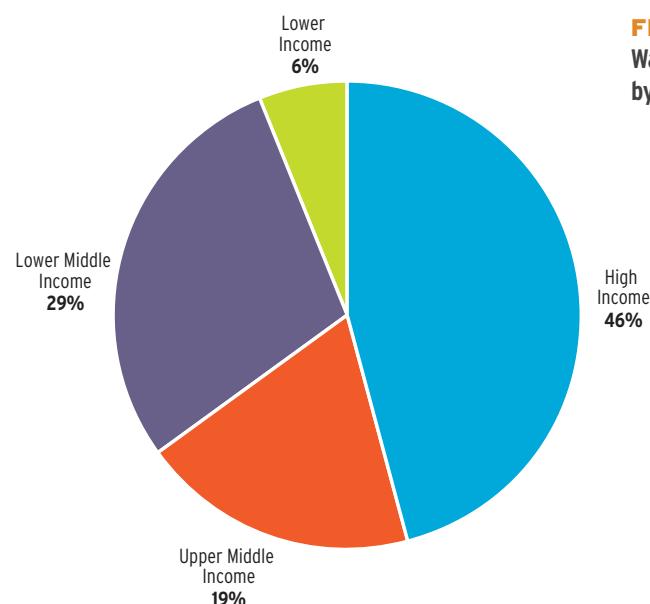
Figure 2 presents global waste generation by country per income level, showing decreasing average rates of per capita waste generation according to income level.

Table 6 shows estimates of waste generation for the year 2025 as expected according to current trends in population growth as determined by country income level.

#### *Methodology for collecting current data:*

MSW generation data by country were collected from official government publications, reports by international agencies, and articles in peer-reviewed journals. Where possible, this report has used the same source for a group of countries so that the data are relatively standardized by methodology and year. For example, MSW generation data for high-income countries are from OECD publications; countries in Latin America and the Caribbean from PAHO studies; and some Middle Eastern countries from METAP data.

In cases where only per capita waste generation rates were available, the total urban population for that year (World Bank, World Development Indicators) was used to calculate the total urban MSW generation.



**FIG. 2**  
Waste Generation  
by Income

Where only total MSW generation numbers were available, total urban population for that year was used to calculate per capita waste generation, assuming that most of the waste generated is in urban areas and only a small fraction comes from rural areas.

For several African countries, data were not readily available. Hence, a per capita amount of 0.5 kg/capita/day is assumed for urban areas for 2005. This estimate is based on the USAID 2009 publication on *Environmental Guidelines for Small-Scale Activities in Africa* (EGSSAA), 2nd Ed. and World Bank studies. For further information on MSW generation rates by country, please see Annex J. When reviewing

| Region              | Current Available Data            |                            |                  | Projections for 2025 (from Annex J) |                             |                            |                  |
|---------------------|-----------------------------------|----------------------------|------------------|-------------------------------------|-----------------------------|----------------------------|------------------|
|                     | Total Urban Population (millions) | Urban Waste Generation     |                  | Projected Population                |                             | Projected Urban Waste      |                  |
|                     |                                   | Per Capita (kg/capita/day) | Total (tons/day) | Total Population (millions)         | Urban Population (millions) | Per Capita (kg/capita/day) | Total (tons/day) |
| Lower Income        | 343                               | 0.60                       | 204,802          | 1,637                               | 676                         | 0.86                       | 584,272          |
| Lower Middle Income | 1,293                             | 0.78                       | 1,012,321        | 4,010                               | 2,080                       | 1.3                        | 2,618,804        |
| Upper Middle Income | 572                               | 1.16                       | 665,586          | 888                                 | 619                         | 1.6                        | 987,039          |
| High Income         | 774                               | 2.13                       | 1,649,547        | 1,112                               | 912                         | 2.1                        | 1,879,590        |
| Total               | 2,982                             | 1.19                       | 3,532,256        | 7,647                               | 4,287                       | 1.4                        | 6,069,705        |

**TABLE 6**  
Waste Generation  
Projections for 2025  
by Income

**TABLE 7**

Sources for 2025  
Projections of  
Solid Waste  
Generation

| Variable                         | Data Source  |
|----------------------------------|--|
| Current GDP (current US\$, 2005) | World Development Indicators                       |
| GDP Projections by Region        | IEA Annual Energy Outlook (2005)                   |
| Urban Population Projections     | United Nations World Urbanization Prospects (2007) |

**TABLE 8**

Average MSW  
Generation Rates  
by Income

| Income Level  | Average MSW Generation (kg/cap/day) |
|---------------|-------------------------------------|
| Low-Income    | 0.6 - 1.0                           |
| Middle-Income | 0.8 - 1.5                           |
| High-Income   | 1.1 - 4.5                           |

the values presented in this report, it's important to keep in mind that values for waste generation at a regional level can differ markedly because of the influence from a single country, such as the US, China or India.

#### *Methodology for calculating 2025 projections:*

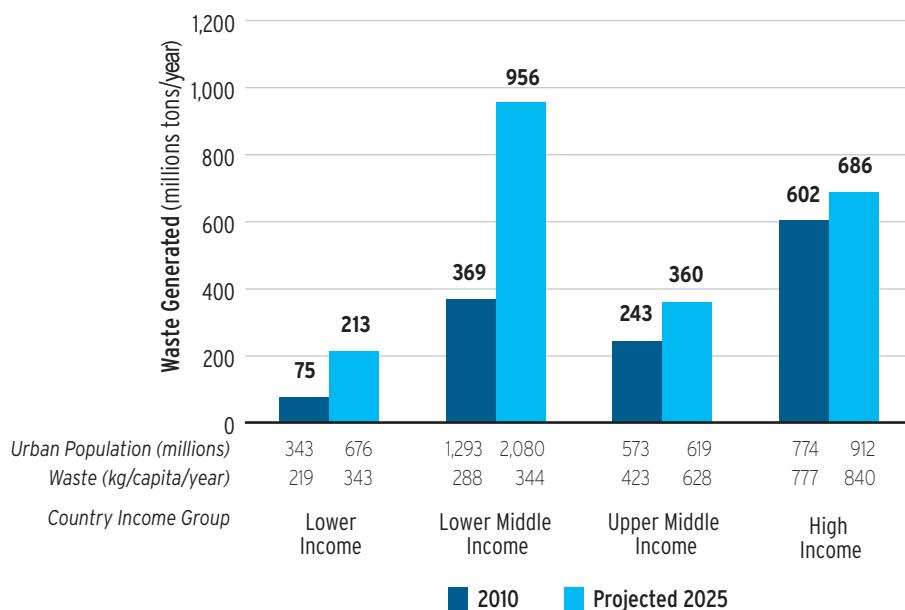
Projections for urban municipal solid waste generation in 2025 were made by factoring expected growth in population and GDP and estimated per capita waste generation. Projections for each country were made based on the level of expected

GDP (high-, middle-, or low-income) and an average range of MSW generation based on that income level. Modest adjustments for current experience and waste generation practices were made where appropriate. Similar to 'energy intensity' urban residents also exhibit 'waste intensity'.

For further information on the sources used for the 2025 projections please refer to Table 7.

Table 8 illustrates the range of MSW based on country income level. These values are supported by Table 6.

**FIG. 3**  
Urban Waste  
Generation  
by Income Level  
and Year



# 4 Waste Collection

## At a Glance:

- ▶ MSW collection is an important aspect in maintaining public health in cities around the world.
- ▶ The amount of MSW collected varies widely by region and income level; collection within cities can also differ greatly.
- ▶ Collection rates range from a low of 41% in low-income countries to a high of 98% in high-income countries.

Waste collection is the collection of solid waste from point of production (residential, industrial commercial, institutional) to the point of treatment or disposal. Municipal solid waste is collected in several ways:

- 1. House-to-House:** Waste collectors visit each individual house to collect garbage. The user generally pays a fee for this service.
- 2. Community Bins:** Users bring their garbage to community bins that are placed at fixed points in a neighborhood or locality. MSW is picked up by the municipality, or its designate, according to a set schedule.
- 3. Curbside Pick-Up:** Users leave their garbage directly outside their homes according to a garbage pick-up schedule set with the local authorities (secondary house-to-house collectors not typical).
- 4. Self Delivered:** Generators deliver the waste directly to disposal sites or transfer stations, or hire third-party operators (or the municipality).
- 5. Contracted or Delegated Service:** Businesses hire firms (or municipality with municipal facilities) who arrange collection schedules and charges with

customers. Municipalities often license private operators and may designate collection areas to encourage collection efficiencies.

Collected MSW can be separated or mixed, depending on local regulations. Generators can be required to separate their waste at source, e.g., into “wet” (food waste, organic matter) and “dry” (recyclables), and possibly a third stream of “waste,” or residue. Waste that is un-segregated could be separated into organic and recycling streams at a sorting facility. The degree of separation can vary over time and by city. ‘Separation’ can be a misnomer as waste is not actually separated

False Creek,  
Vancouver, Canada



Separate  
garbage  
containers,  
Singapore



Photo: Cyrus Lala

but rather is placed out for collection in separate containers without first being ‘mixed’ together. Often, especially in developing countries, MSW is not separated or sorted before it is taken for disposal, but recyclables are removed by waste pickers prior to collection, during the collection process, and at disposal sites.

The degree of source separation impacts the total amount of material recycled and the quality of secondary materials that can be supplied. Recyclables recovered from mixed waste, for example, tend to be contaminated, reducing marketing possibilities. However, source separation and separate collection can add costs to the waste collection process.

Collection programs need to be differentiated by type of generator. Often more attention is devoted to residential waste even though this is usually less than 50% of the total waste stream. Waste generated by the ICI sector tends to be collected better, because of more efficient containerization and purpose-built vehicles, and benefits from the collection of fees. Residential waste collection, on the other hand, tends to be more expensive to collect per tonne as

waste is more dispersed. Annex G provides data for MSW collection in cities over 100,000.

The percent of MSW collected varies by national income and by region. Higher income countries tend to have higher collection efficiency although less of the solid waste management budget goes towards collection. In low-income countries, collection services make up the bulk of a municipality’s SWM budget (as high as 80 to 90% in many cases), yet collection rates tend to be much lower, leading to lower collection frequency and efficiency. In high-income countries, although collection costs can represent less than 10% of a municipality’s budget, collection rates are usually higher than 90% on average and collection methods tend to be mechanized, efficient, and frequent. While total collection budgets are higher, they are proportionally lower as other budget items increase. For further information on estimated solid waste management costs according to income level, please refer to Annex E.

The degree and sophistication of waste picking influences overall collection. In cities like Buenos Aires, waste pickers tend to remove recyclables

after the waste is placed curbside. The resulting scattered waste is more costly to collect: in some cases the value of recyclables are less than the extra costs associated with collecting the disturbed waste. In some cities informal waste pickers have strong links to the waste program and municipally sanctioned crews can be prevented from accessing the waste as informal waste pickers process the waste. Waste pickers can be formally or informally organized into groups or unions with varying degrees of autonomy and political voice.

Containerization is an important aspect for waste collection, particularly from residential generators. If waste is not set out for collection in closed containers it can be disturbed by vermin such as dogs and rats, and it can become water-logged, or set afire.

Frequency of collection is an important aspect readily under a municipality's control. From a health perspective, no more than weekly collection is needed. However in some cities, largely because of culture and habituation, three-times per day residential collection is offered (e.g. Shanghai). Good waste collection programming requires an ongoing iterative approach between collection crews and generators (usually households). Therefore, waste generators should be aware of the true costs of collection, and ideally be charged for these directly.

### MSW Collection by Income

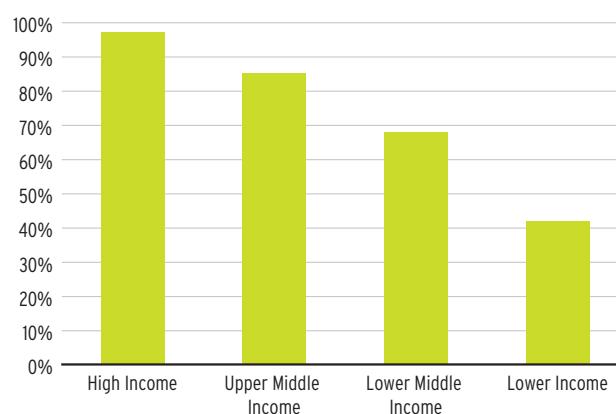
The data show that the average waste collection rates are directly related to income levels. Low-income countries have low collection rates, around 41%, while high-income countries have higher collection rates averaging 98%. Figure 4 shows the average collection percentage by income. Annex K details MSW collection rates by country.

### MSW Collection by Region

Figure 5 shows MSW collection efficiency by region. Regions with low-income countries tend to have low collection rates. South Asia and Africa are the lowest with 65% and 46% respectively. Not surprisingly, OECD countries tend to have the highest collection efficiency at 98%.

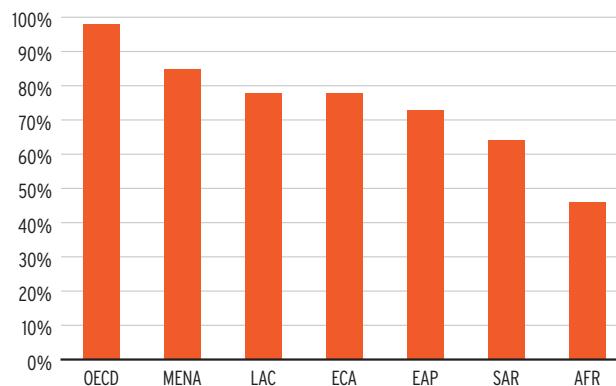
**FIG. 4**

#### Waste Collection Rates by Income



**FIG. 5**

#### Waste Collection Rates by Region



# 5

## Waste Composition

### At a Glance:

- ▶ Waste composition is influenced by factors such as culture, economic development, climate, and energy sources; composition impacts how often waste is collected and how it is disposed.
- ▶ Low-income countries have the highest proportion of organic waste.
- ▶ Paper, plastics, and other inorganic materials make up the highest proportion of MSW in high-income countries.
- ▶ By region, EAP has the highest proportion of organic waste at 62%, while OECD countries have the least at 27%, although total amount of organic waste is still highest in OECD countries.
- ▶ Although waste composition is usually provided by weight, as a country's affluence increases, waste volumes tend to be more important, especially with regard to collection: organics and inert generally decrease in relative terms, while increasing paper and plastic increases overall waste volumes.

In the municipal solid waste stream, waste is broadly classified into organic and inorganic. In this study, waste composition is categorized as organic, paper, plastic, glass, metals, and ‘other.’ These categories can be further refined, however, these six categories are usually sufficient for general solid waste planning purposes. Table 9 describes the different types of waste and their sources.

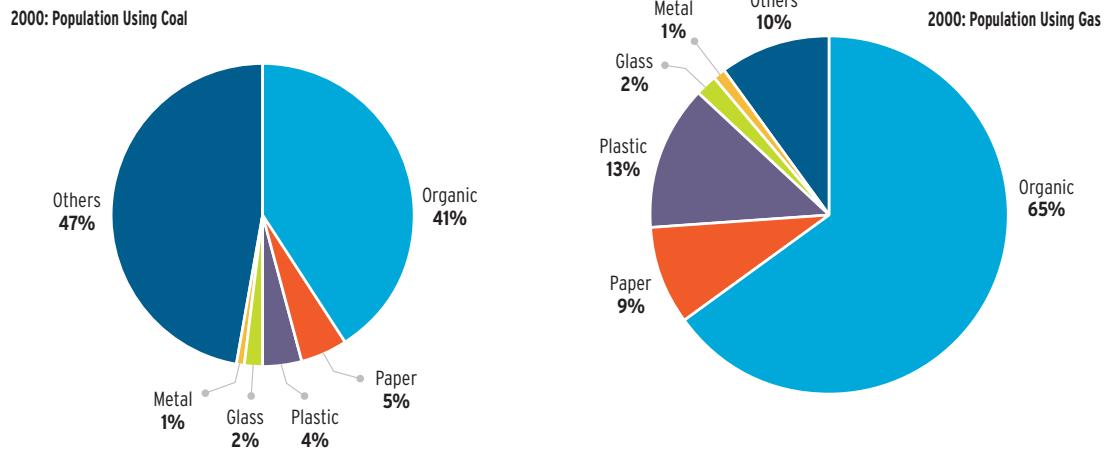
An important component that needs to be considered is ‘construction and demolition waste’ (C&D), such as building rubble, concrete and masonry. In some cities this can represent as much

as 40% of the total waste stream. However, in this report, C&D waste is not included unless specifically identified. A separate case-by-case review is recommended for specific cities.

Industrial, Commercial and Institutional (ICI) waste also needs further local refinement. Many industrial processes have specific wastes and by-products. In most cities this material, with its relatively easier flow and quality control, is the first material to be recycled. Some industrial process waste requires specific treatment. For most MSW management plans industrial by-products are not

**TABLE 9**  
Types of Waste  
and Their Sources

| Type    | Sources  |
|---------|--|
| Organic | Food scraps, yard (leaves, grass, brush) waste, wood, process residues   |
| Paper   | Paper scraps, cardboard, newspapers, magazines, bags, boxes, wrapping paper, telephone books, shredded paper, paper beverage cups. Strictly speaking paper is organic but unless it is contaminated by food residue, paper is not classified as organic. |
| Plastic | Bottles, packaging, containers, bags, lids, cups   |
| Glass   | Bottles, broken glassware, light bulbs, colored glass  |
| Metal   | Cans, foil, tins, non-hazardous aerosol cans, appliances (white goods), railings, bicycles   |
| Other   | Textiles, leather, rubber, multi-laminates, e-waste, appliances, ash, other inert materials  |



Source: Hoornweg 2005

Municipal Waste Generated from Population Using Coal for household heating = 49,500,000 tons  
Municipal Waste Generated from Population Using Gas for household heating = 100,500,000 tons  
Total Municipal Waste Generation in 2000 = 150,000,000 tons

**FIG. 6**  
Waste  
Composition  
in China

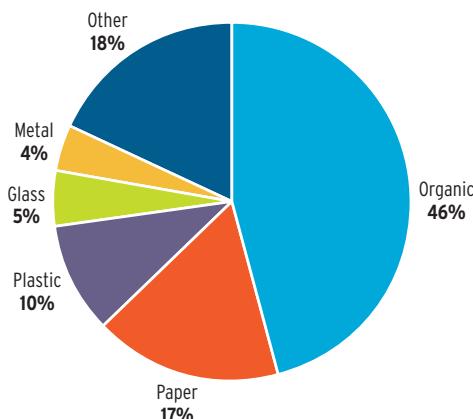
included in waste composition analyses, however household and general waste should be included since it is usually disposed at common facilities, and in most cities waste from the ICI sector represents the largest fraction of the waste collected.

Waste composition is influenced by many factors, such as level of economic development, cultural norms, geographical location, energy sources, and climate. As a country urbanizes and populations become wealthier, consumption of inorganic materials (such as plastics, paper, and aluminum) increases, while the relative organic fraction decreases. Generally, low- and middle-income countries have a high percentage of organic matter in the urban waste stream, ranging from 40 to 85% of the total. Paper, plastic, glass, and metal fractions increase in the waste stream of middle- and high-income countries. For data on MSW composition in cities with a population of over 100,000, please refer to Annex I.

Figure 8 illustrates the differences between low- and high-income countries: organics make up 64% of the MSW stream for low-income countries and paper only 5%, whereas in high-income countries it is 28% and 31% respectively. The IPCC uses its own classi-

fication of MSW composition based on region (See Annex N). In high-income countries, an integrated approach for organic waste is particularly important, as organic waste may be diverted to water-borne sewers, which is usually a more expensive option.

Geography influences waste composition by determining building materials (e.g. wood versus steel), ash content (often from household heating), amount of street sweepings (can be as much as 10% of a city's waste stream in dry locations), and horticultural waste. The type of energy source



**FIG. 7**  
Global  
Solid Waste  
Composition

in a location can have an impact on the composition of MSW generated. This is especially true in low-income countries or regions where energy for cooking, heating, and lighting might not come from district heating systems or the electricity grid. For example, Figure 6 shows the difference in waste composition in China between a section of the population that uses coal and another that uses natural gas for space heating. The ‘other’ category is clearly higher: 47% when coal is used, and an ash residue is included, as opposed to 10% when natural gas is used for home heating.

Climate can also influence waste generation in a city, country, or region. For example, in Ulan Bator, Mongolia, ash makes up 60% of the MSW generated in the winter, but only 20% in the summer (UNEP/GRID-Arendal 2004). Precipitation is also important in waste composition, particularly when measured by mass, as un-containerized waste can absorb significant amounts of water from rain and snow. Humidity also influences waste composition by influencing moisture content.

### *Methodology*

This report includes waste composition data that was available for 105 countries from various sources. Please see Annex M for further information on MSW composition data by country. Waste composition data is generally available as percentages of the various waste streams, commonly divided into the categories shown in Table 10. In some cases, ‘other’ wastes are further disaggregated into textiles, rubber, ash, etc. However, for the purposes of standardization and simplification the ‘other’ category in this report includes all of these wastes. Although the definitions and methodologies for determining composition are not always provided or standardized in the waste studies referenced, the compositions for MSW are assumed to be based on wet weight. Each waste category was calculated using waste generation figures from individual

countries. The total waste composition figures by income and by region were then aggregated.

Figure 7 shows the MSW composition for the entire world in 2009. Organic waste comprises the majority of MSW, followed by paper, metal, other wastes, plastic, and glass. These are only approximate values, given that the data sets are from various years.

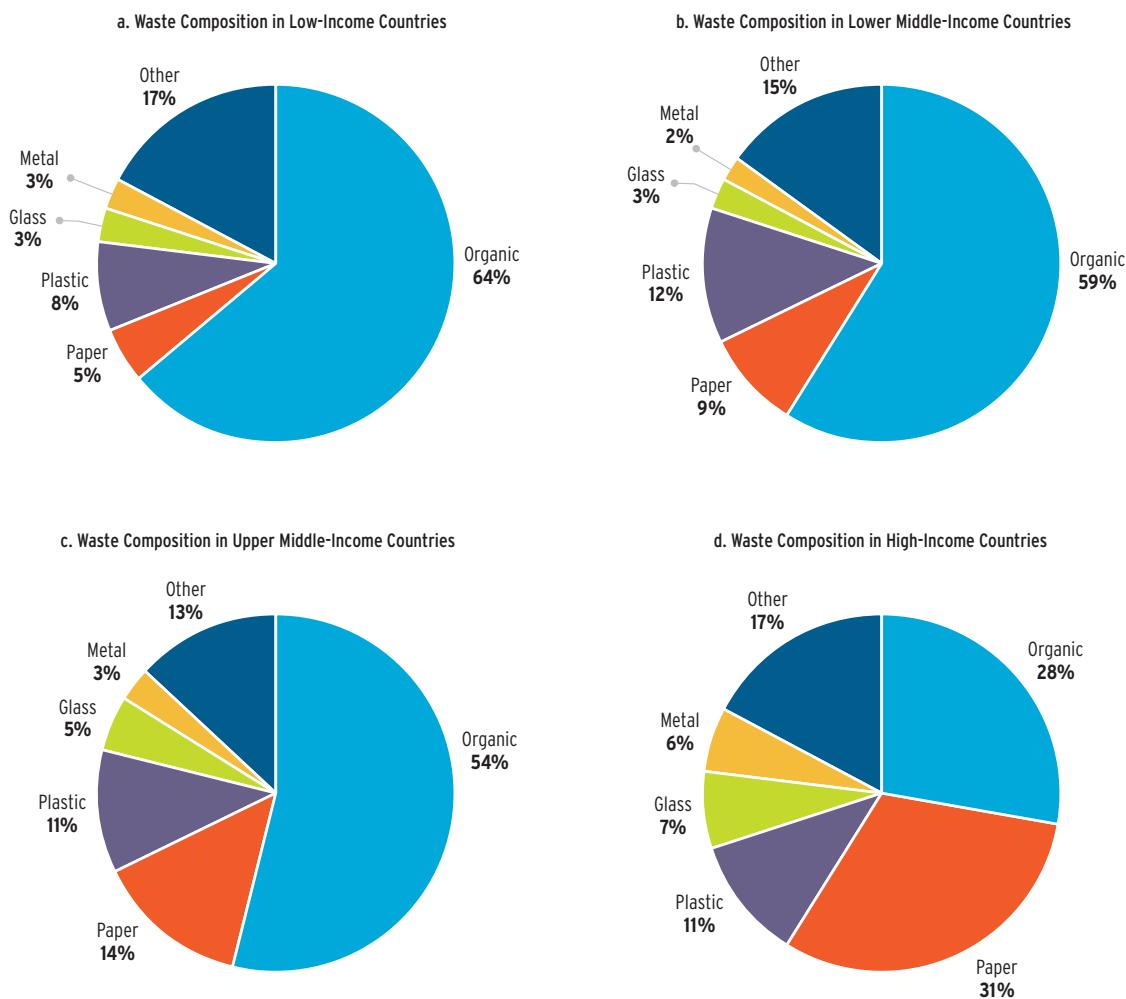
### **Waste Composition by Income**

As Figures 8 a-d show, the organic fraction tends to be highest in low-income countries and lowest in high-income countries. Total amount of organic waste tends to increase steadily as affluence increases at a slower rate than the non-organic fraction. Low-income countries have an organic fraction of 64% compared to 28% in high-income countries. The data presented in Figure 9 illustrates solid waste composition by income as compared between current values and values projected for 2025. Annex J provides data for MSW projections for 2025 by income level.

Table 10 represents a compilation of composition values of current day data presented in Annex M, and specific reports for larger countries such as China and India. Estimates for waste composition in 2025 are based on trends observed in OECD countries and authors’ projections.

### **Waste Composition by Region**

MSW composition by region is shown in Figures 10 a-g. The East Asia and the Pacific Region has the highest fraction of organic waste (62%) compared to OECD countries, which have the least (27%). The amount of paper, glass, and metals found in the MSW stream are the highest in OECD countries (32%, 7%, and 6%, respectively) and lowest in the South Asia Region (4% for paper and 1% for both glass and metals). Annex J provides data for MSW projections for 2025 by region.



**FIG. 8**  
Waste Composition  
by Income

**TABLE 10**  
Types of Waste  
Composition by  
Income Level

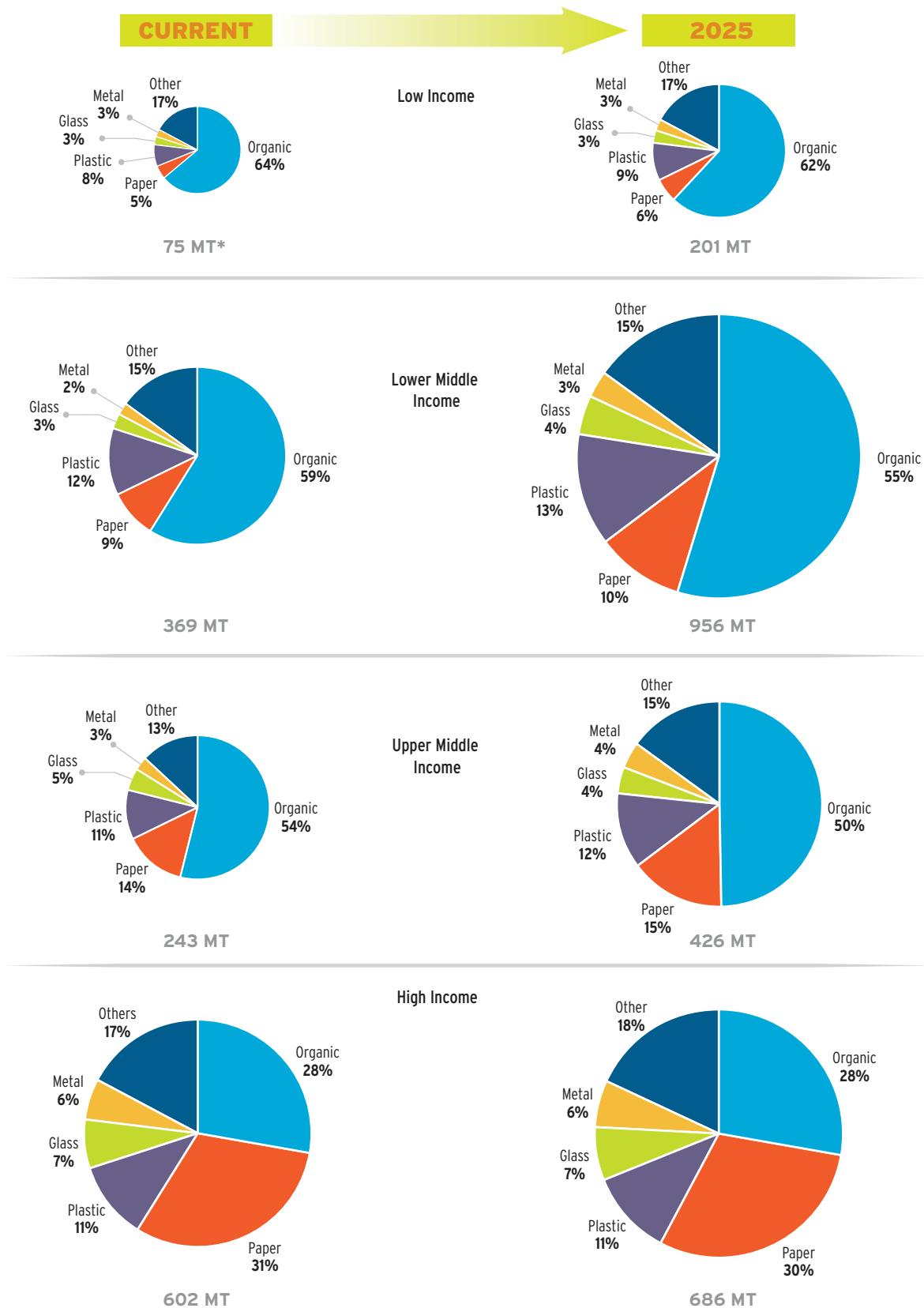
| CURRENT ESTIMATES*  |             |           |             |           |           |           |
|---------------------|-------------|-----------|-------------|-----------|-----------|-----------|
| Income Level        | Organic (%) | Paper (%) | Plastic (%) | Glass (%) | Metal (%) | Other (%) |
| Low Income          | 64          | 5         | 8           | 3         | 3         | 17        |
| Lower Middle Income | 59          | 9         | 12          | 3         | 2         | 15        |
| Upper Middle Income | 54          | 14        | 11          | 5         | 3         | 13        |
| High Income         | 28          | 31        | 11          | 7         | 6         | 17        |

| 2025 ESTIMATES**    |             |           |             |           |           |           |
|---------------------|-------------|-----------|-------------|-----------|-----------|-----------|
| Income Level        | Organic (%) | Paper (%) | Plastic (%) | Glass (%) | Metal (%) | Other (%) |
| Low Income          | 62          | 6         | 9           | 3         | 3         | 17        |
| Lower Middle Income | 55          | 10        | 13          | 4         | 3         | 15        |
| Upper Middle Income | 50          | 15        | 12          | 4         | 4         | 15        |
| High Income         | 28          | 30        | 11          | 7         | 6         | 18        |

\*Source year: varies, see Annex C on Data Availability.

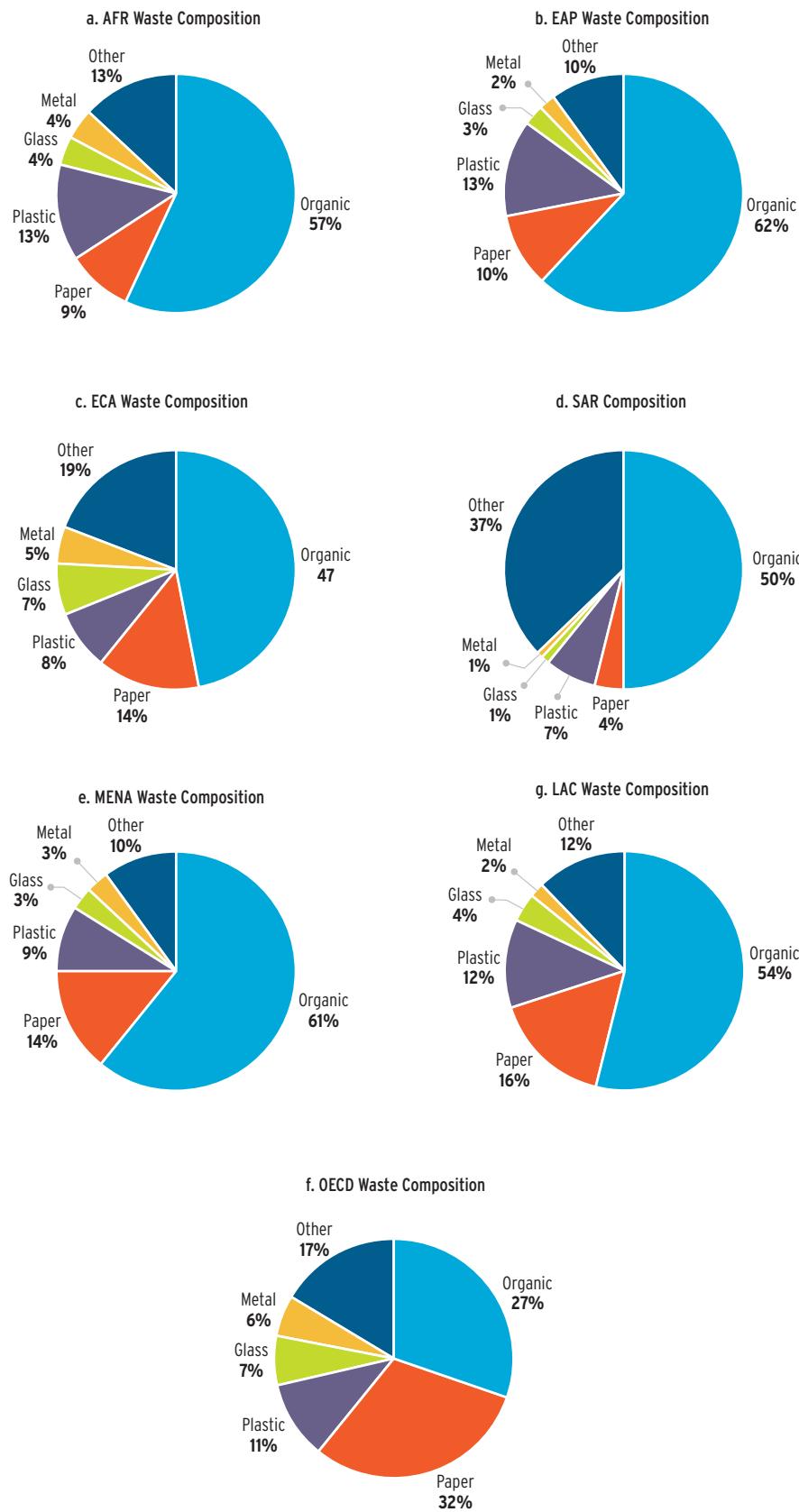
\*\*Source: By author from global trends, and Annex J.

**FIG. 9**  
Solid Waste  
Composition  
by Income  
and Year



Source: Current data vary by country.

\*Total annual waste volume in millions of tonnes



**FIG. 10**  
Waste Composition  
by Region

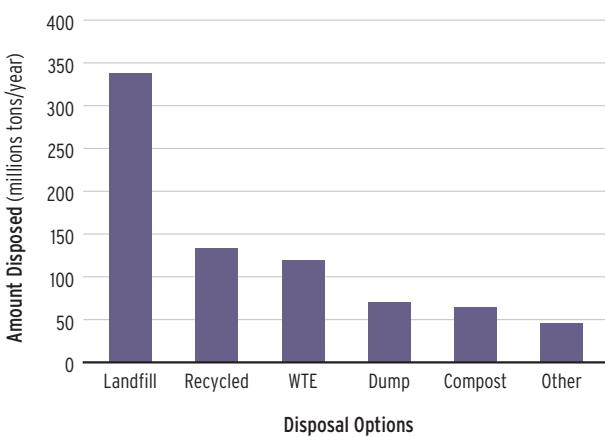
# 6 Waste Disposal

## At a Glance:

- ▶ Landfilling and thermal treatment of waste are the most common methods of MSW disposal in high-income countries.
- ▶ Although quantitative data is not readily available, most low- and lower middle-income countries dispose of their waste in open dumps.
- ▶ Several middle-income countries have poorly operated landfills; disposal should likely be classified as controlled dumping.

Waste disposal data are the most difficult to collect. Many countries do not collect waste disposal data at the national level, making comparisons across income levels and regions difficult. Furthermore, in cases where data is available, the methodology of how disposal is calculated and the definitions used for each of the categories is often either not known or not consistent. For example, some countries only give the percentage of waste that is dumped or sent to a landfill, the rest falls under ‘other’ disposal. In other cases, compostable and recyclable material is removed before the waste reaches the disposal site and is not included in waste disposal statistics. Please refer to Annex H for MSW disposal data for cities with populations over 100,000.

**FIG. 11**  
Total MSW Disposed of Worldwide



## Methodology

Waste disposal data was available for 87 countries through various sources. Annex L presents MSW disposal methods data by country. Waste disposal data sets are generally available as percentages of the various waste disposal options, commonly divided into the categories shown in Table 10. Although the definitions and methodologies for calculating waste disposal methods and quantities are not always provided or standardized in waste studies, the disposal of MSW is assumed to be based on wet weight. Each waste disposal category was calculated using waste generation figures for the individual country. The total waste disposal figures by income and by region were then aggregated.

Figure 11 shows current annual global MSW disposal for the entire world. These are only approximate values, given that the data is from various years.

## MSW Disposal by Income

Table 11 shows in further detail how MSW disposal varies according to country income level.

Figures 12 and 13 illustrate the differences in MSW disposal methods according to country income level, in particular low-income and upper middle-income countries.

**TABLE 11**  
MSW Disposal  
by Income  
(million tonnes)

| High Income  |      | Upper Middle Income |      |
|--------------|------|---------------------|------|
| Dumps        | 0.05 | Dumps               | 44   |
| Landfills    | 250  | Landfills           | 80   |
| Compost      | 66   | Compost             | 1.3  |
| Recycled     | 129  | Recycled            | 1.9  |
| Incineration | 122  | Incineration        | 0.18 |
| Other        | 21   | Other               | 8.4  |
| Low Income   |      | Lower Middle Income |      |
| Dumps        | 0.47 | Dumps               | 27*  |
| Landfills    | 2.2  | Landfills           | 6.1  |
| Compost      | 0.05 | Compost             | 1.2  |
| Recycled     | 0.02 | Recycled            | 2.9  |
| Incineration | 0.05 | Incineration        | 0.12 |
| Other        | 0.97 | Other               | 18   |

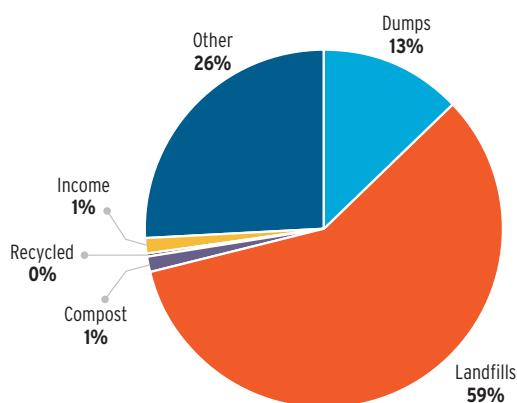
\*This value is relatively high due to the inclusion of China.



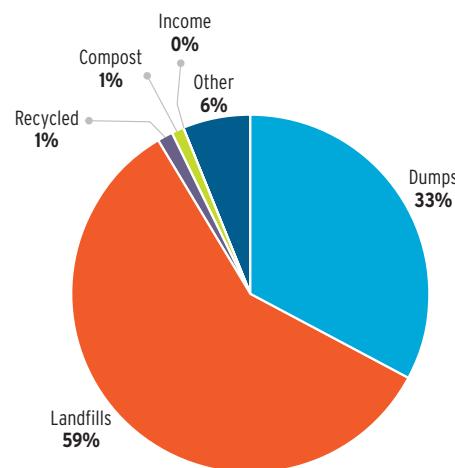
Table 12 contrasts the world's richest (OECD) and poorest (Africa) regions. Populations in the two regions are roughly equal, yet the OECD region produces about 100 times the waste of Africa (these disparities are parallel to regional differ-

ences in GHG emissions). Africa's collected waste is almost exclusively dumped or sent to landfills, while more than 60% of OECD's waste is diverted from landfill.

**FIG. 12**  
Low-Income Countries Waste Disposal



**FIG. 13**  
Upper Middle-Income Countries Waste Disposal



**TABLE 12**  
MSW Disposal  
in two contrasting  
regions (million  
tonnes)

| AFR          |      | OECD         |     |
|--------------|------|--------------|-----|
| Dumps        | 2.3  | Dumps        | -   |
| Landfills    | 2.6  | Landfills    | 242 |
| Compost      | 0.05 | Compost      | 66  |
| Recycled     | 0.14 | Recycled     | 125 |
| Incineration | 0.05 | Incineration | 120 |
| Other        | 0.11 | Other        | 20  |

# 7

## Waste and the Environment

### Integrated Solid Waste Management

Integrated solid waste management (ISWM) reflects the need to approach solid waste in a comprehensive manner with careful selection and sustained application of appropriate technology, working conditions, and establishment of a ‘social license’ between the community and designated waste management authorities (most commonly local government). ISWM is based on both a high degree of professionalism on behalf of solid

waste managers; and on the appreciation of the critical role that the community, employees, and local (and increasingly global) ecosystems have in effective SWM. ISWM should be driven by clear objectives and is based on the hierarchy of waste management: reduce, reuse, recycle – often adding a fourth ‘R’ for recovery. These waste diversion options are then followed by incineration and landfill, or other disposal options. Please refer to Box 3 for a detailed list describing the components of an ISWM Plan.

### Components of an Integrated Solid Waste Management Plan

An integrated Solid Waste Management plan should include the following sections:

- ▶ All municipal policies, aims, objectives, and initiatives related to waste management;
- ▶ The character and scale of the city, natural conditions, climate, development and distribution of population;
- ▶ Data on all waste generation, including data covering both recent years and projections over the lifetime of the plan (usually 15-25 years). This should include data on MSW composition and other characteristics, such as moisture content and density (dry weight), present and predicted;
- ▶ Identify all proposed options (and combination of options) for waste collection, transportation, treatment, and disposal of the defined types and quantities of solid wastes (this must address options for all types of solid waste arising);
- ▶ Evaluation of the Best Practical Environmental Option(s), integrating balanced assessments of all technical, environmental, social, and financial issues;
- ▶ The proposed plan, specifying the amount, scale, and distribution of collection, transportation, treatment and disposal systems to be developed, with proposed waste mass flows proposed through each;
- ▶ Specifications on the proposed on-going monitoring and controls that will be implemented in conjunction with facilities and practices and ways in which this information will be regularly reported;
- ▶ Associated institutional reforms and regulatory arrangements needed to support the plan;
- ▶ Financial assessment of the plan, including analysis of both investment and recurrent costs associated with the proposed facilities and services, over the lifetime of the plan (or facilities);
- ▶ All the sources of finance and revenues associated with developing and operating the plan including estimated subsidy transfers and user fees;
- ▶ The requirements for managing all non-MSW arisings, what facilities are required, who will provide them and the related services, and how such facilities and services will be paid for;
- ▶ The proposed implementation plan covering a period of at least 5-10 years, with an immediate action plan detailing actions set out for the first 2-3 years;
- ▶ Outline of public consultations carried out during preparation of the plan and proposed in future;
- ▶ Outline of the detailed program to be used to site key waste management facilities, e.g. landfills, compost plants, and transfer stations.
- ▶ An assessment of GHG emissions and the role of MSW in the city’s overall urban metabolism.

**BOX 3**

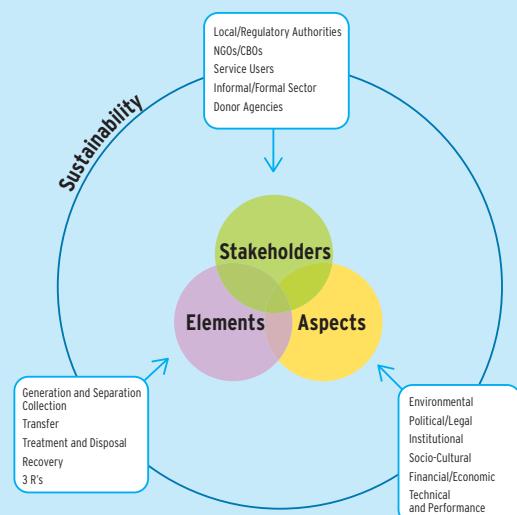
# BOX 4

## Integrated Sustainable Waste Management Framework

**Stakeholders:** include individuals or groups that have an interest or roles. All stakeholders should be identified and where practical involved in creating a SWM program.

**Elements (Process):** include the technical aspects of solid waste management. All stakeholders impact one or more of the elements. The elements need to be considered simultaneously when creating an SWM program in order to have an efficient and effective system.

**Aspects (Policies and Impacts):** encompass the regulatory, environmental and financial realities in which the waste management system operates. Specific aspects can be changeable, e.g. a community increases influence or environmental regulations are tightened. Measures and priorities are created based on these various local, national and global aspects.



Adapted from van de Klundert and Anschütz 2001.

As outlined by the Dutch NGO, WASTE, ISWM is based on four principles: equity for all citizens to have access to waste management systems for public health reasons; *effectiveness* of the waste management system to safely remove the waste; *efficiency* to maximize benefits, minimize costs, and optimize the use of resources; and *sustainability* of the system from a technical, environmental, social (cultural), economic, financial, institutional, and political perspective (van de Klundert and Anschütz 2001).

There are three interdependent and interconnected dimensions of ISWM, which need to be addressed simultaneously when designing a solid waste management system: stakeholders, elements, and aspects. Please refer to Box 4 for further details on the interconnected dimensions of ISWM.

An alternative framework is provided by UN-HABITAT, which identifies three key system elements in ISWM: public health, environmental protection, and resource management (UN-Habitat 2009).

**Public Health:** In most jurisdictions, public health concerns have been the basis for solid waste management programs, as solid waste management is essential to maintaining public health. Solid waste that is not properly collected and disposed can be a breeding ground for insects, vermin, and scavenging animals, and can thus pass on air- and water-borne diseases. Surveys conducted by UN-Habitat show that in areas where waste is not collected frequently, the incidence of diarrhea is twice as high and acute respiratory infections six times higher than in areas where collection is frequent (UN-Habitat 2009).

**Environmental Protection:** Poorly collected or improperly disposed of waste can have a detrimental impact on the environment. In low- and middle-income countries, MSW is often dumped in low-lying areas and land adjacent to slums. Lack of enforced regulations enables potentially infectious medical and hazardous waste to be mixed with MSW, which is harmful to waste pickers and the environment. Environmental threats include contamination of groundwater and surface water

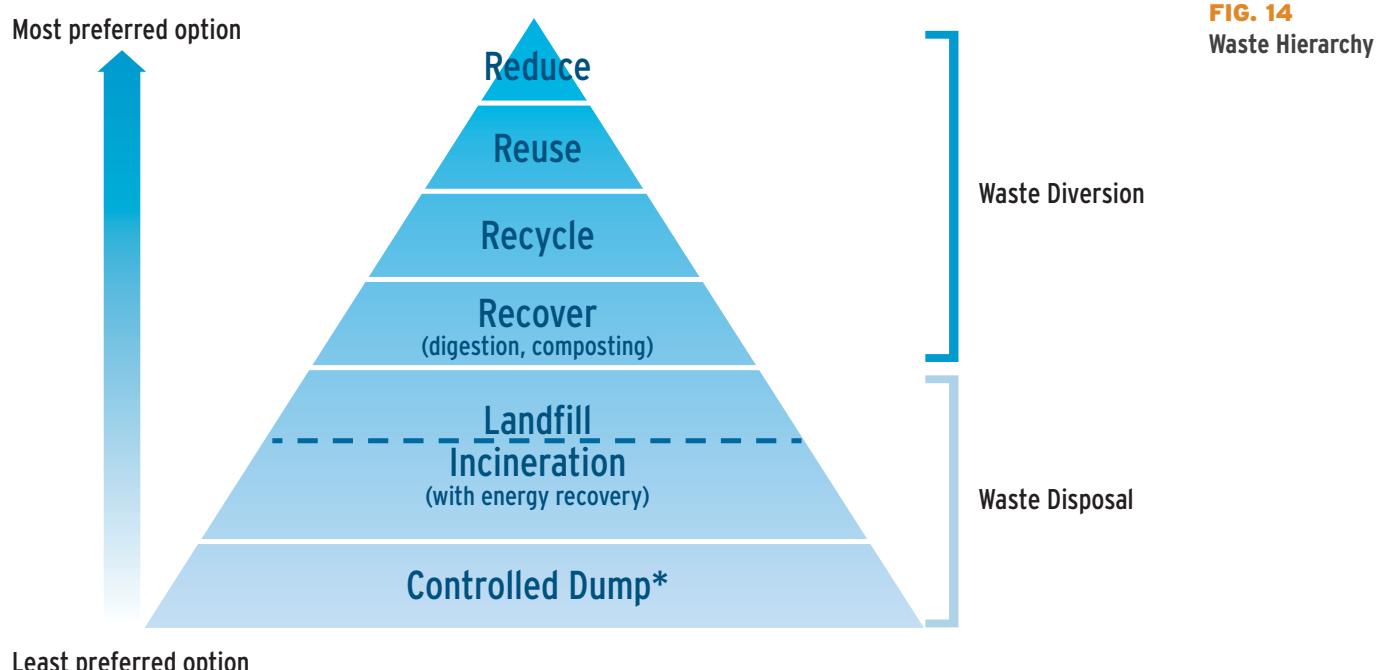
by leachate, as well as air pollution from burning of waste that is not properly collected and disposed.

**Resource Management:** MSW can represent a considerable potential resource. In recent years, the global market for recyclables has increased significantly. The world market for post consumer scrap metal is estimated at 400 million tonnes annually and around 175 million tonnes annually for paper and cardboard (UN-Habitat 2009). This represents a global value of at least \$30 billion per year. Recycling, particularly in low- and middle-income countries, occurs through an active, although usually informal, sector. Producing new products with secondary materials can save significant energy. For example, producing aluminum from recycled aluminum requires 95% less energy than producing it from virgin materials. As the

cost of virgin materials and their environmental impact increases, the relative value of secondary materials is expected to increase.

## Waste Disposal Options

The waste management sector follows a generally accepted hierarchy. The earliest known usage of the ‘waste management hierarchy’ appears to be Ontario’s Pollution Probe in the early 1970s. The hierarchy started as the ‘three Rs’ – reduce, reuse, recycle – but now a fourth R is frequently added – recovery. The hierarchy responds to financial, environmental, social and management considerations. The hierarchy also encourages minimization of GHG emissions. See Figure 14 for the waste hierarchy.



\*As a minimum, waste should be disposed at a “controlled dump,” which includes site selection, controlled access, and where practical, compaction of waste. Incineration requires a complimentary sanitary landfill, as bottom ash, non-combustibles and by-passed waste needs to be landfilled.



Photo: Eric Miller/World Bank

▲ Maputo - Fapel, paper mill and paper recycling factory

1. **Waste Reduction:** Waste or source reduction initiatives (including prevention, minimization, and reuse) seek to reduce the quantity of waste at generation points by redesigning products or changing patterns of production and consumption. A reduction in waste generation has a two-fold benefit in terms of greenhouse gas emission reductions. First, the emissions associated with material and product manufacture are avoided. The second benefit is eliminating the emissions associated with the avoided waste management activities.
2. **Recycling and Materials Recovery:** The key advantages of recycling and recovery are reduced quantities of disposed waste and the return of materials to the economy. In many developing countries, informal waste pickers at collection points and disposal sites recover a significant portion of discards. In China, for example, about 20% of discards are recovered for recycling, largely attributable to informal waste picking (Hoornweg et al 2005). Related

GHG emissions come from the carbon dioxide associated with electricity consumption for the operation of material recovery facilities. Informal recycling by waste pickers will have little GHG emissions, except for processing the materials for sale or reuse, which can be relatively high if improperly burned, e.g. metal recovery from e-waste.

3. **Aerobic Composting and Anaerobic Digestion:** Composting with windrows or enclosed vessels is intended to be an aerobic (with oxygen) operation that avoids the formation of methane associated with anaerobic conditions (without oxygen). When using an anaerobic digestion process, organic waste is treated in an enclosed vessel. Often associated with wastewater treatment facilities, anaerobic digestion will generate methane that can either be flared or used to generate heat and/or electricity. Generally speaking, composting is less complex, more forgiving, and less costly than anaerobic

digestion. Methane is an intended by-product of anaerobic digestion and can be collected and combusted. Experience from many jurisdictions shows that composting source separated organics significantly reduces contamination of the finished compost, rather than processing mixed MSW with front-end or back-end separation.

**4. Incineration:** Incineration of waste (with energy recovery) can reduce the volume of disposed waste by up to 90%. These high volume reductions are seen only in waste streams with very high amounts of packaging materials, paper, cardboard, plastics and horticultural waste. Recovering the energy value embedded in waste prior to final disposal is considered preferable to direct landfilling – assuming pollution control requirements and costs are adequately addressed. Typically, incineration without energy recovery (or non-autogenic combustion, the need to regularly add fuel) is not a preferred option due to costs and pollution. Open-burning of waste is particularly discouraged due to severe air pollution associated with low temperature combustion.

**5. Landfill:** The waste or residue from other processes should be sent to a disposal site. Landfills are a common final disposal site for waste and should be engineered and operated to protect the environment and public health. Landfill gas (LFG), produced from the anaerobic decomposition of organic matter, can be recovered and the methane (about 50% of LFG) burned with or without energy recovery to reduce GHG emissions. Proper landfilling is often lacking, especially in developing countries. Landfilling usually progresses from open-dumping, controlled dumping, controlled landfilling, to sanitary landfilling (see Table 13).

## Waste and Climate Change

GHG emissions from MSW have emerged as a major concern as post-consumer waste is estimated to account for almost 5% (1,460 mtCO<sub>2</sub>e) of total global greenhouse gas emissions. Solid waste also includes significant embodied GHG emissions. For example, most of the GHG emissions associated with paper occur before it becomes MSW. Encouraging waste minimization through MSW programs can therefore have significant up-stream GHG minimization benefits.

**TABLE 13**  
Landfill  
Classifications

|   | Operation and Engineering Measures  | Leachate Management   | Landfill Gas Management                 |
|---|---|---|---|
| Semi-controlled Dumps                       | Few controls; some directed placement of waste; informal waste picking; no engineering measures   | Unrestricted contaminant release  | None                                    |
| Controlled Dump                             | Registration and placement/compaction of waste; surface water monitoring; no engineering measures   | Unrestricted contaminant release  | None                                    |
| Engineered Landfill/<br>Controlled Landfill | Registration and placement/compaction of waste; uses daily cover material; surface and ground water monitoring; infrastructure and liner in place   | Containment and some level of leachate treatment; reduced leachate volume through waste cover | Passive ventilation or flaring          |
| Sanitary Landfill                           | Registration and placement/compaction of waste; uses daily cover; measures for final top cover and closure; proper siting, infrastructure; liner and leachate treatment in place and post-closure plan. | Containment and leachate treatment (often biological and physico-chemical treatment)          | Flaring with or without energy recovery |

**TABLE 14**  
**Landfill Methane Emissions and Total GHG Emissions for Selected Countries**

| Country      | Methane Emissions from Post-Consumer Municipal Waste Disposal* (MtCO <sub>2</sub> e) | Greenhouse Gas Emissions** (CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O) (MtCO <sub>2</sub> e) | % Methane from Disposal Sites Relative to Total GHG Emissions |
|--------------|--|---|---|
| Brazil       | 16   | 659   | 2.4%  |
| China        | 45   | 3,650   | 1.2%  |
| India        | 14   | 1,210   | 1.1%  |
| Mexico       | 31   | 383   | 8.1%  |
| South Africa | 16   | 380   | 4.3%  |

\*EPA 2006a.

\*\*UNFCCC 2005.

Methane from landfills represents 12% of total global methane emissions (EPA 2006b). Landfills are responsible for almost half of the methane emissions attributed to the municipal waste sector in 2010 (IPCC 2007).<sup>4</sup> The level of methane from landfills varies by country, depending on waste composition, climatic conditions (ambient temperature, precipitation) and waste disposal practices. Table 14 highlights some examples.

Organic biomass<sup>5</sup> decomposes anaerobically in a sanitary landfill. Landfill gas, a by-product of the anaerobic decomposition is composed of methane (typically about 50%) with the balance being carbon dioxide and other gases. Methane, which

has a Global Warming Potential 21 times greater than carbon dioxide, is the second most common greenhouse gas after carbon dioxide.

Greenhouse gas emissions from waste management can readily be reduced. Within the European Union, the rate of GHG emissions from waste has declined from 69 mtCO<sub>2</sub>e per year to 32 million tCO<sub>2</sub>e per year from 1990 to 2007 (ISWA 2009).

## Greenhouse Gas Mitigation Opportunities

Efforts to reduce emissions from the municipal solid waste sector include generating less waste, improving the efficiency of waste collection, expanding recycling, methane avoidance (aerobic composting, anaerobic digestion with combustion

<sup>4</sup>Wastewater management adds an equal amount of methane to the atmosphere.

<sup>5</sup>Organic biomass excludes organic waste such as plastics that are derived from fossil energy sources.

A transfer station in Amman, Jordan



| Waste Management Component                                 | Technology Options   |
|--|--|
| Waste Reduction  | Design of longer-lasting and reusable products; reduced consumption.   |
| Waste Collection   | Use of alternative, non-fossil fuels (bio-fuel, natural gas).  |
| Recycling/Materials Recovery                               | Materials recovery facility (MRF) to process source separated materials or mixed waste, although source separated is the preferred option as the materials would have less contamination from other discards.<br><br>MRFs use a combination of manual and mechanical sorting options. Waste pickers could be used as a source of labor for manual sorting stages.  |
| Composting/Aerobic Digestion                               | Institute composting programs ideally with source separated organics. As with recyclables source separated materials reduce the contamination associated with recovery from mixed waste.<br><br>Compost the organic material after digestion to produce a useful soil conditioner and avoid landfill disposal. Finished compost applied to soils is also an important method to reduce GHG emissions by reducing nitrogen requirements and associated GHG emissions. |
| Incineration/Waste-to-energy/<br>Refuse-Derived Fuel (RDF) | Use the combustible fraction of waste as a fuel either in a dedicated combustion facility (incineration) with or without energy recovery or as RDF in a solid fuel boiler.   |
| Landfill   | Capture the methane generated in disposal sites and flare or use as a renewable energy resource.   |

**TABLE 15**  
**Technical GHG Mitigation Opportunities by Waste Management Component**

of produced methane and capture, treatment and use of landfill gas). Energy generated from methane combustion can displace other fossil fuels either as a process energy resource or as electricity. Suitable technology options by waste management component are provided in Table 15.

### Policy Recommendations for Reducing GHG Emissions

Governments have a range of policy options to encourage waste management practices that will reduce greenhouse gas emissions. Practical approaches that could be applied in most cities include:

- ▶ Public education to inform people about their options to reduce waste generation and increase recycling and composting.
- ▶ Pricing mechanisms, such as product charges can stimulate consumer behavior to reduce waste generation and increase recycling. A product charge is a cost assessment added to the price of a product and is tied to the cost of the desired waste management system. Consumers would pay for the waste management service when they buy the product. The fees collected would be directed to municipalities relative to the waste generated. An example of this economic mechanism is an excise tax on tires assessed by most states in the US. Product charges are a policy mechanism often better implemented by regional or national governments.
- ▶ Another pricing mechanism well suited to urban areas is user charges tied to quantity of waste disposed. Consumers who separate recyclables pay a lower fee for waste disposal. This pricing policy can work well in locations where waste collection is from individual households so that waste quantities for disposal can be readily monitored. However, it may not be practical in many areas in developing countries, particularly in those where there are communal collection points associated with multi-unit households (such as apartment user charges tied to quantity or volume).
- ▶ Preferential procurement policies and pricing to stimulate demand for products made with recycled post-consumer waste. Use of compost in public parks and other property owned by cities.

when they buy the product. The fees collected would be directed to municipalities relative to the waste generated. An example of this economic mechanism is an excise tax on tires assessed by most states in the US. Product charges are a policy mechanism often better implemented by regional or national governments.

## A Note on the Reliability of Solid Waste Data

Solid waste data should be considered with a degree of caution due to global inconsistencies in definitions, data collection methodologies, and completeness. The reliability of the data is influenced by:

- ▶ Undefined words or phrases
- ▶ Inconsistent or omitted units
- ▶ Dates, methodologies, or sources of data not indicated
- ▶ Estimates made without basis
- ▶ Incomplete or inconsistent data (please see Annexes C and D for further information on available data)
- ▶ Information collected at a non-representative moment

In most low- and middle-income countries, the reliability of solid waste data is further compromised by large seasonal variations (e.g. seasonal rains and un-containerized waste, horticultural variations), incomplete waste collection and disposal (e.g. a significant level of waste is disposed directly through local burning or thrown in waterways and low lying areas), and a lack of weight scales at landfill sites to record waste quantities.

Rarely is it disclosed at what stage the waste generation rates and composition were determined, and whether they were estimated or physically measured. The most accurate method measures the waste generated at source before any recycling, composting, burning, or open dumping takes place. However, the generation rate and composition are commonly calculated using waste quantities arriving at the final disposal site. This method of measurement does not fully represent the waste stream because waste can be diverted prior to final disposal, especially in low- and

middle-income countries where the informal sector removes a large fraction of recyclables. Additionally, in most low- and middle-income countries, waste collection rates are low and formal service does not extend to all communities, thereby reducing the quantities of waste delivered to final disposal sites. Measuring waste quantities for final disposal is practical for municipal purposes. Large variation in waste quantity and composition can be observed if the economic situation changes, yet growing waste quantities associated with increasing GNP are not necessarily a true reflection of increased waste; they might be changes in the relative recoverable value of the secondary materials and improvements in overall collection efficiency.

Waste composition specifies the components of the waste stream as a percentage of the total mass or volume. The component categories used within this report are:

- ▶ organics (i.e. compostables such as food, yard, and wood wastes)
- ▶ paper
- ▶ plastic
- ▶ glass
- ▶ metal
- ▶ others (includes ceramics, textiles, leather, rubber, bones, inerts, ashes, coconut husks, bulky wastes, household goods)

'Others' wastes should be differentiated into two categories: other-residue and other-consumer products. Other-residue is made up of ash, inerts, dirt, and sweepings and is a significant component of the waste stream in low- and middle-income countries. Other-consumer products consist of

bulky wastes, household appliances, electronics, and multi-material packaging (e.g., tetrapaks and blister packaging). This waste stream is much more significant in high-income countries and differs from other-residue in that the volumes are much higher per kilogram of waste and are generally combustible.

It is important to cite whether the percentages are given on a dry or wet basis, because component percentages will differ markedly depending on moisture content. Rarely is it indicated within a waste study whether the percentage is on a wet or dry basis, or based on volume or mass. It is assumed that the composition was determined on a wet basis. Probably both mass and volume measurements were used depending upon the country. Low- and middle-income countries would be more inclined to use volume since it does not require sophisticated measuring equipment and can be estimated. High-income countries usually use mass as a basis since they have greater funding resources and support to complete a more accurate waste characterization.

Another major inconsistency among the various waste studies is the use of imperial units versus metric units. Frequently the imperial ton and the metric tonne are interchanged when reporting waste quantities. Data are also denoted by the letter "t" to denote the unit, causing the true value to be unknown. Within this report, all of the units are metric, unless clearly noted. Waste densities and moisture contents are needed to convert data to a common frame of reference for comparison (e.g. from mass to volume and from wet to dry). Usually the higher the percentage of organic matter, the higher the moisture content and often the higher the density of the waste stream.

There are major efforts being done to correct data inconsistencies at the city level. So far, there is no single standard or comprehensive system to measure and monitor city performance and urban quality of life. In response to this need, the Global City Indicators Program (GCIP), based in Toronto, has been developed. The GCIP (please see Annex O) provides a practical means for cities to collect credible information on MSW.



Bangalore,  
India

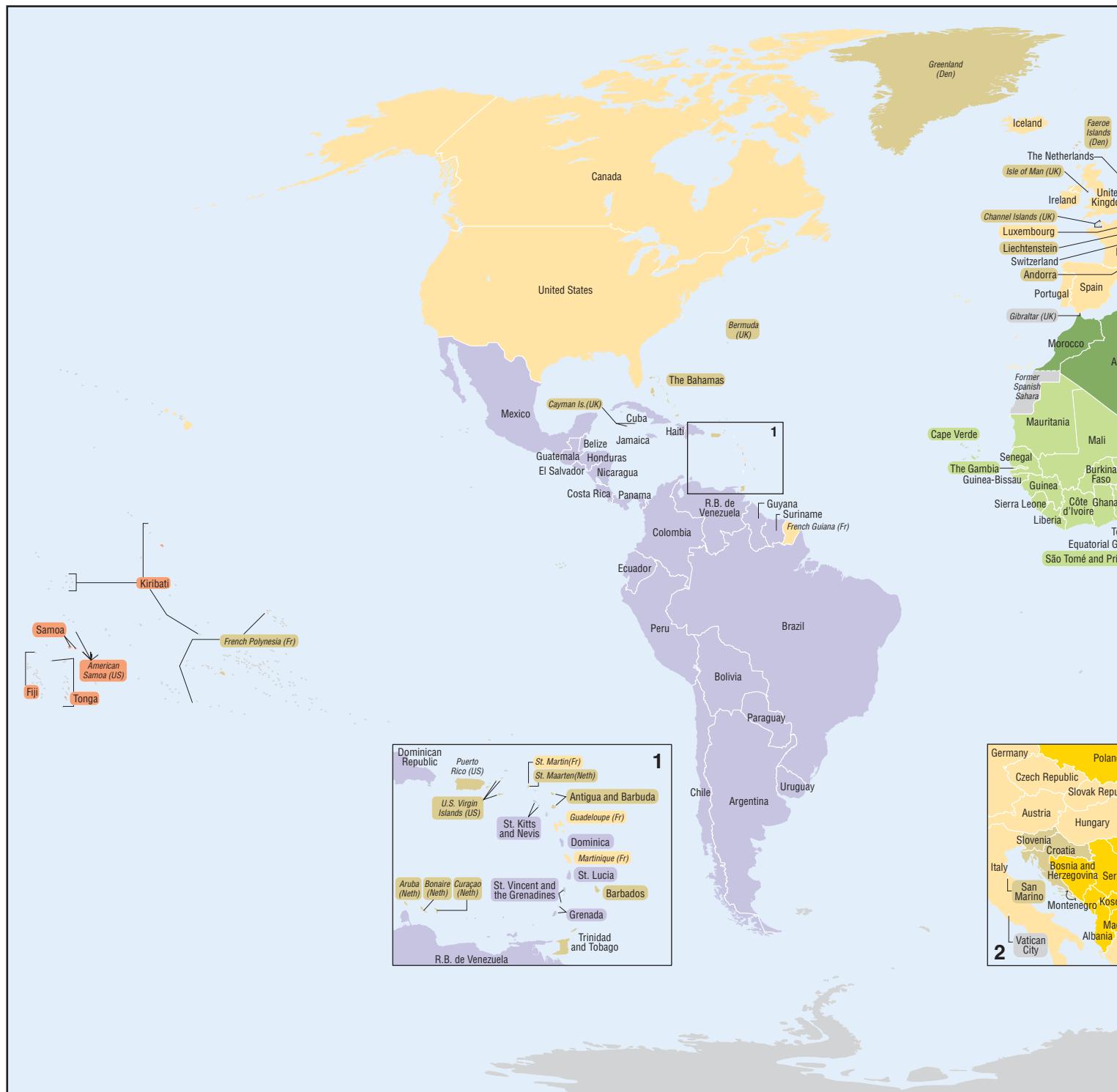


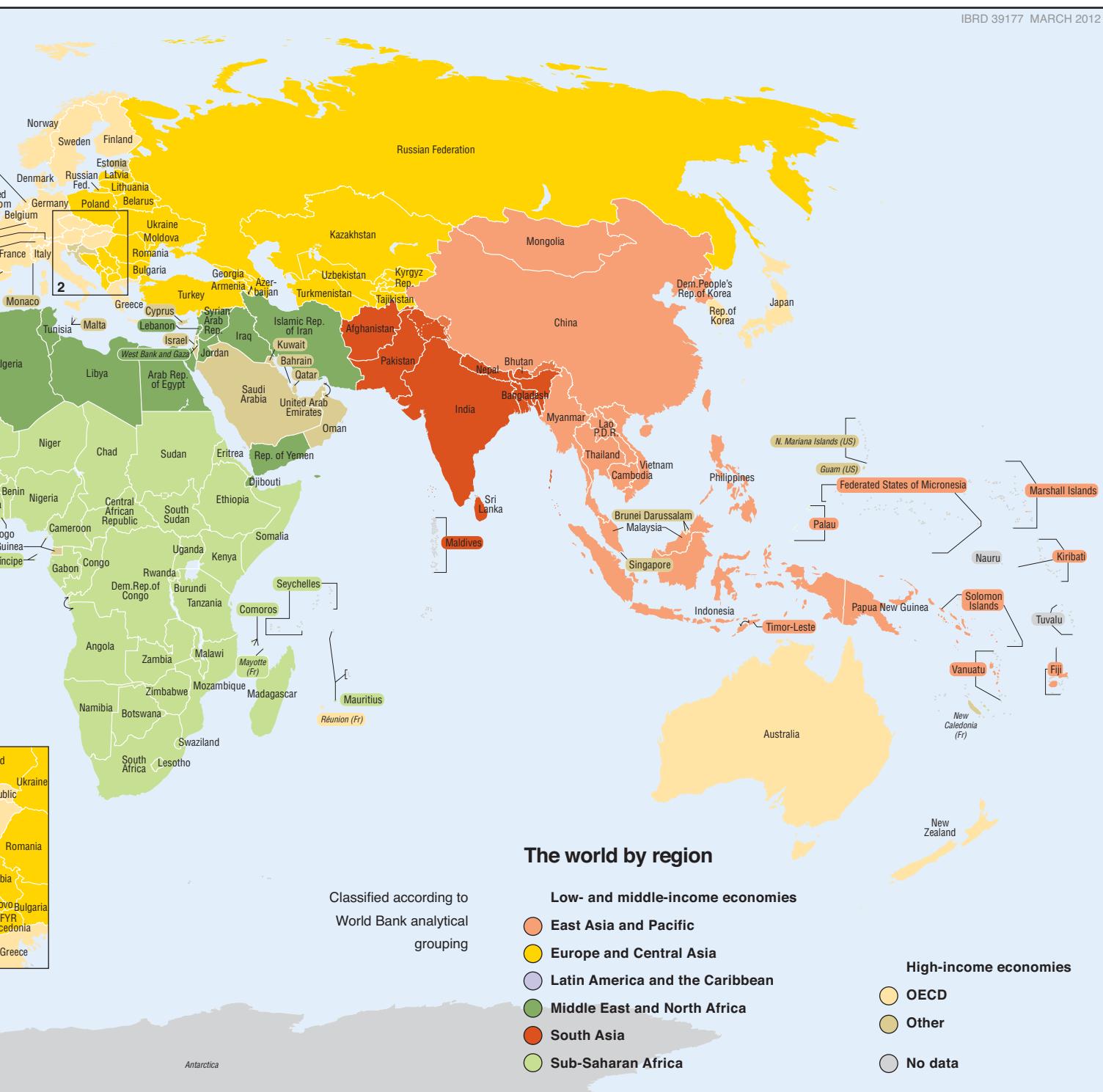
A couple salvage old bricks  
from an area demolished  
for renovation in Saigon

# **ANNEXES**

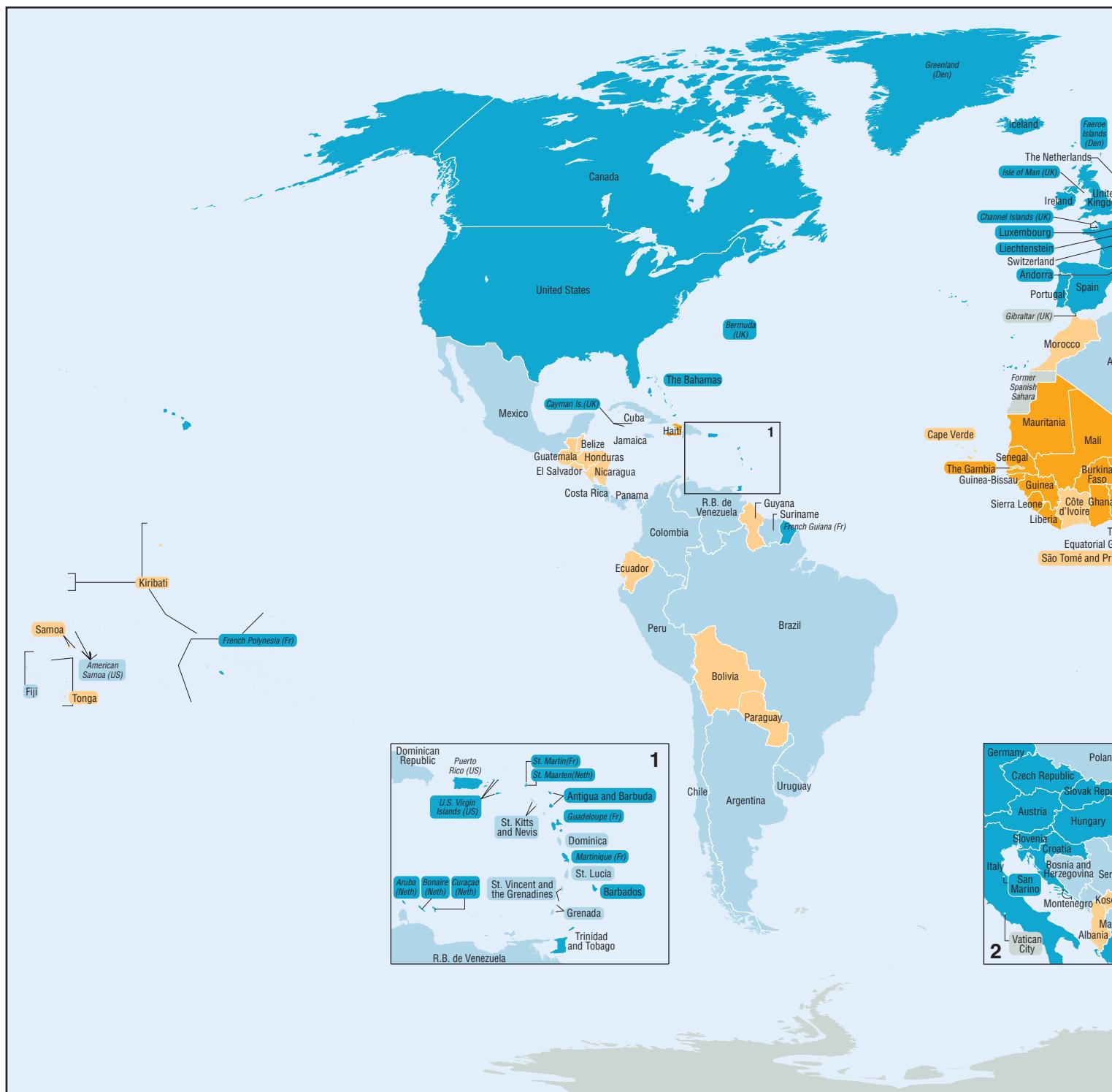
## ANNEX A

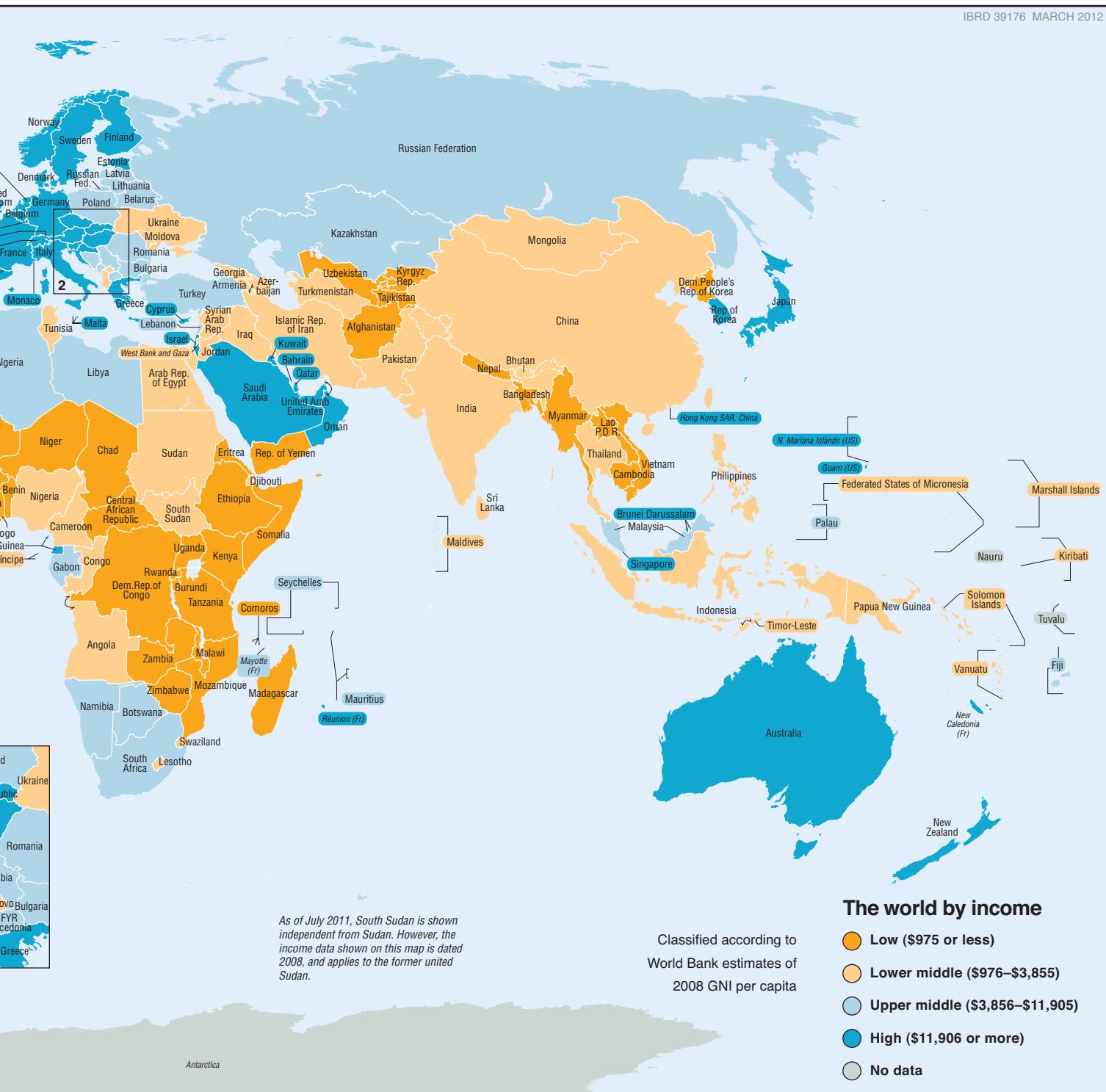
## Map of Regions





## ANNEX B

**Map of Income Distribution**



**ANNEX C****Availability of MSW Data by Country**

| Country                               | Income Level | Region | Gen-eration | Year of Data | Source                                       | Collec-tion | Urban or Total | Year of Data | Source            | Disposal | Year of Data | Source                                       | Composi-tion | Year of Data | Source                    |
|---------------------------------------|--------------|--------|-------------|--------------|--|-------------|----------------|--------------|-------------------|----------|--------------|--|--------------|--------------|---------------------------|
| Albania <sup>1</sup>                  | LMI          | ECA    | x           | 2006         | Denmark Ministry of Foreign Affairs          | x           | T              | 2005         | UNSD (2009)       |          |              |  | x            | 2005         | UNSD (2009)               |
| Algeria                               | UMI          | MENA   | x           | 2002         | METAP (2004)                                 | x           | U              | 2002         | METAP (2004)      | x        | 2002         | METAP (2004)                                 | x            | 2002         | METAP (2004)              |
| Andorra                               | HIC          | OECD   | x           | 2007         | UNSD (2009)                                  | x           | T              | 2007         | UNSD (2009)       |          |              |  | x            | 2005         | UNSD (2009)               |
| Angola <sup>2</sup>                   | LMI          | AFR    | x           | 2005         | USAID (2009)                                 |             |                |              |                   |          |              |  |              |              |                           |
| Antigua and Barbuda                   | HIC          | LCR    | x           | 2001         | PAHO (2005)                                  | x           | T              | 2007         | UNSD (2009)       | x        | 2007         | UNSD (2009)                                  |              |              |                           |
| Argentina                             | UMI          | LCR    | x           | 2001         | PAHO (2005)                                  |             |                |              |                   |          |              |  | x            | 2001         | UNSD (2009)               |
| Armenia                               | LMI          | ECA    | x           | 2007         | UNSD (2009)                                  | x           | T              | 2007         | UNSD (2009)       | x        | 2007         | UNSD (2009)                                  | x            | 2007         | UNSD (2009)               |
| Australia                             | HIC          | OECD   | x           | 1999         | OECD (2008)                                  |             |                |              |                   | x        | 2003         | OECD (2008)                                  | x            | 2005         | OECD (2008)               |
| Austria                               | HIC          | OECD   | x           | 2006         | OECD (2008)                                  | x           | T              | 2007         | UNSD (2009)       | x        | 2004         | OECD (2008)                                  | x            | 2004         | OECD (2008)               |
| Bahamas, The                          | HIC          | LCR    | x           | 2001         | PAHO (2005)                                  |             |                |              |                   |          |              |  |              |              |                           |
| Bahrain <sup>3</sup>                  | HIC          | MENA   | x           | 2000         | UNESCOLA (2007)                              |             |                |              |                   |          |              |  |              |              |                           |
| Bangladesh <sup>4</sup>               | LI           | SAR    | x           | 2004         | Bangladesh Department of Environment (2004)  |             |                |              |                   |          |              |  | x            | 2004         | UNSD (2009)               |
| Barbados                              | HIC          | LCR    | x           | 2001         | PAHO (2005)                                  |             |                |              |                   |          |              |  |              |              |                           |
| Belarus                               | UMI          | ECA    | x           | 2005         | Belarus Ministry of Natural Resources (2006) | x           | T              | 2007         | UNSD (2009)       | x        | 2005         | Belarus Ministry of Natural Resources (2006) | x            | 2004         | UNSD (2009)               |
| Belgium                               | HIC          | OECD   | x           | 2006         | OECD (2008)                                  | x           | T              | 2007         | UNSD (2009)       | x        | 2003         | OECD (2008)                                  | x            | 2003         | OECD (2008)               |
| Belize                                | LMI          | LCR    | x           | 2001         | PAHO (2005)                                  | x           | T              | 2005         | UNSD (2009)       | x        | 2005         | UNSD (2009)                                  | x            | 1997         | UNSD (2009)               |
| Benin <sup>2</sup>                    | LI           | AFR    | x           | 2005         | USAID (2009)                                 | x           | T              | 2000         | UNSD (2009)       |          |              |  | x            | 2002         | UNSD (2009)               |
| Bhutan                                | LMI          | SAR    | x           | 2007         | Phuntsho (2008)                              |             |                |              |                   |          |              |  | x            | 2008         | Phuntsho (2008)           |
| Bolivia                               | LMI          | LCR    | x           | 2003         | Business News Americas (2004)                |             |                |              |                   |          |              |  | x            | 1999         | UNSD (2009)               |
| Botswana                              | UMI          | AFR    | x           | 1998         | Kgathi and Bolaane (2001)                    |             |                |              |                   |          |              |  |              |              |                           |
| Brazil                                | UMI          | LCR    | x           | 2001         | PAHO (2005)                                  | x           | T              | 2007         | UNSD (2009)       |          |              |  | x            | 2006         | UNSD (2009)               |
| Brunei Darussalam                     | HIC          | EAP    | x           | 2006         | Ngoc and Schnitzer (2009)                    |             |                |              |                   |          |              |  | x            | 2006         | Ngoc and Schnitzer (2009) |
| Bulgaria                              | LMI          | ECA    | x           | 2007         | European Environment Agency (2008)           | x           | T              | 2002         | UNSD (2009)       | x        | 2007         | UNSD (2009)                                  |              |              |                           |
| Burkina Faso <sup>2</sup>             | LI           | AFR    | x           | 2005         | USAID (2009)                                 |             |                |              |                   |          |              |  |              |              |                           |
| Burundi <sup>2</sup>                  | LI           | AFR    | x           | 2005         | USAID (2009)                                 |             |                |              |                   |          |              |  |              |              |                           |
| Cambodia <sup>5</sup>                 | LI           | EAP    |             |              |  | x           | U              | 2000         | Kum et al. (2005) | x        | 2004         | Kum et al. (2005)                            | x            | 2000         | Ngoc and Schnitzer (2009) |
| Cameroon                              | LMI          | AFR    | x           | 2000         | Parrot et al. (2009)                         |             |                |              |                   | x        | 2001         | Parrot et al. (2009)                         | x            | 2006         | UNSD (2009)               |
| Canada                                | HIC          | OECD   | x           | 1990         | OECD (2008)                                  | x           | T              | 1996         | UNSD (2009)       | x        | 2004         | OECD (2008)                                  | x            | 2004         | OECD (2008)               |
| Cape Verde <sup>2</sup>               | LMI          | AFR    | x           | 2005         | USAID (2009)                                 |             |                |              |                   |          |              |  |              |              |                           |
| Central African Republic <sup>2</sup> | LI           | AFR    | x           | 2005         | USAID (2009)                                 |             |                |              |                   |          |              |  |              |              |                           |
| Chad <sup>2</sup>                     | LI           | AFR    | x           | 2005         | USAID (2009)                                 |             |                |              |                   |          |              |  |              |              |                           |
| Chile                                 | UMI          | LCR    | x           | 2001         | PAHO (2005)                                  |             |                |              |                   | x        | 2006         | UNSD (2009)                                  | x            | 1998         | UNSD (2009)               |
| China                                 | LMI          | EAP    | x           | 2004         | Hoornweg et al. (2005)                       |             |                |              |                   |          |              |  |              |              |                           |
| Colombia                              | UMI          | LCR    | x           | 2001         | PAHO (2005)                                  | x           | T              | 2001         | PAHO (2005)       | x        | 2005         | PAHO (2005)                                  | x            | 2005         | UNSD (2009)               |
| Comoros                               | LI           | AFR    | x           | 2003         | Payet (2003)                                 | x           | T              | 2003         | Payet (2003)      |          |              |  |              |              |                           |
| Congo, Dem. Rep. <sup>2</sup>         | LI           | AFR    | x           | 2005         | USAID (2009)                                 |             |                |              |                   |          |              |  |              |              |                           |
| Congo, Rep.                           | LMI          | AFR    | x           | 2005         | USAID (2009)                                 |             |                |              |                   |          |              |  |              |              |                           |
| Costa Rica                            | UMI          | LCR    | x           | 2001         | PAHO (2005)                                  | x           | T              | 2001         | PAHO (2005)       | x        | 2001         | PAHO (2005)                                  | x            | 2005         | UNSD (2009)               |
| Côte d'Ivoire <sup>2</sup>            | LMI          | AFR    | x           | 2005         | USAID (2009)                                 |             |                |              |                   |          |              |  |              |              |                           |
| Croatia <sup>6</sup>                  | HIC          | ECA    | x           | 2008         | Vego (2008)                                  | x           | T              | 2005         | UNSD (2009)       | x        | 2006         | UNSD (2009)                                  | x            | 2000         | UNSD (2009)               |
| Cuba                                  | UMI          | LCR    | x           | 2001         | PAHO (2005)                                  | x           | T              | 2005         | UNSD (2009)       | x        | 2005         | UNSD (2009)                                  | x            | 2005         | UNSD (2009)               |

## **ANNEX C** (continued)

### **Availability of MSW Data by Country**

## **ANNEX C (continued)**

## Availability of MSW Data by Country

## **ANNEX C (continued)**

## Availability of MSW Data by Country

**ANNEX C (continued)****Availability of MSW Data by Country**

| Country               | Income Level | Region | Gen-eration | Year of Data | Source                                 | Collection | Urban or Total | Year of Data | Source       | Disposal | Year of Data | Source       | Composi-tion | Year of Data | Source                    |
|-----------------------|--------------|--------|-------------|--------------|--|------------|----------------|--------------|--------------|----------|--------------|--------------|--------------|--------------|---------------------------|
| United Kingdom        | HIC          | OECD   | x           | 2006         | OECD (2008)                            | x          | T              | 2007         | UNSD (2009)  | x        | 2005         | OECD (2008)  |              |              |                           |
| United States         | HIC          | OECD   | x           | 2006         | OECD (2008)                            | x          | T              | 2005         | UNSD (2009)  | x        | 2005         | OECD (2008)  | x            | 2005         | OECD (2008)               |
| Uruguay               | UMI          | LCR    | x           | 2001         | PAHO (2005)                            | x          | T              | 2001         | PAHO (2005)  | x        | 2001         | PAHO (2005)  | x            | 2003         | UNSD (2009)               |
| Vanuatu               | LI           | EAP    | x           | 1994         | McIntyre (2005)                        |            |                |              |              |          |              |              | x            | 1994         | McIntyre (2005)           |
| Venezuela, RB         | UMI          | LCR    | x           | 2001         | PAHO (2005)                            | x          | T              | 2001         | PAHO (2005)  | x        | 2001         | PAHO (2005)  |              |              |                           |
| Vietnam               | LI           | EAP    | x           | 2004         | World Bank (2004)                      |            |                |              |              |          |              |              | x            | 2000         | Ngoc and Schnitzer (2009) |
| West Bank and Gaza    | LMI          | MENA   | x           | 2001         | METAP (2004)                           | x          | U              | 2001         | METAP (2004) | x        | 2001         | METAP (2004) | x            | 2001         | METAP (2004)              |
| Zambia <sup>19</sup>  | LI           | AFR    | x           |              | Environmental Council of Zambia (2004) | x          | T              | 2005         | UNSD (2009)  |          |              |              |              |              |                           |
| Zimbabwe <sup>2</sup> | LI           | AFR    | x           | 2005         | USAID (2009)                           |            |                |              |              |          |              |              | x            | 2007         | UNSD (2009)               |

**NOTES:**<sup>1</sup>Year for generation data is assumed to be 2006<sup>2</sup>Generation rates calculated using a per capita rate of 0.5kg/cap/day<sup>3</sup>Generation value refers to domestic waste (household) only<sup>4</sup>Generation rates are for urban areas only<sup>5</sup>Collection and disposal values are for Phnom Penh only<sup>6</sup>Generation rate is for Dalmatia<sup>7</sup>Generation value for Mekelle City<sup>8</sup>Collection value is for Jakarta only<sup>9</sup>Generation and composition values are for Tehran<sup>10</sup>Population values are for 1999, the most recent year available<sup>11</sup>Composition values for Monrovia only<sup>12</sup>Generation values are for Kuala Lumpur<sup>13</sup>Generation and composition values are for Bamako<sup>14</sup>Generation and composition values are for Maputo<sup>15</sup>Generation and composition values are for Lahore<sup>16</sup>All values are for Freetown<sup>17</sup>Generation values are based on Cape Town per capita values<sup>18</sup>All values are for Kampala city only<sup>19</sup>Generation values are from 1996; composition values are for Lusaka only

**ANNEX D****Countries Excluded for Lack of Data**

| Country                         | Income level | Region |
|---------------------------------|--------------|--------|
| Afghanistan                     | LI           | SAR    |
| American Samoa                  | UMI          | EAP    |
| Aruba                           | HIC          | OECD   |
| Azerbaijan                      | LMI          | ECA    |
| Bermuda                         | HIC          | OECD   |
| Bosnia and Herzegovina          | UMI          | ECA    |
| Cayman Islands                  | HIC          | OECD   |
| Channel Islands                 | HIC          | OECD   |
| Djibouti                        | LMI          | MENA   |
| Equatorial Guinea               | HIC          | OECD   |
| Faeroe Islands                  | HIC          | OECD   |
| French Polynesia                | HIC          | OECD   |
| Greenland                       | HIC          | OECD   |
| Guam                            | HIC          | OECD   |
| Guinea-Bissau                   | LI           | AFR    |
| Isle of Man                     | HIC          | OECD   |
| Kazakhstan                      | UMI          | ECA    |
| Kiribati                        | LMI          | EAP    |
| Korea, Dem. People's Rep.       | LI           | EAP    |
| Kosovo                          | LMI          | ECA    |
| Kyrgyz Republic                 | LI           | ECA    |
| Libya                           | UMI          | MENA   |
| Liechtenstein                   | HIC          | OECD   |
| Mayotte                         | UMI          | AFR    |
| Micronesia, Federated States of | LMI          | EAP    |
| Moldova                         | LMI          | ECA    |
| Montenegro                      | UMI          | ECA    |
| Netherlands Antilles            | HIC          | OECD   |
| New Caledonia                   | HIC          | OECD   |
| Northern Mariana Islands        | HIC          | OECD   |
| Palau                           | LMI          | EAP    |
| Papua New Guinea                | LMI          | EAP    |
| Puerto Rico                     | HIC          | OECD   |
| Samoa                           | LMI          | EAP    |
| San Marino                      | HIC          | OECD   |
| Somalia                         | LI           | AFR    |
| Taiwan, China                   | HIC          | EAP    |
| Timor-Leste                     | LMI          | EAP    |
| Ukraine                         | LMI          | ECA    |
| Uzbekistan                      | LI           | ECA    |
| Virgin Islands (US)             | HIC          | OECD   |
| Yemen, Republic of              | LI           | MENA   |

**ANNEX E****Estimated Solid Waste Management Costs****Estimated Solid Waste Management Costs by Disposal Method<sup>1</sup>**

|   | Low Income Countries | Lower Mid Inc Countries | Upper Mid Inc Countries | High Income Countries |
|---|----------------------|-------------------------|-------------------------|-----------------------|
| Income (GNI/capita)                                 | <\$876               | \$876-3,465             | \$3,466-10,725          | >\$10,725             |
| Waste Generation (tonnes/capita/yr)                 | 0.22                 | 0.29                    | 0.42                    | 0.78                  |
| Collection Efficiency (percent collected)           | 43%                  | 68%                     | 85%                     | 98%                   |
| <b>Cost of Collection and Disposal (US\$/tonne)</b> |                      |                         |                         |                       |
| Collection <sup>2</sup>                             | 20-50                | 30-75                   | 40-90                   | 85-250                |
| Sanitary Landfill                                   | 10-30                | 15-40                   | 25-65                   | 40-100                |
| Open Dumping  | 2-8                  | 3-10                    | NA                      | NA                    |
| Composting <sup>3</sup>                             | 5-30                 | 10-40                   | 20-75                   | 35-90                 |
| Waste -to-Energy Incineration <sup>4</sup>          | NA                   | 40-100                  | 60-150                  | 70-200                |
| Anaerobic Digestion <sup>5</sup>                    | NA                   | 20-80                   | 50-100                  | 65-150                |

**NOTE:** This is a compilation table from several World Bank documents, discussions with the World Bank's Thematic Group on Solid Waste, Carl Bartone and other industry and organizational colleagues. Costs associated with uncollected waste—more than half of all waste generated in low-income countries—are not included.

**Estimated Solid Waste Management Costs 2010 and 2025**

| Country Income Group                       | 2010 Cost <sup>6</sup> | 2025 Cost            |
|--|------------------------|----------------------|
| Low Income Countries <sup>7</sup>          | \$1.5 billion          | \$7.7 billion        |
| Lower Middle Income Countries <sup>8</sup> | \$20.1 billion         | \$84.1 billion       |
| Upper Middle Income Countries <sup>9</sup> | \$24.5 billion         | \$63.5 billion       |
| High Income Countries <sup>10</sup>        | \$159.3 billion        | \$220.2 billion      |
| <b>Total Global Cost (US\$)</b>            | <b>\$205.4 billion</b> | <b>\$375 billion</b> |

Source: Authors' calculations with input from *What a Waste* report (Hoornweg and Thomas 1999) and the World Bank Solid Waste Thematic Group and Carl Bartone.

<sup>1</sup>All values provided in the table are exclusive of any potential carbon finance, subsidies, or external incentives. Costs included are for purchase (including land), operation, maintenance, and debt service.

<sup>2</sup>Collection includes pick up, transfer, and transport to final disposal site for residential and non-residential waste.

<sup>3</sup>Composting excludes sale of finished compost (which ranges from \$0 to \$100/ton).

<sup>4</sup>Includes sale of any net energy; excludes disposal costs of bottom and fly ash (non hazardous and hazardous).

<sup>5</sup>Anaerobic digestion includes sale of energy from methane and excludes cost of residue sale and disposal.

<sup>6</sup>Cost of SWM (US\$) = waste generated (tonnes) X percent of waste collected (%) X [cost of collection (\$/ton) + cost of disposal (\$/ton)]

<sup>7</sup>2010: \$1.5bil = 75,000,000 tonnes X 43% X (\$30/ton + \$15/ton); 2025: \$7.7bil = 201,000,000 tonnes X 55% X (\$45/ton + \$25/ton)

<sup>8</sup>2010: \$20.1bil = 369,000,000 tonnes X 68% X (\$50/ton + \$30/ton); 2025: \$84.1bil = 956,000,000 tonnes X 80% X (\$65/ton + \$45/ton)

<sup>9</sup>2010: \$24.5bil = 243,000,000 tonnes X 84% X ((0.9<sub>Landfill</sub> (\$65/ton + \$50/ton)) + (0.1<sub>Incinerate</sub> (\$65/ton + \$100/ton))); 2025: \$63.5bil = 426,000,000 X 92% X ((0.85<sub>Landfill</sub> (\$85/ton + \$65/ton)) + (0.15<sub>Incinerate</sub> (\$85/ton + \$145/ton)))

<sup>10</sup>2010: \$159.3bil = 602,000,000 tonnes X 98% X ((0.8<sub>Landfill</sub> (\$180/ton + \$75/ton)) + (0.2<sub>Incinerate</sub> (\$180/ton + \$150/ton))); 2025: \$220.2bil = 686,000,000 tonnes X 98% X ((0.75<sub>Landfill</sub> (\$210/ton + \$95/ton)) + 0.25<sub>Incinerate</sub> (\$210/ton + \$185/ton)))

**ANNEX F****MSW Generation Data for Cities Over 100,000**

| City                                  | Year | Urban Population | Generation Rate (kg/capita/day) | Total MSW Generated (kg/day) | Total Waste (tons/day) |
|---------------------------------------|------|------------------|---------------------------------|------------------------------|------------------------|
| <b>Africa</b>                         |      |                  |                                 |                              |                        |
| <b>Benin</b>                          |      |                  |                                 |                              |                        |
| Parakou (UNSD 2009)                   | 2002 | 148,450          | 0.59                            | 87,671                       | 88                     |
| Porto Novo (Achankeng 2003)           | 1993 |                  | 0.50                            |                              | –                      |
| <b>Burkina Faso (UNSD 2009)</b>       |      |                  |                                 |                              |                        |
| Ouagadougou                           | 2002 | 876,200          | 0.79                            | 692,635                      | 693                    |
| <b>Burundi (Achankeng 2003)</b>       |      |                  |                                 |                              |                        |
| Bujumbura                             | 1993 |                  | 1.40                            |                              | –                      |
| <b>Cameroon (Achankeng 2003)</b>      |      |                  |                                 |                              |                        |
| Douala                                | 1993 |                  | 0.70                            |                              |                        |
| Yaounde                               | 1993 |                  | 0.80                            |                              |                        |
| <b>Congo, Rep. (Achankeng 2003)</b>   |      |                  |                                 |                              |                        |
| Brazzaville                           | 1993 |                  | 0.60                            |                              |                        |
| <b>Cote d'Ivoire (Achankeng 2003)</b> |      |                  |                                 |                              |                        |
| Abidjan                               | 1993 |                  | 1.00                            |                              |                        |
| <b>Egypt (Achankeng 2003)</b>         |      |                  |                                 |                              |                        |
| Cairo                                 | 1993 |                  | 0.50                            |                              |                        |
| <b>Gambia, The (Achankeng 2003)</b>   |      |                  |                                 |                              |                        |
| Banjul                                | 1993 |                  | 0.30                            |                              |                        |
| <b>Ghana</b>                          |      |                  |                                 |                              |                        |
| Accra (Achankeng 2003)                | 1993 |                  | 0.40                            |                              |                        |
| Kumasi (Asase 2009)                   | 2006 | 1,610,867        | 0.60                            | 966,520                      | 967                    |
| <b>Guinea (UNSD 2009)</b>             |      |                  |                                 |                              |                        |
| Conakry                               | 2007 | 3,000,000        | 0.24                            | 725,274                      | 725                    |
| <b>Madagascar (Achankeng 2003)</b>    |      |                  |                                 |                              |                        |
| Antananarivo                          | 1993 |                  | 0.30                            |                              |                        |
| <b>Mauritania (Achankeng 2003)</b>    |      |                  |                                 |                              |                        |
| Nouakchott                            | 1993 |                  | 0.90                            |                              |                        |
| <b>Morocco (Achankeng 2003)</b>       |      |                  |                                 |                              |                        |
| Rabat                                 | 1993 |                  | 0.60                            |                              |                        |
| <b>Namibia (Achankeng 2003)</b>       |      |                  |                                 |                              |                        |
| Windhoek                              | 1993 |                  | 0.70                            |                              |                        |
| <b>Niger</b>                          |      |                  |                                 |                              |                        |
| Niamey (Achankeng 2003)               | 1993 |                  | 1.00                            |                              |                        |
| Zinder (UNSD 2009)                    | 2006 | 242,800a         | 0.29                            | 69,430                       | 69                     |
| <b>Nigeria (Achankeng 2003)</b>       |      |                  |                                 |                              |                        |
| Ibadan                                | 1993 |                  | 1.10                            |                              |                        |
| Lagos                                 | 1993 |                  | 0.30                            |                              |                        |
| <b>Rwanda (Achankeng 2003)</b>        |      |                  |                                 |                              |                        |
| Kigali                                | 1993 |                  | 0.60                            |                              |                        |
| <b>Senegal (Achankeng 2003)</b>       |      |                  |                                 |                              |                        |
| Dakar                                 | 1993 |                  | 0.70                            |                              |                        |
| <b>Tanzania (Achankeng 2003)</b>      |      |                  |                                 |                              |                        |
| Dar es Salaam                         | 1993 |                  | 1.00                            |                              |                        |
| <b>Togo (Achankeng 2003)</b>          |      |                  |                                 |                              |                        |
| Lome                                  | 1993 |                  | 1.90                            |                              |                        |
| <b>Tunisia (Achankeng 2003)</b>       |      |                  |                                 |                              |                        |
| Tunis                                 | 1993 |                  | 0.50                            |                              |                        |
| <b>Uganda (Achankeng 2003)</b>        |      |                  |                                 |                              |                        |
| Kampala                               | 1993 |                  | 6.00                            |                              |                        |
| <b>Zambia (UNSD 2009)</b>             |      |                  |                                 |                              |                        |
| Lusaka                                | 2005 | 1,300,000        | 0.90                            | 1,171,994                    | 1,172                  |
| <b>Zimbabwe (UNSD 2009)</b>           |      |                  |                                 |                              |                        |
| Harare                                | 2005 | 2,500,000        | 0.08                            | 207,500                      | 208                    |

**ANNEX F (continued)****MSW Generation Data for Cities Over 100,000**

| City                           | Year | Urban Population | Generation Rate (kg/capita/day) | Total MSW Generated (kg/day) | Total Waste (tons/day) |
|--------------------------------|------|------------------|---------------------------------|------------------------------|------------------------|
| <b>East Asia &amp; Pacific</b> |      |                  |                                 |                              |                        |
| China** (Hoornweg et al. 2005) |      |                  |                                 |                              |                        |
| Anshan, Liaoning               | 2000 | 1,453,000        | 0.90                            | 1,307,701                    | 1,308                  |
| Baotou, Inner Mongolia         | 2000 | 1,319,000        | 0.90                            | 1,187,101                    | 1,187                  |
| Beijing, Beijing               | 2000 | 10,839,000       | 0.90                            | 9,755,101                    | 9,755                  |
| Benxi, Liaoning                | 2000 | 957,000          | 0.90                            | 861,301                      | 861                    |
| Changchun, Jilin               | 2000 | 3,093,000        | 0.90                            | 2,783,701                    | 2,784                  |
| Changde, Hunan                 | 2000 | 1,374,000        | 0.90                            | 1,236,600                    | 1,237                  |
| Changsha, Hunan                | 2000 | 1,775,000        | 0.90                            | 1,597,501                    | 1,598                  |
| Changzhou, Jiangsu             | 2000 | 886,000          | 0.90                            | 797,400                      | 797                    |
| Chengdu, Sichuan               | 2000 | 3,294,000        | 0.90                            | 2,964,600                    | 2,965                  |
| Chifeng, Inner Mongolia        | 2000 | 1,087,000        | 0.90                            | 978,301                      | 978                    |
| Chongqing, Chongqing           | 2000 | 4,900,000        | 0.90                            | 4,410,000                    | 4,410                  |
| Dalian, Liaoning               | 2000 | 2,628,000        | 0.90                            | 2,365,200                    | 2,365                  |
| Daqing, Heilongjiang           | 2000 | 1,076,000        | 0.90                            | 968,400                      | 968                    |
| Datong, Shanxi                 | 2000 | 1,165,000        | 0.90                            | 1,048,501                    | 1,049                  |
| Dongguan, Guangdong            | 2000 | 1,319,000        | 0.90                            | 1,187,101                    | 1,187                  |
| Fushun, Guangdong              | 2000 | 1,413,000        | 0.90                            | 1,271,701                    | 1,272                  |
| Fuxin, Liaoning                | 2000 | 785,000          | 0.90                            | 706,501                      | 707                    |
| Fuyu, Jilin                    | 2000 | 1,025,000        | 0.90                            | 922,501                      | 923                    |
| Fuzhou, Fujian                 | 2000 | 1,397,000        | 0.90                            | 1,257,301                    | 1,257                  |
| Guangzhou, Guangdong           | 2000 | 3,893,000        | 0.90                            | 3,503,701                    | 3,504                  |
| Guiyang, Guizhou               | 2000 | 2,533,000        | 0.90                            | 2,279,701                    | 2,280                  |
| Handan, Hebei                  | 2000 | 1,996,000        | 0.90                            | 1,796,400                    | 1,796                  |
| Hangzhou, Zhejiang             | 2000 | 1,780,000        | 0.90                            | 1,602,000                    | 1,602                  |
| Harbin, Heilongjiang           | 2000 | 2,928,000        | 0.90                            | 2,635,200                    | 2,635                  |
| Hefei, Anhui                   | 2000 | 1,242,000        | 0.90                            | 1,117,800                    | 1,118                  |
| Hengyang, Hunan                | 2000 | 799,000          | 0.90                            | 719,101                      | 719                    |
| Heze, Shandong                 | 2000 | 1,600,000        | 0.90                            | 1,440,000                    | 1,440                  |
| Huaian, Jiangsu                | 2000 | 1,232,000        | 0.90                            | 1,108,800                    | 1,109                  |
| Huabei, Anhui                  | 2000 | 814,000          | 0.90                            | 732,600                      | 733                    |
| Huainan, Anhui                 | 2000 | 1,354,000        | 0.90                            | 1,218,600                    | 1,219                  |
| Huahaote, Inner Mongolia       | 2000 | 978,000          | 0.90                            | 880,200                      | 880                    |
| Hunjiang, Jilin                | 2000 | 772,000          | 0.90                            | 694,800                      | 695                    |
| Huzhou, Zhejiang               | 2000 | 1,077,000        | 0.90                            | 969,301                      | 969                    |
| Jiamusi, Heilongjiang          | 2000 | 874,000          | 0.90                            | 786,600                      | 787                    |
| Jiaxing, Zhejiang              | 2000 | 791,000          | 0.90                            | 711,901                      | 712                    |
| Jilin, Jilin                   | 2000 | 1,435,000        | 0.90                            | 1,291,501                    | 1,292                  |
| Jinan, Shandong                | 2000 | 2,568,000        | 0.90                            | 2,311,200                    | 2,311                  |
| Jingmen, Hubei                 | 2000 | 1,153,000        | 0.90                            | 1,037,701                    | 1,038                  |
| Jining, Inner Mongolia         | 2000 | 1,019,000        | 0.90                            | 917,101                      | 917                    |
| Jinzhou, Liaoning              | 2000 | 834,000          | 0.90                            | 750,600                      | 751                    |
| Jixi, Liaoning                 | 2000 | 949,000          | 0.90                            | 854,101                      | 854                    |
| Kaifeng, Henan                 | 2000 | 769,000          | 0.90                            | 692,101                      | 692                    |
| Kunming, Yunnan                | 2000 | 1,701,000        | 0.90                            | 1,530,901                    | 1,531                  |
| Lanzhou, Gansu                 | 2000 | 1,730,000        | 0.90                            | 1,557,000                    | 1,557                  |
| Leshan, Sichuan                | 2000 | 1,137,000        | 0.90                            | 1,023,301                    | 1,023                  |
| Linqing, Shandong              | 2000 | 891,000          | 0.90                            | 801,901                      | 802                    |
| Linyi, Shandong                | 2000 | 2,498,000        | 0.90                            | 2,248,200                    | 2,248                  |
| Liuan, Anhui                   | 2000 | 1,818,000        | 0.90                            | 1,636,200                    | 1,636                  |
| Liupanshui, Guizhou            | 2000 | 2,023,000        | 0.90                            | 1,820,701                    | 1,821                  |
| Luoyang, Henan                 | 2000 | 1,451,000        | 0.90                            | 1,305,901                    | 1,306                  |
| Mianyang, Sichuan              | 2000 | 1,065,000        | 0.90                            | 958,501                      | 959                    |
| Mudanjiang, Heilongjiang       | 2000 | 801,000          | 0.90                            | 720,901                      | 721                    |

**ANNEX F (continued)****MSW Generation Data for Cities Over 100,000**

| City                   | Year | Urban Population | Generation Rate (kg/capita/day) | Total MSW Generated (kg/day) | Total Waste (tons/day) |
|------------------------|------|------------------|---------------------------------|------------------------------|------------------------|
| Nanchang, Jiangxi      | 2000 | 1,722,000        | 0.90                            | 1,549,800                    | 1,550                  |
| Nanjing, Jiangsu       | 2000 | 2,740,000        | 0.90                            | 2,466,000                    | 2,466                  |
| Neijiang, Sichuan      | 2000 | 1,393,000        | 0.90                            | 1,253,701                    | 1,254                  |
| Ningbo, Zhejiang       | 2000 | 1,173,000        | 0.90                            | 1,055,701                    | 1,056                  |
| Pingxiang, Jiangxi     | 2000 | 1,502,000        | 0.90                            | 1,351,800                    | 1,352                  |
| Qingdao, Shandong      | 2000 | 2,316,000        | 0.90                            | 2,084,400                    | 2,084                  |
| Qiqihar, Heilongjiang  | 2000 | 1,435,000        | 0.90                            | 1,291,501                    | 1,292                  |
| Shanghai, Shanghai     | 2000 | 12,887,000       | 0.90                            | 11,598,301                   | 11,598                 |
| Shantou, Guangdong     | 2000 | 1,176,000        | 0.90                            | 1,058,400                    | 1,058                  |
| Shenyang, Liaoning     | 2000 | 4,828,000        | 0.90                            | 4,345,200                    | 4,345                  |
| Shenzhen, Guangdong    | 2000 | 1,131,000        | 0.90                            | 1,017,901                    | 1,018                  |
| Shijiazhuang, Hebei    | 2000 | 1,603,000        | 0.90                            | 1,442,701                    | 1,443                  |
| Suining, Sichuan       | 2000 | 1,428,000        | 0.90                            | 1,285,200                    | 1,285                  |
| Suqian, Jiangsu        | 2000 | 1,189,000        | 0.90                            | 1,070,101                    | 1,070                  |
| Suzhou, Jiangsu        | 2000 | 1,183,000        | 0.90                            | 1,064,701                    | 1,065                  |
| Taian, Shandong        | 2000 | 1,503,000        | 0.90                            | 1,352,701                    | 1,353                  |
| Taiyuan, Shanxi        | 2000 | 2,415,000        | 0.90                            | 2,173,501                    | 2,174                  |
| Tangshan, Hebei        | 2000 | 1,671,000        | 0.90                            | 1,503,901                    | 1,504                  |
| Tianjin, Tianjin       | 2000 | 9,156,000        | 0.90                            | 8,240,400                    | 8,240                  |
| Tianmen, Hubei         | 2000 | 1,779,000        | 0.90                            | 1,601,101                    | 1,601                  |
| Tianshui, Gansu        | 2000 | 1,187,000        | 0.90                            | 1,068,301                    | 1,068                  |
| Tongliao, Jilin        | 2000 | 785,000          | 0.90                            | 706,501                      | 707                    |
| Wanxian, Chongqing     | 2000 | 1,759,000        | 0.90                            | 1,583,101                    | 1,583                  |
| Weifang, Shandong      | 2000 | 1,287,000        | 0.90                            | 1,158,301                    | 1,158                  |
| Wenzhou, Zhejiang      | 2000 | 1,269,000        | 0.90                            | 1,142,101                    | 1,142                  |
| Wuhan, Hubei           | 2000 | 5,169,000        | 0.90                            | 4,652,101                    | 4,652                  |
| Wulumuqi, Xinjiang     | 2000 | 1,415,000        | 0.90                            | 1,273,501                    | 1,274                  |
| Wuxi, Jiangsu          | 2000 | 1,127,000        | 0.90                            | 1,014,301                    | 1,014                  |
| Xian, Shaanxi          | 2000 | 3,123,000        | 0.90                            | 2,810,701                    | 2,811                  |
| Xiangxiang, Hunan      | 2000 | 908,000          | 0.90                            | 817,200                      | 817                    |
| Xiantao, Hubei         | 2000 | 1,614,000        | 0.90                            | 1,452,600                    | 1,453                  |
| Xianyang, Shaanxi      | 2000 | 896,000          | 0.90                            | 806,400                      | 806                    |
| Xiaoshan, Zhejiang     | 2000 | 1,124,000        | 0.90                            | 1,011,600                    | 1,012                  |
| Xinghua, Jiangsu       | 2000 | 1,556,000        | 0.90                            | 1,400,400                    | 1,400                  |
| Xintai, Hebei          | 2000 | 1,325,000        | 0.90                            | 1,192,501                    | 1,193                  |
| Xinyi, Jiangsu         | 2000 | 973,000          | 0.90                            | 875,701                      | 876                    |
| Xinyu, Guangdong       | 2000 | 808,000          | 0.90                            | 727,200                      | 727                    |
| Xuanzhou, Anhui        | 2000 | 823,000          | 0.90                            | 740,701                      | 741                    |
| Xuzhou, Jiangsu        | 2000 | 1,636,000        | 0.90                            | 1,472,400                    | 1,472                  |
| Yancheng, Jiangsu      | 2000 | 1,562,000        | 0.90                            | 1,405,800                    | 1,406                  |
| Yichun, Jiangxi        | 2000 | 871,000          | 0.90                            | 783,901                      | 784                    |
| Yichun, Jilin          | 2000 | 904,000          | 0.90                            | 813,600                      | 814                    |
| Yixing, Jiangsu        | 2000 | 1,108,000        | 0.90                            | 997,200                      | 997                    |
| Yiyang, Hunan          | 2000 | 1,343,000        | 0.90                            | 1,208,701                    | 1,209                  |
| Yongzhou, Hunan        | 2000 | 1,097,000        | 0.90                            | 987,301                      | 987                    |
| Yueyang, Hunan         | 2000 | 1,213,000        | 0.90                            | 1,091,701                    | 1,092                  |
| Yulin, Guangxi         | 2000 | 1,558,000        | 0.90                            | 1,402,200                    | 1,402                  |
| Yuyao, Zhejiang        | 2000 | 848,000          | 0.90                            | 763,200                      | 763                    |
| Yuzhou, Henan          | 2000 | 1,173,000        | 0.90                            | 1,055,701                    | 1,056                  |
| Zaoyang, Hubei         | 2000 | 1,121,000        | 0.90                            | 1,008,901                    | 1,009                  |
| Zaozhuang, Shandong    | 2000 | 2,048,000        | 0.90                            | 1,843,200                    | 1,843                  |
| Zhangjiagang, Jiangsu  | 2000 | 886,000          | 0.90                            | 797,400                      | 797                    |
| Zhangjiakou, Hebei     | 2000 | 880,000          | 0.90                            | 792,000                      | 792                    |
| Zhanjiang, Guangdong   | 2000 | 1,368,000        | 0.90                            | 1,231,200                    | 1,231                  |
| Zhaodong, Heilongjiang | 2000 | 851,000          | 0.90                            | 765,901                      | 766                    |

**ANNEX F (continued)****MSW Generation Data for Cities Over 100,000**

| City   | Year | Urban Population | Generation Rate (kg/capita/day) | Total MSW Generated (kg/day) | Total Waste (tons/day) |
|--|------|------------------|---------------------------------|------------------------------|------------------------|
| Zhengzhou, Henan                                     | 2000 | 2,070,000        | 0.90                            | 1,863,000                    | 1,863                  |
| Zibo, Shandong                                       | 2000 | 2,675,000        | 0.90                            | 2,407,501                    | 2,408                  |
| Zigong, Sichuan                                      | 2000 | 1,072,000        | 0.90                            | 964,800                      | 965                    |
| China, Hong Kong SAR (UNSD 2009)                     |      |                  |                                 |                              |                        |
| Hong Kong  | 2007 | 6,926,000        | 2.47                            | 17,128,767                   | 17,129                 |
| China, Macao SAR (UNSD 2009)                         |      |                  |                                 |                              |                        |
| Macao  | 2007 | 525,760          | 1.51                            | 792,932                      | 793                    |
| Indonesia (UNSD 2009)                                |      |                  |                                 |                              |                        |
| Jakarta  | 2005 | 8,962,000        | 0.88                            | 7,896,024                    | 7,896                  |
| Philippines (UNSD 2009)                              |      |                  |                                 |                              |                        |
| Manila   | 2007 | 1,660,714        | 3.00                            | 4,974,766                    | 4,975                  |
| Quezon City  | 2005 | 2,392,701        | 1.56                            | 3,728,911                    | 3,729                  |
| <b>Eastern Europe &amp; Central Asia (UNSD 2009)</b> |      |                  |                                 |                              |                        |
| Albania  |      |                  |                                 |                              |                        |
| Tirana   | 2007 | 1,532,000        | 1.01                            | 1,549,467                    | 1,549                  |
| Belarus  |      |                  |                                 |                              |                        |
| Minsk  | 2007 | 1,806,200        | 1.21                            | 2,181,918                    | 2,182                  |
| Croatia  |      |                  |                                 |                              |                        |
| Zagreb   | 2006 | 784,900          | 1.24                            | 974,904                      | 975                    |
| Georgia  |      |                  |                                 |                              |                        |
| Batumi   | 2007 | 303,200          | 2.00                            | 605,391                      | 605                    |
| Kutaisi  | 2007 | 185,960          | 3.06                            | 568,133                      | 568                    |
| Tbilisi  | 2007 | 1,300,000        | 0.82                            | 1,064,384                    | 1,064                  |
| <b>Latin America and the Caribbean (PAHO 2005)</b>   |      |                  |                                 |                              |                        |
| Argentina  |      |                  |                                 |                              |                        |
| Area Metropolitana Buenos Aires                      | 2001 | 12,544,018       | 1.16                            | 14,551,061                   | 14,551                 |
| Bahia Blanca   | 2001 | 285,000          | 0.88                            | 249,660                      | 250                    |
| Neuquen  | 2001 | 202,518          | 0.95                            | 192,392                      | 192                    |
| Salta Capital  | 2001 | 472,971          | 0.49                            | 232,040                      | 232                    |
| Bahamas  |      |                  |                                 |                              |                        |
| Nassau, Bahamas                                      | 2001 | 200,000          | 2.67                            | 534,000                      | 534                    |
| Barbados*  |      |                  |                                 |                              |                        |
| Barbados   | 2001 | 268,792          | 0.95                            | 255,352                      | 255                    |
| Bolivia*   |      |                  |                                 |                              |                        |
| Cochabamba   | 2001 | 717,026          | 0.60                            | 430,216                      | 430                    |
| El Alto  | 2001 | 629,955          | 0.36                            | 226,784                      | 227                    |
| La Paz   | 2001 | 790,353          | 0.53                            | 419,677                      | 420                    |
| Oruro  | 2001 | 201,230          | 0.33                            | 66,406                       | 66                     |
| Potosi   | 2001 | 135,783          | 0.33                            | 45,352                       | 45                     |
| Santa Cruz de la Sierra                              | 2001 | 1,113,000        | 0.54                            | 599,907                      | 600                    |
| Sacre  | 2001 | 193,876          | 0.40                            | 77,357                       | 77                     |
| Tarija   | 2001 | 135,783          | 0.46                            | 62,868                       | 63                     |
| Brazil   |      |                  |                                 |                              |                        |
| Abaetetuba   | 2001 | 119,152          | 0.29                            | 35,000                       | 35                     |
| Aguas Lindas de Goias                                | 2001 | 105,746          | 0.44                            | 47,000                       | 47                     |
| Alagoinhas   | 2001 | 130,095          | 0.58                            | 76,000                       | 76                     |
| Alvorada   | 2001 | 183,968          | 1.14                            | 210,000                      | 210                    |
| Americana  | 2001 | 182,593          | 0.95                            | 173,900                      | 174                    |
| Ananindeua   | 2001 | 393,569          | 1.27                            | 500,000                      | 500                    |
| Anapolis   | 2001 | 288,085          | 0.62                            | 180,000                      | 180                    |
| Angra dos Reis                                       | 2001 | 119,247          | 0.75                            | 89,200                       | 89                     |
| Aparaceida de Goiania                                | 2001 | 336,392          | 0.30                            | 102,000                      | 102                    |
| Apucarana  | 2001 | 107,827          | 0.88                            | 95,000                       | 95                     |
| Aracaju  | 2001 | 461,534          | 0.89                            | 410,000                      | 410                    |
| Aracatuba  | 2001 | 169,254          | 0.74                            | 125,000                      | 125                    |

**ANNEX F (continued)****MSW Generation Data for Cities Over 100,000**

| City                    | Year | Urban Population | Generation Rate (kg/capita/day) | Total MSW Generated (kg/day) | Total Waste (tons/day) |
|-------------------------|------|------------------|---------------------------------|------------------------------|------------------------|
| Araguaina               | 2001 | 113,143          | 0.53                            | 59,500                       | 60                     |
| Araguari                | 2001 | 101,974          | 0.88                            | 90,000                       | 90                     |
| Arapiraca               | 2001 | 186,466          | 0.99                            | 185,000                      | 185                    |
| Araraquara              | 2001 | 182,471          | 0.87                            | 158,400                      | 158                    |
| Araras                  | 2001 | 104,196          | 0.72                            | 75,000                       | 75                     |
| Atibaia                 | 2001 | 111,300          | 1.49                            | 165,700                      | 166                    |
| Bage                    | 2001 | 118,767          | 0.42                            | 50,000                       | 50                     |
| Barbacena               | 2001 | 114,126          | 0.83                            | 95,200                       | 95                     |
| Barra Mansa             | 2001 | 170,753          | 0.76                            | 130,000                      | 130                    |
| Barreiras               | 2001 | 131,849          | 1.76                            | 232,200                      | 232                    |
| Barretos                | 2001 | 103,913          | 0.76                            | 79,200                       | 79                     |
| Barueri                 | 2001 | 208,281          | 1.87                            | 390,000                      | 390                    |
| Bauru                   | 2001 | 316,064          | 1.39                            | 440,000                      | 440                    |
| Belem                   | 2001 | 1,280,614        | 1.57                            | 2,012,000                    | 2,012                  |
| Belford Roxo            | 2001 | 434,474          | 0.81                            | 350,000                      | 350                    |
| Belo Horizonte          | 2001 | 2,238,526        | 1.43                            | 3,201,800                    | 3,202                  |
| Betim                   | 2001 | 306,675          | 0.49                            | 150,000                      | 150                    |
| Blumenau                | 2001 | 261,808          | 0.84                            | 220,000                      | 220                    |
| Boa Vista               | 2001 | 200,568          | 0.57                            | 115,000                      | 115                    |
| Botucatu                | 2001 | 108,306          | 1.41                            | 153,000                      | 153                    |
| Braganca Paulista       | 2001 | 125,031          | 1.03                            | 128,500                      | 129                    |
| Brasilia                | 2001 | 2,051,146        | 0.76                            | 1,556,700                    | 1,557                  |
| Cabo de Santo Agostinho | 2001 | 152,977          | 0.92                            | 140,000                      | 140                    |
| Cabo Frio               | 2001 | 126,828          | 1.58                            | 200,000                      | 200                    |
| Cachoeirinha            | 2001 | 107,564          | 1.17                            | 125,400                      | 125                    |
| Cachoeiro de Itapemirim | 2001 | 174,879          | 1.03                            | 180,000                      | 180                    |
| Camacari                | 2001 | 161,727          | 0.99                            | 160,000                      | 160                    |
| Camaragibe              | 2001 | 128,702          | 1.01                            | 130,000                      | 130                    |
| Campina Grande          | 2001 | 355,331          | 1.35                            | 480,000                      | 480                    |
| Campinas                | 2001 | 969,396          | 1.69                            | 1,641,000                    | 1,641                  |
| Campo Grande            | 2001 | 663,621          | 0.75                            | 496,400                      | 496                    |
| Campos dos Goytacazes   | 2001 | 406,989          | 0.73                            | 296,000                      | 296                    |
| Canoas                  | 2001 | 306,093          | 0.68                            | 207,000                      | 207                    |
| Carapicuiba             | 2001 | 344,596          | 0.73                            | 250,000                      | 250                    |
| Cariacica               | 2001 | 324,285          | 1.05                            | 340,000                      | 340                    |
| Caruaru                 | 2001 | 253,634          | 0.79                            | 200,000                      | 200                    |
| Cascavel                | 2001 | 245,369          | 0.59                            | 145,000                      | 145                    |
| Castanhal               | 2001 | 134,496          | 0.40                            | 54,000                       | 54                     |
| Catanduva               | 2001 | 105,847          | 0.94                            | 100,000                      | 100                    |
| Caucaia                 | 2001 | 250,479          | 0.73                            | 183,000                      | 183                    |
| Caxias                  | 2001 | 139,756          | 0.76                            | 106,600                      | 107                    |
| Caxias do Sul           | 2001 | 360,419          | 0.92                            | 330,000                      | 330                    |
| Chapeco                 | 2001 | 146,967          | 0.49                            | 72,200                       | 72                     |
| Colatina                | 2001 | 112,711          | 0.71                            | 80,000                       | 80                     |
| Colombo                 | 2001 | 183,329          | 0.39                            | 72,000                       | 72                     |
| Contagem                | 2001 | 538,017          | 1.86                            | 1,000,000                    | 1,000                  |
| Cotia                   | 2001 | 148,987          | 0.78                            | 116,700                      | 117                    |
| Crato                   | 2001 | 104,646          | 0.33                            | 35,000                       | 35                     |
| Criciuma                | 2001 | 170,420          | 0.56                            | 96,000                       | 96                     |
| Cubatao                 | 2001 | 108,309          | 0.85                            | 92,000                       | 92                     |
| Curitiba                | 2001 | 1,587,315        | 0.75                            | 1,186,700                    | 1,187                  |
| Diadema                 | 2001 | 357,064          | 0.79                            | 281,600                      | 282                    |
| Dourados                | 2001 | 164,949          | 1.33                            | 219,000                      | 219                    |

**ANNEX F (continued)****MSW Generation Data for Cities Over 100,000**

| City                    | Year | Urban Population | Generation Rate (kg/capita/day) | Total MSW Generated (kg/day) | Total Waste (tons/day) |
|-------------------------|------|------------------|---------------------------------|------------------------------|------------------------|
| Duque de Caxias         | 2001 | 775,456          | 0.94                            | 730,000                      | 730                    |
| Embu                    | 2001 | 207,663          | 0.67                            | 140,000                      | 140                    |
| Feira de Santana        | 2001 | 480,949          | 1.56                            | 750,800                      | 751                    |
| Ferraz de Vasconcelos   | 2001 | 142,377          | 0.58                            | 83,000                       | 83                     |
| Florianopolis           | 2001 | 342,315          | 1.27                            | 435,000                      | 435                    |
| Fortaleza               | 2001 | 2,141,402        | 1.11                            | 2,375,000                    | 2,375                  |
| Foz do Iguacu           | 2001 | 258,543          | 0.75                            | 195,000                      | 195                    |
| Franca                  | 2001 | 287,737          | 0.95                            | 273,000                      | 273                    |
| Francisco Morato        | 2001 | 133,738          | 0.82                            | 109,100                      | 109                    |
| Franco da Rocha         | 2001 | 108,122          | 0.59                            | 64,000                       | 64                     |
| Garanhuns               | 2001 | 117,749          | 1.66                            | 195,000                      | 195                    |
| Goiania                 | 2001 | 1,093,007        | 1.17                            | 1,279,700                    | 1,280                  |
| Governador Valadares    | 2001 | 247,131          | 1.21                            | 300,000                      | 300                    |
| Gravatai                | 2001 | 232,629          | 0.55                            | 127,100                      | 127                    |
| Guarapuava              | 2001 | 155,161          | 0.53                            | 83,000                       | 83                     |
| Guaratinguetá           | 2001 | 104,219          | 0.58                            | 60,000                       | 60                     |
| Guaruja                 | 2001 | 264,812          | 0.98                            | 260,600                      | 261                    |
| Guarulhos               | 2001 | 1,072,717        | 0.79                            | 850,000                      | 850                    |
| Hortolandia             | 2001 | 152,523          | 0.62                            | 95,000                       | 95                     |
| Ibirite                 | 2001 | 133,044          | 0.83                            | 110,000                      | 110                    |
| Ilheus                  | 2001 | 222,127          | 0.36                            | 80,000                       | 80                     |
| Imperatriz              | 2001 | 230,566          | 0.98                            | 227,000                      | 227                    |
| Indaiatuba              | 2001 | 147,050          | 0.61                            | 90,400                       | 90                     |
| Ipatinga                | 2001 | 212,496          | 0.94                            | 200,000                      | 200                    |
| Itaborai                | 2001 | 187,479          | 0.62                            | 116,000                      | 116                    |
| Itabuna                 | 2001 | 196,675          | 1.27                            | 250,000                      | 250                    |
| Itajai                  | 2001 | 147,494          | 0.95                            | 140,000                      | 140                    |
| Itapecerica da Serra    | 2001 | 129,685          | 0.66                            | 85,500                       | 86                     |
| Itapetininga            | 2001 | 125,559          | 0.50                            | 62,200                       | 62                     |
| Itapevi                 | 2001 | 162,433          | 0.60                            | 98,000                       | 98                     |
| Itaquaquecetuba         | 2001 | 272,942          | 0.70                            | 190,000                      | 190                    |
| Itu                     | 2001 | 135,366          | 0.96                            | 130,000                      | 130                    |
| Jaboatao dos Guararapes | 2001 | 581,556          | 0.77                            | 450,000                      | 450                    |
| Jacareí                 | 2001 | 191,291          | 0.63                            | 120,000                      | 120                    |
| Jaragua do Sul          | 2001 | 108,489          | 0.72                            | 78,000                       | 78                     |
| Jau                     | 2001 | 112,104          | 1.03                            | 115,400                      | 115                    |
| Jequie                  | 2001 | 147,202          | 0.48                            | 70,000                       | 70                     |
| Ji-Parana               | 2001 | 106,800          | 0.66                            | 70,000                       | 70                     |
| Joao Pessoa             | 2001 | 597,934          | 1.72                            | 1,027,900                    | 1,028                  |
| Joinville               | 2001 | 429,604          | 1.15                            | 493,200                      | 493                    |
| Juazeiro                | 2001 | 174,567          | 1.18                            | 206,000                      | 206                    |
| Juazeiro do Norte       | 2001 | 212,133          | 1.08                            | 230,000                      | 230                    |
| Juiz de Fora            | 2001 | 456,796          | 0.64                            | 290,500                      | 291                    |
| Jundiai                 | 2001 | 323,397          | 1.02                            | 330,200                      | 330                    |
| Lages                   | 2001 | 157,682          | 0.51                            | 80,000                       | 80                     |
| Lauro de Freitas        | 2001 | 113,543          | 0.79                            | 90,000                       | 90                     |
| Limeira                 | 2001 | 249,046          | 0.64                            | 159,500                      | 160                    |
| Linhares                | 2001 | 112,617          | 0.57                            | 64,000                       | 64                     |
| Londrina                | 2001 | 447,065          | 1.61                            | 720,000                      | 720                    |
| Luziania                | 2001 | 141,082          | 0.71                            | 100,000                      | 100                    |
| Macae                   | 2001 | 132,461          | 1.89                            | 250,000                      | 250                    |
| Macapa                  | 2001 | 283,308          | 1.34                            | 380,000                      | 380                    |
| Maceio                  | 2001 | 797,759          | 1.32                            | 1,050,000                    | 1,050                  |

**ANNEX F (continued)****MSW Generation Data for Cities Over 100,000**

| City                     | Year | Urban Population | Generation Rate (kg/capita/day) | Total MSW Generated (kg/day) | Total Waste (tons/day) |
|--------------------------|------|------------------|---------------------------------|------------------------------|------------------------|
| Mage                     | 2001 | 205,830          | 1.04                            | 215,000                      | 215                    |
| Manaus                   | 2001 | 1,405,835        | 1.55                            | 2,180,000                    | 2,180                  |
| Maraba                   | 2001 | 168,020          | 0.31                            | 52,000                       | 52                     |
| Maracanau                | 2001 | 179,732          | 0.64                            | 115,000                      | 115                    |
| Marilia                  | 2001 | 197,342          | 0.98                            | 192,500                      | 193                    |
| Maringa                  | 2001 | 288,653          | 0.98                            | 284,000                      | 284                    |
| Maua                     | 2001 | 363,392          | 0.64                            | 232,700                      | 233                    |
| Mogi Guacu               | 2001 | 124,228          | 0.67                            | 83,000                       | 83                     |
| Moji das Cruzes          | 2001 | 330,241          | 0.63                            | 208,100                      | 208                    |
| Montes Claros            | 2001 | 306,947          | 1.51                            | 462,000                      | 462                    |
| Mossoro                  | 2001 | 213,841          | 0.71                            | 151,500                      | 152                    |
| Natal                    | 2001 | 712,317          | 1.72                            | 1,223,000                    | 1,223                  |
| Nilopolis                | 2001 | 153,712          | 1.63                            | 250,000                      | 250                    |
| Niteroi                  | 2001 | 459,451          | 1.47                            | 675,300                      | 675                    |
| Nossa Senhora do Socorro | 2001 | 131,679          | 0.38                            | 50,500                       | 51                     |
| Nova Friburgo            | 2001 | 173,418          | 0.81                            | 140,000                      | 140                    |
| Nova Iguacu              | 2001 | 920,599          | 0.75                            | 693,900                      | 694                    |
| Novo Hamburgo            | 2001 | 236,193          | 0.66                            | 155,000                      | 155                    |
| Olinda                   | 2001 | 367,902          | 1.05                            | 385,600                      | 386                    |
| Osasco                   | 2001 | 652,593          | 0.87                            | 570,000                      | 570                    |
| Palhoca                  | 2001 | 102,742          | 0.24                            | 25,000                       | 25                     |
| Palmas                   | 2001 | 137,355          | 0.59                            | 81,000                       | 81                     |
| Paranagua                | 2001 | 127,339          | 1.10                            | 140,000                      | 140                    |
| Parnaiba                 | 2001 | 132,282          | 0.94                            | 125,000                      | 125                    |
| Parnamirim               | 2001 | 124,690          | 0.40                            | 50,000                       | 50                     |
| Passo Fundo              | 2001 | 168,458          | 0.60                            | 101,300                      | 101                    |
| Patos de Minas           | 2001 | 123,881          | 0.66                            | 82,000                       | 82                     |
| Paulista                 | 2001 | 262,237          | 0.76                            | 200,000                      | 200                    |
| Pelotas                  | 2001 | 323,158          | 0.56                            | 180,000                      | 180                    |
| Petrolina                | 2001 | 218,538          | 0.64                            | 140,000                      | 140                    |
| Petropolis               | 2001 | 286,537          | 1.05                            | 300,000                      | 300                    |
| Pindamonhangaba          | 2001 | 126,026          | 0.99                            | 125,000                      | 125                    |
| Pinhais                  | 2001 | 102,985          | 0.58                            | 60,000                       | 60                     |
| Piracicaba               | 2001 | 329,158          | 0.73                            | 239,700                      | 240                    |
| Pocos de Caldas          | 2001 | 135,627          | 0.66                            | 90,000                       | 90                     |
| Ponta Grossa             | 2001 | 273,616          | 1.03                            | 280,900                      | 281                    |
| Porto Alegre             | 2001 | 1,360,590        | 0.98                            | 1,340,000                    | 1,340                  |
| Porto Velho              | 2001 | 334,661          | 0.58                            | 193,400                      | 193                    |
| Pouso Alegre             | 2001 | 106,776          | 0.84                            | 90,000                       | 90                     |
| Praia Grande             | 2001 | 193,582          | 0.93                            | 180,900                      | 181                    |
| Presidente Prudente      | 2001 | 189,186          | 0.53                            | 100,000                      | 100                    |
| Queimados                | 2001 | 121,993          | 0.53                            | 64,500                       | 65                     |
| Recife                   | 2001 | 1,422,905        | 0.97                            | 1,376,000                    | 1,376                  |
| Resende                  | 2001 | 104,549          | 0.97                            | 101,000                      | 101                    |
| Ribeirao das Neves       | 2001 | 246,846          | 0.97                            | 240,000                      | 240                    |
| Ribeirao Pires           | 2001 | 104,508          | 1.71                            | 179,000                      | 179                    |
| Ribeirao Preto           | 2001 | 504,923          | 0.89                            | 450,000                      | 450                    |
| Rio Branco               | 2001 | 253,059          | 0.56                            | 141,200                      | 141                    |
| Rio Claro                | 2001 | 168,218          | 0.74                            | 125,100                      | 125                    |
| Rio de Janeiro           | 2001 | 5,857,904        | 1.20                            | 7,058,700                    | 7,059                  |
| Rio Grande               | 2001 | 186,544          | 1.29                            | 240,000                      | 240                    |
| Rio Verde                | 2001 | 116,552          | 0.87                            | 101,300                      | 101                    |
| Rondonopolis             | 2001 | 150,227          | 0.55                            | 82,000                       | 82                     |
| Sabara                   | 2001 | 115,352          | 0.52                            | 60,200                       | 60                     |
| Salvador                 | 2001 | 2,443,107        | 1.08                            | 2,636,500                    | 2,637                  |
| Santa Barbara D Oeste    | 2001 | 170,078          | 0.83                            | 141,000                      | 141                    |

**ANNEX F (continued)****MSW Generation Data for Cities Over 100,000**

| City                     | Year | Urban Population | Generation Rate (kg/capita/day) | Total MSW Generated (kg/day) | Total Waste (tons/day) |
|--------------------------|------|------------------|---------------------------------|------------------------------|------------------------|
| Santa Cruz do Sul        | 2001 | 107,632          | 0.51                            | 55,000                       | 55                     |
| Santa Luzia              | 2001 | 184,903          | 0.49                            | 91,300                       | 91                     |
| Santa Maria              | 2001 | 243,611          | 0.66                            | 160,000                      | 160                    |
| Santa Rita               | 2001 | 115,844          | 0.65                            | 75,000                       | 75                     |
| Santarem                 | 2001 | 262,538          | 0.51                            | 133,700                      | 134                    |
| Santo Andre              | 2001 | 649,331          | 0.99                            | 640,000                      | 640                    |
| Santos                   | 2001 | 417,983          | 1.10                            | 460,000                      | 460                    |
| Sao Bernardo do Campo    | 2001 | 703,177          | 0.81                            | 566,700                      | 567                    |
| Sao Caetano do Sul       | 2001 | 140,159          | 1.43                            | 200,000                      | 200                    |
| Sao Carlos               | 2001 | 192,998          | 0.69                            | 133,300                      | 133                    |
| Sao Goncalo              | 2001 | 891,119          | 0.70                            | 620,000                      | 620                    |
| Sao Joao de Meriti       | 2001 | 449,476          | 0.69                            | 312,000                      | 312                    |
| Sao Jose                 | 2001 | 173,559          | 1.18                            | 205,000                      | 205                    |
| Sao Jose de Ribamar      | 2001 | 107,384          | 0.47                            | 50,000                       | 50                     |
| Sao Jose do Rio Preto    | 2001 | 358,523          | 1.03                            | 367,900                      | 368                    |
| Sao Jose dos Campos      | 2001 | 539,313          | 1.23                            | 661,600                      | 662                    |
| Sao Jose dos Pinhais     | 2001 | 204,316          | 0.69                            | 140,000                      | 140                    |
| Sao Leopoldo             | 2001 | 193,547          | 0.52                            | 100,000                      | 100                    |
| Sao Luis                 | 2001 | 870,028          | 0.85                            | 740,000                      | 740                    |
| Sao Paulo                | 2001 | 10,434,252       | 2.00                            | 20,855,700                   | 20,856                 |
| Sao Vicente              | 2001 | 303,551          | 0.96                            | 290,000                      | 290                    |
| Sapucaia do Sul          | 2001 | 122,751          | 0.59                            | 73,000                       | 73                     |
| Serra                    | 2001 | 321,181          | 1.12                            | 358,700                      | 359                    |
| Sete Lagoas              | 2001 | 184,871          | 0.78                            | 145,000                      | 145                    |
| Sobral                   | 2001 | 155,276          | 0.89                            | 138,000                      | 138                    |
| Sorocaba                 | 2001 | 493,468          | 0.92                            | 455,000                      | 455                    |
| Sumare                   | 2001 | 196,723          | 0.91                            | 180,000                      | 180                    |
| Suzano                   | 2001 | 228,690          | 0.58                            | 133,000                      | 133                    |
| Taboao da Serra          | 2001 | 197,644          | 0.84                            | 167,000                      | 167                    |
| Taubate                  | 2001 | 244,165          | 0.67                            | 162,500                      | 163                    |
| Teixeira de Freitas      | 2001 | 107,486          | 0.88                            | 95,000                       | 95                     |
| Teofilo Otoni            | 2001 | 129,424          | 0.40                            | 52,000                       | 52                     |
| Teresina                 | 2001 | 715,360          | 1.48                            | 1,058,900                    | 1,059                  |
| Teresopolis              | 2001 | 138,081          | 0.83                            | 115,000                      | 115                    |
| Timon                    | 2001 | 129,692          | 0.33                            | 42,200                       | 42                     |
| Uberaba                  | 2001 | 252,051          | 1.55                            | 391,000                      | 391                    |
| Uberlandia               | 2001 | 501,214          | 0.90                            | 451,600                      | 452                    |
| Uruguiana                | 2001 | 126,936          | 0.79                            | 100,000                      | 100                    |
| Varginha                 | 2001 | 108,998          | 1.03                            | 112,000                      | 112                    |
| Varzea Grande            | 2001 | 215,298          | 0.58                            | 125,000                      | 125                    |
| Viamao                   | 2001 | 227,429          | 0.77                            | 175,000                      | 175                    |
| Vila Velha               | 2001 | 345,965          | 0.95                            | 330,000                      | 330                    |
| Vitoria                  | 2001 | 292,304          | 1.08                            | 315,000                      | 315                    |
| Vitoria da Conquista     | 2001 | 262,494          | 1.32                            | 346,000                      | 346                    |
| Vitoria de Santo Antao   | 2001 | 117,609          | 1.36                            | 160,000                      | 160                    |
| Volta Redonda            | 2001 | 242,063          | 0.66                            | 160,000                      | 160                    |
| <b>Chile</b>             |      |                  |                                 |                              |                        |
| Antofagasta, Antofagasta | 2001 | 318,779          | 0.80                            | 255,023                      | 255                    |
| Antofagasta, Calama      | 2001 | 138,402          | 0.65                            | 89,961                       | 90                     |
| Araucanía, Temuco        | 2001 | 245,347          | 1.03                            | 252,707                      | 253                    |
| B.O'Higgins, Rancagua    | 2001 | 214,344          | 0.80                            | 171,475                      | 171                    |
| Biobío, Chillán          | 2001 | 161,953          | 1.00                            | 161,953                      | 162                    |
| Biobío, Concepción       | 2001 | 216,061          | 0.80                            | 172,849                      | 173                    |
| Biobío, Talcahuano       | 2001 | 250,348          | 0.94                            | 235,327                      | 235                    |

**ANNEX F (continued)****MSW Generation Data for Cities Over 100,000**

| City                     | Year | Urban Population | Generation Rate (kg/capita/day) | Total MSW Generated (kg/day) | Total Waste (tons/day) |
|--------------------------|------|------------------|---------------------------------|------------------------------|------------------------|
| Coquimbo, Coquimbo       | 2001 | 163,036          | 0.90                            | 146,732                      | 147                    |
| Coquimbo, La Serena      | 2001 | 160,148          | 0.95                            | 152,141                      | 152                    |
| Los Lagos, Osorno        | 2001 | 145,475          | 1.00                            | 145,475                      | 145                    |
| Los Lagos, Puerto Montt  | 2001 | 175,938          | 1.00                            | 175,938                      | 176                    |
| Los Lagos, Valdivia      | 2001 | 140,559          | 0.42                            | 59,035                       | 59                     |
| Magallanes, Punta Arenas | 2001 | 120,874          | 0.80                            | 96,699                       | 97                     |
| Maule, Curicó            | 2001 | 120,299          | 1.00                            | 120,299                      | 120                    |
| Maule, Talca             | 2001 | 203,231          | 0.95                            | 193,069                      | 193                    |
| Santiago, Cerro Navia    | 2001 | 148,312          | 1.00                            | 148,460                      | 148                    |
| Santiago, La Florida     | 2001 | 365,674          | 1.00                            | 365,674                      | 366                    |
| Santiago, La Pintana     | 2001 | 190,085          | 0.68                            | 129,258                      | 129                    |
| Santiago, Maipú          | 2001 | 468,390          | 1.01                            | 472,137                      | 472                    |
| Santiago, Providencia    | 2001 | 120,874          | 1.40                            | 169,224                      | 169                    |
| Santiago, Recoleta       | 2001 | 148,220          | 1.21                            | 179,346                      | 179                    |
| Santiago, Santiago       | 2001 | 200,792          | 1.63                            | 327,893                      | 328                    |
| Tarapacá, Arica          | 2001 | 185,268          | 0.71                            | 131,540                      | 132                    |
| Valparaíso, Valparaíso   | 2001 | 275,982          | 1.00                            | 275,982                      | 276                    |
| Valparaíso, Viña del Mar | 2001 | 286,931          | 0.96                            | 275,454                      | 275                    |
| <b>Colombia</b>          |      |                  |                                 |                              |                        |
| Armenia                  | 2001 | 293,000          | 0.58                            | 169,940                      | 170                    |
| Barrancabermeja          | 2001 | 183,000          | 0.60                            | 109,800                      | 110                    |
| Barranquilla             | 2001 | 1,276,000        | 0.80                            | 1,020,800                    | 1,021                  |
| Bello                    | 2001 | 353,000          | 0.49                            | 172,970                      | 173                    |
| Bogotá                   | 2001 | 6,558,000        | 0.72                            | 4,721,760                    | 4,722                  |
| Bucaramanga              | 2001 | 543,000          | 0.55                            | 298,650                      | 299                    |
| Buenaventura             | 2001 | 230,000          | 0.65                            | 149,500                      | 150                    |
| Buga                     | 2001 | 113,000          | 0.61                            | 68,930                       | 69                     |
| Cali                     | 2001 | 2,181,000        | 0.77                            | 1,679,370                    | 1,679                  |
| Cartagena                | 2001 | 854,000          | 0.87                            | 742,980                      | 743                    |
| Cartago                  | 2001 | 129,000          | 0.44                            | 56,760                       | 57                     |
| Cúcuta                   | 2001 | 644,000          | 0.46                            | 296,240                      | 296                    |
| Dosquebradas             | 2001 | 166,000          | 0.40                            | 66,400                       | 66                     |
| Envigado                 | 2001 | 145,000          | 0.31                            | 44,950                       | 45                     |
| Florencia                | 2001 | 116,000          | 1.04                            | 120,640                      | 121                    |
| Floridablanca            | 2001 | 232,000          | 0.50                            | 116,000                      | 116                    |
| Girardot                 | 2001 | 117,000          | 1.02                            | 119,340                      | 119                    |
| Ibagué                   | 2001 | 403,000          | 0.63                            | 253,890                      | 254                    |
| Itagüí                   | 2001 | 246,000          | 0.62                            | 152,520                      | 153                    |
| Maicao                   | 2001 | 115,000          | 0.60                            | 69,000                       | 69                     |
| Manizales                | 2001 | 345,000          | 0.72                            | 248,400                      | 248                    |
| Medellín                 | 2001 | 1,909,000        | 0.81                            | 1,546,290                    | 1,546                  |
| Montería                 | 2001 | 256,000          | 0.60                            | 153,600                      | 154                    |
| Neiva                    | 2001 | 317,000          | 0.80                            | 253,600                      | 254                    |
| Palmira                  | 2001 | 234,000          | 0.66                            | 154,440                      | 154                    |
| Pasto                    | 2001 | 349,000          | 0.61                            | 212,890                      | 213                    |
| Pereira                  | 2001 | 401,000          | 0.58                            | 232,580                      | 233                    |
| Popayán                  | 2001 | 206,000          | 0.67                            | 138,020                      | 138                    |
| Santa Marta              | 2001 | 382,000          | 0.72                            | 275,040                      | 275                    |
| Sincelejo                | 2001 | 234,000          | 0.51                            | 119,340                      | 119                    |
| Soacha                   | 2001 | 285,000          | 0.88                            | 250,800                      | 251                    |
| Sogamoso                 | 2001 | 114,000          | 0.38                            | 43,320                       | 43                     |
| Soledad                  | 2001 | 310,000          | 0.60                            | 186,000                      | 186                    |

**ANNEX F (continued)****MSW Generation Data for Cities Over 100,000**

| City                             | Year | Urban Population | Generation Rate (kg/capita/day) | Total MSW Generated (kg/day) | Total Waste (tons/day) |
|----------------------------------|------|------------------|---------------------------------|------------------------------|------------------------|
| Tuluá                            | 2001 | 157,000          | 0.75                            | 117,750                      | 118                    |
| Tunja                            | 2001 | 112,000          | 0.79                            | 88,480                       | 88                     |
| Valledupar                       | 2001 | 278,000          | 0.85                            | 236,300                      | 236                    |
| Villavicencio                    | 2001 | 289,000          | 0.51                            | 147,390                      | 147                    |
| <b>Costa Rica</b>                |      |                  |                                 |                              |                        |
| Alajuela                         | 2001 | 234,737          | 0.85                            | 199,526                      | 200                    |
| Desamparados                     | 2001 | 203,770          | 1.38                            | 281,203                      | 281                    |
| San José                         | 2001 | 326,384          | 1.02                            | 332,585                      | 333                    |
| <b>Cuba</b>                      |      |                  |                                 |                              |                        |
| Bayamo                           | 2001 | 154,832          | 0.44                            | 67,662                       | 68                     |
| Camagüey                         | 2001 | 308,288          | 0.50                            | 154,144                      | 154                    |
| Ciego de Ávila                   | 2001 | 118,935          | 0.41                            | 48,763                       | 49                     |
| Cienfuegos                       | 2001 | 154,897          | 0.75                            | 116,173                      | 116                    |
| Ciudad de La Habana              | 2001 | 2,186,632        | 0.75                            | 1,639,974                    | 1,640                  |
| Guantánamo                       | 2001 | 222,217          | 0.56                            | 124,442                      | 124                    |
| Holguín                          | 2001 | 268,843          | 0.50                            | 134,422                      | 134                    |
| Manzanillo                       | 2001 | 110,846          | 0.44                            | 48,440                       | 48                     |
| Matanzas                         | 2001 | 133,177          | 0.60                            | 79,906                       | 80                     |
| Pinar del Río                    | 2001 | 162,078          | 0.60                            | 97,247                       | 97                     |
| Sancti Spíritus                  | 2001 | 109,220          | 0.58                            | 63,348                       | 63                     |
| Santa Clara                      | 2001 | 220,345          | 0.58                            | 127,800                      | 128                    |
| Santiago de Cuba                 | 2001 | 452,307          | 0.50                            | 226,154                      | 226                    |
| Tunas                            | 2001 | 144,381          | 0.47                            | 67,859                       | 68                     |
| <b>Ecuador*</b>                  |      |                  |                                 |                              |                        |
| Quito                            | 2001 | 1,841,200        | 0.72                            | 1,325,664                    | 1,326                  |
| Santo Domingo de los Colorados   | 2001 | 200,421          | 0.65                            | 130,274                      | 130                    |
| <b>El Salvador</b>               |      |                  |                                 |                              |                        |
| La Libertad - Nueva San Salvador | 2001 | 136,909          | 0.70                            | 95,836                       | 96                     |
| San Miguel, San Miguel           | 2001 | 172,203          | 0.82                            | 141,206                      | 141                    |
| San Salvador - Apopa             | 2001 | 139,802          | 0.54                            | 75,493                       | 75                     |
| San Salvador - Ilopango,         | 2001 | 115,358          | 0.51                            | 58,833                       | 59                     |
| San Salvador - Mejicanos         | 2001 | 172,548          | 0.61                            | 105,254                      | 105                    |
| San Salvador - Soyapango         | 2001 | 285,286          | 0.57                            | 162,613                      | 163                    |
| San Salvador, San Salvador       | 2001 | 479,605          | 0.81                            | 388,480                      | 388                    |
| Santa Ana, Santa Ana             | 2001 | 167,975          | 0.63                            | 105,824                      | 106                    |
| <b>Grenada</b>                   |      |                  |                                 |                              |                        |
| Grenada                          | 2001 | 95,551           | 0.85                            | 81,218                       | 81                     |
| <b>Guatemala</b>                 |      |                  |                                 |                              |                        |
| Antigua Guatemala                | 2001 | 248,019          | 1.20                            | 297,623                      | 298                    |
| Guatemala                        | 2001 | 2,541,581        | 0.95                            | 2,414,502                    | 2,415                  |
| Jutiapa                          | 2001 | 130,000          | 0.90                            | 117,000                      | 117                    |
| Quetzaltenango                   | 2001 | 122,157          | 0.90                            | 109,941                      | 110                    |
| San Benito                       | 2001 | 366,735          | 0.80                            | 293,388                      | 293                    |
| San Pedro Carchá                 | 2001 | 130,118          | 0.85                            | 110,600                      | 111                    |
| <b>Guyana</b>                    |      |                  |                                 |                              |                        |
| Georgetown                       | 2001 | 180,000          | 1.53                            | 275,400                      | 275                    |
| <b>Haiti</b>                     |      |                  |                                 |                              |                        |
| Cap-Haïtien                      | 2001 | 141,061          | 0.60                            | 84,637                       | 85                     |
| Carrefour                        | 2001 | 416,301          | 0.60                            | 249,781                      | 250                    |
| Croix des Bouquets               | 2001 | 143,803          | 0.30                            | 43,141                       | 43                     |
| Delmas                           | 2001 | 335,866          | 0.60                            | 201,520                      | 202                    |
| Dessalines                       | 2001 | 167,599          | 0.30                            | 50,280                       | 50                     |

**ANNEX F (continued)****MSW Generation Data for Cities Over 100,000**

| City  | Year | Urban Population | Generation Rate (kg/capita/day) | Total MSW Generated (kg/day) | Total Waste (tons/day) |
|---|------|------------------|---------------------------------|------------------------------|------------------------|
| Gonaïves  | 2001 | 138,480          | 0.30                            | 41,544                       | 42                     |
| Jacmel  | 2001 | 138,504          | 0.60                            | 83,102                       | 83                     |
| Jean Rabel  | 2001 | 121,221          | 0.30                            | 36,366                       | 36                     |
| Léogâne   | 2001 | 105,806          | 0.25                            | 26,452                       | 26                     |
| Les Cayes   | 2001 | 152,845          | 0.30                            | 45,854                       | 46                     |
| Pétion Ville  | 2001 | 143,452          | 0.60                            | 86,071                       | 86                     |
| Petit Goâve   | 2001 | 125,433          | 0.25                            | 31,358                       | 31                     |
| Petite Rivière de l'Artibonite                            | 2001 | 126,474          | 0.35                            | 44,266                       | 44                     |
| Port de Paix  | 2001 | 113,191          | 0.40                            | 45,276                       | 45                     |
| Port-au-Prince  | 2001 | 1,100,085        | 0.60                            | 660,051                      | 660                    |
| Saint Marc  | 2001 | 164,868          | 0.30                            | 49,460                       | 49                     |
| Saint Michel  | 2001 | 124,603          | 0.30                            | 37,381                       | 37                     |
| <b>Honduras</b>   |      |                  |                                 |                              |                        |
| Choloma   | 2001 | 126,402          | 0.70                            | 88,481                       | 88                     |
| Distrito Central  | 2001 | 819,867          | 0.67                            | 549,311                      | 549                    |
| La Ceiba  | 2001 | 126,721          | 0.63                            | 79,834                       | 80                     |
| San Pedro Sula  | 2001 | 483,384          | 0.69                            | 333,535                      | 334                    |
| <b>Jamaica*</b>   |      |                  |                                 |                              |                        |
| North Eastern Wasteshed(Portland, St.Mary and St.Ann)     | 2001 | 357,265          | 1.00                            | 357,265                      | 357                    |
| Portmore  | 2001 | 159,974          | 0.89                            | 142,377                      | 142                    |
| Retirement(Westmoreland, Hanover,Trelawny & St.James)     | 2001 | 452,724          | 1.00                            | 452,724                      | 453                    |
| Riverton ( Kgn, St.And, St.Cath. Clarendon and St.Thomas) | 2001 | 1,458,155        | 1.00                            | 1,458,155                    | 1,458                  |
| Southern(Manchester, St.Elizabeth)                        | 2001 | 331,190          | 1.00                            | 331,190                      | 331                    |
| <b>Mexico</b>   |      |                  |                                 |                              |                        |
| Acapulco, Guerrero  | 2001 | 728,010          | 0.94                            | 685,785                      | 686                    |
| Acuña, Coahuila   | 2001 | 117,271          | 0.89                            | 104,019                      | 104                    |
| Aguascalientes, Aguascalientes                            | 2001 | 656,245          | 0.80                            | 522,371                      | 522                    |
| Altamira, Tamaulipas                                      | 2001 | 130,425          | 0.85                            | 110,340                      | 110                    |
| Apatzingan, Michoacán                                     | 2001 | 108,466          | 0.53                            | 57,704                       | 58                     |
| Apodaca, Nuevo León                                       | 2001 | 297,776          | 1.17                            | 348,398                      | 348                    |
| Atizapan de Zaragoza, México                              | 2001 | 475,683          | 0.80                            | 380,546                      | 381                    |
| Atlixco, Puebla   | 2001 | 117,929          | 0.53                            | 62,974                       | 63                     |
| Boca del Río, Veracruz                                    | 2001 | 135,875          | 0.92                            | 124,733                      | 125                    |
| Campeche, Campeche  | 2001 | 219,281          | 0.94                            | 207,001                      | 207                    |
| Cancún, Benito Juárez, Quintana Roo                       | 2001 | 444,870          | 0.94                            | 418,178                      | 418                    |
| Cárdenas, Tabasco   | 2001 | 219,414          | 0.53                            | 116,948                      | 117                    |
| Carmen, Campeche  | 2001 | 169,784          | 0.94                            | 159,937                      | 160                    |
| Celaya, Guanajuato  | 2001 | 388,012          | 0.94                            | 364,731                      | 365                    |
| Chalco, México  | 2001 | 232,956          | 1.20                            | 279,547                      | 280                    |
| Chetumal, Othon P. Blanco, Quintana Roo                   | 2001 | 209,241          | 0.94                            | 196,896                      | 197                    |
| Chihuahua, Chihuahua                                      | 2001 | 676,160          | 0.97                            | 658,580                      | 659                    |
| Chilpancingo, Guerrero                                    | 2001 | 197,275          | 0.94                            | 186,030                      | 186                    |
| Coatzacoalcos, Veracruz                                   | 2001 | 268,673          | 0.94                            | 252,015                      | 252                    |
| Colima, Colima  | 2001 | 131,268          | 0.95                            | 124,048                      | 124                    |
| Comitán de Domínguez, Chiapas                             | 2001 | 107,065          | 0.52                            | 55,995                       | 56                     |
| Córdoba, Veracruz   | 2001 | 178,672          | 0.60                            | 107,739                      | 108                    |
| Cuauhtémoc, Chihuahua                                     | 2001 | 125,105          | 0.54                            | 67,056                       | 67                     |
| Cuautla, Morelos  | 2001 | 155,363          | 1.27                            | 197,311                      | 197                    |
| Cuernavaca, Morelos                                       | 2001 | 342,374          | 0.92                            | 316,354                      | 316                    |
| Culiacán, Sinaloa   | 2001 | 755,017          | 0.90                            | 677,250                      | 677                    |
| Delicias, Chihuahua                                       | 2001 | 117,215          | 0.92                            | 107,838                      | 108                    |
| Dolores Hidalgo, Guanajuato                               | 2001 | 130,748          | 0.53                            | 69,035                       | 69                     |

**ANNEX F (continued)****MSW Generation Data for Cities Over 100,000**

| City                                   | Year | Urban Population | Generation Rate (kg/capita/day) | Total MSW Generated (kg/day) | Total Waste (tons/day) |
|--|------|------------------|---------------------------------|------------------------------|------------------------|
| Durango, Durango                       | 2001 | 495,962          | 0.93                            | 461,245                      | 461                    |
| Ecatepec, México                       | 2001 | 1,655,225        | 1.28                            | 2,118,688                    | 2,119                  |
| Ensenada, Baja California              | 2001 | 381,747          | 0.93                            | 355,025                      | 355                    |
| Fresnillo, Zacatecas                   | 2001 | 183,941          | 0.53                            | 98,041                       | 98                     |
| General Escobedo, Nuevo León           | 2001 | 246,166          | 1.18                            | 289,245                      | 289                    |
| Gómez Palacio, Durango                 | 2001 | 276,085          | 0.94                            | 258,139                      | 258                    |
| Guadalajara, Jalisco                   | 2001 | 1,650,776        | 1.20                            | 1,980,931                    | 1,981                  |
| Guadalupe, Nuevo León                  | 2001 | 679,230          | 1.18                            | 801,491                      | 801                    |
| Guadalupe, Zacatecas                   | 2001 | 109,179          | 0.95                            | 103,174                      | 103                    |
| Guanajuato, Guanajuato                 | 2001 | 144,166          | 0.92                            | 132,921                      | 133                    |
| Guasave, Sinaloa                       | 2001 | 279,878          | 0.94                            | 263,925                      | 264                    |
| Guaymas, Sonora                        | 2001 | 129,236          | 1.05                            | 135,698                      | 136                    |
| Hermosillo, Sonora                     | 2001 | 619,185          | 0.99                            | 615,470                      | 615                    |
| Hidalgo del Parral, Chihuahua          | 2001 | 101,390          | 0.76                            | 76,752                       | 77                     |
| Hidalgo, Michoacán                     | 2001 | 106,922          | 0.54                            | 57,310                       | 57                     |
| Huixquilucan, México                   | 2001 | 198,564          | 1.13                            | 224,377                      | 224                    |
| Iguala, Guerrero                       | 2001 | 125,395          | 0.93                            | 116,994                      | 117                    |
| Irapuato, Guanajuato                   | 2001 | 445,778          | 0.95                            | 423,489                      | 423                    |
| Juárez, Chihuahua                      | 2001 | 1,264,121        | 1.22                            | 1,543,492                    | 1,543                  |
| La Paz, Baja California Sur            | 2001 | 199,712          | 1.42                            | 283,591                      | 284                    |
| Lagos de Moreno, Jalisco               | 2001 | 128,407          | 0.54                            | 68,955                       | 69                     |
| Lázaro Cárdenas, Michoacán             | 2001 | 174,205          | 0.92                            | 160,965                      | 161                    |
| León, Guanajuato                       | 2001 | 1,153,998        | 1.10                            | 1,269,398                    | 1,269                  |
| Lerdo, Durango                         | 2001 | 113,705          | 0.85                            | 96,649                       | 97                     |
| Lerma, México                          | 2001 | 103,909          | 1.13                            | 117,417                      | 117                    |
| Los Cabos, Baja California Sur         | 2001 | 113,727          | 0.50                            | 56,864                       | 57                     |
| Los Mochis-Topolobampo, Ahome, Sinaloa | 2001 | 362,442          | 1.00                            | 362,442                      | 362                    |
| Madero, Tamaulipas                     | 2001 | 184,289          | 0.85                            | 155,908                      | 156                    |
| Mante, Tamaulipas                      | 2001 | 111,671          | 0.54                            | 59,967                       | 60                     |
| Manzanillo, Colima                     | 2001 | 127,443          | 0.95                            | 121,071                      | 121                    |
| Matamoros, Tamaulipas                  | 2001 | 427,966          | 0.98                            | 419,407                      | 419                    |
| Mazatlán, Sinaloa                      | 2001 | 385,047          | 0.94                            | 361,944                      | 362                    |
| Mérida, Yucatán                        | 2001 | 714,689          | 0.99                            | 705,398                      | 705                    |
| Metepec, México                        | 2001 | 197,699          | 1.13                            | 223,400                      | 223                    |
| Mexicali, Baja California              | 2001 | 779,523          | 0.94                            | 733,531                      | 734                    |
| México, Federal District               | 2001 | 8,615,955        | 1.38                            | 11,890,018                   | 11,890                 |
| Minatitlán, Veracruz                   | 2001 | 144,574          | 0.54                            | 78,070                       | 78                     |
| Monclova, Coahuila                     | 2001 | 194,458          | 0.98                            | 190,569                      | 191                    |
| Monterrey, Nuevo León                  | 2001 | 1,112,636        | 1.19                            | 1,324,037                    | 1,324                  |
| Morelia, Michoacán                     | 2001 | 628,801          | 0.89                            | 556,489                      | 556                    |
| Naucalpan, México                      | 2001 | 861,173          | 1.20                            | 1,033,408                    | 1,033                  |
| Navojoa, Sonora                        | 2001 | 141,412          | 0.94                            | 132,927                      | 133                    |
| Nezahualcoyotl, México                 | 2001 | 1,223,180        | 1.28                            | 1,565,670                    | 1,566                  |
| Nogales, Sonora                        | 2001 | 164,819          | 0.94                            | 154,930                      | 155                    |
| Nuevo Laredo, Tamaulipas               | 2001 | 317,877          | 1.47                            | 467,279                      | 467                    |
| Oaxaca, Oaxaca                         | 2001 | 259,343          | 0.92                            | 237,818                      | 238                    |
| Obregón, Cajeme, Sonora                | 2001 | 357,857          | 0.94                            | 336,386                      | 336                    |
| Orizaba, Veracruz                      | 2001 | 119,405          | 0.98                            | 117,256                      | 117                    |
| Pachuca, Hidalgo                       | 2001 | 249,838          | 0.80                            | 198,621                      | 199                    |
| Piedras Negras, Coahuila               | 2001 | 130,398          | 0.94                            | 122,574                      | 123                    |
| Poza Rica, Veracruz                    | 2001 | 152,318          | 1.05                            | 159,934                      | 160                    |
| Puebla, Puebla                         | 2001 | 1,372,446        | 1.38                            | 1,893,975                    | 1,894                  |
| Puerto Vallarta, Jalisco               | 2001 | 191,424          | 0.71                            | 135,528                      | 136                    |
| Querétaro, Querétaro                   | 2001 | 657,447          | 0.83                            | 542,394                      | 542                    |
| Reynosa, Tamaulipas                    | 2001 | 438,696          | 0.76                            | 333,409                      | 333                    |

**ANNEX F (continued)****MSW Generation Data for Cities Over 100,000**

| City                                  | Year | Urban Population | Generation Rate (kg/capita/day) | Total MSW Generated (kg/day) | Total Waste (tons/day) |
|---------------------------------------|------|------------------|---------------------------------|------------------------------|------------------------|
| Río Bravo, Tamaulipas                 | 2001 | 104,620          | 0.76                            | 79,511                       | 80                     |
| Salamanca, Guanajuato                 | 2001 | 228,239          | 0.62                            | 141,508                      | 142                    |
| Saltillo, Coahuila                    | 2001 | 587,730          | 0.86                            | 502,509                      | 503                    |
| San Andrés Tuxtla, Veracruz           | 2001 | 143,235          | 0.54                            | 77,060                       | 77                     |
| San Cristóbal de las Casas, Chiapas   | 2001 | 135,731          | 0.92                            | 125,008                      | 125                    |
| San Francisco del Rincón, Guanajuato  | 2001 | 100,805          | 0.54                            | 54,031                       | 54                     |
| San Juan Bautista de Tuxtepec, Oaxaca | 2001 | 134,895          | 0.53                            | 71,899                       | 72                     |
| San Juan del Río, Querétaro           | 2001 | 184,679          | 0.50                            | 92,340                       | 92                     |
| San Luis Potosí, San Luis Potosí      | 2001 | 678,645          | 0.97                            | 658,286                      | 658                    |
| San Luis Río Colorado, Sonora         | 2001 | 147,912          | 0.94                            | 139,037                      | 139                    |
| San Martín Texmelucan, Puebla         | 2001 | 123,072          | 0.80                            | 98,458                       | 98                     |
| San Miguel de Allende, Guanajuato     | 2001 | 138,393          | 0.52                            | 71,964                       | 72                     |
| San Nicolás de los Garza, Nuevo León  | 2001 | 497,078          | 1.20                            | 596,494                      | 596                    |
| San Pedro Garza García, Nuevo León    | 2001 | 127,254          | 1.10                            | 139,979                      | 140                    |
| Santa Catarina, Nuevo León            | 2001 | 231,809          | 1.20                            | 277,012                      | 277                    |
| Silao, Guanajuato                     | 2001 | 134,539          | 0.53                            | 71,306                       | 71                     |
| Soledad de Graciano, San Luis Potosí  | 2001 | 185,063          | 0.53                            | 97,528                       | 98                     |
| Tampico, Tamaulipas                   | 2001 | 298,063          | 0.85                            | 252,161                      | 252                    |
| Tapachula, Chiapas                    | 2001 | 276,743          | 0.94                            | 259,862                      | 260                    |
| Taxco, Guerrero                       | 2001 | 100,889          | 0.94                            | 94,836                       | 95                     |
| Tecomán, Colima                       | 2001 | 101,049          | 0.53                            | 53,556                       | 54                     |
| Tehuacán, Puebla                      | 2001 | 233,807          | 0.91                            | 212,998                      | 213                    |
| Tepatitlán, Jalisco                   | 2001 | 121,076          | 0.53                            | 64,049                       | 64                     |
| Tepic, Nayarit                        | 2001 | 307,550          | 0.84                            | 256,804                      | 257                    |
| Tijuana, Baja California              | 2001 | 1,262,520        | 1.22                            | 1,537,749                    | 1,538                  |
| Tlajomulco, Jalisco                   | 2001 | 128,339          | 1.05                            | 134,756                      | 135                    |
| Tlalnepantla, México                  | 2001 | 722,279          | 1.04                            | 749,726                      | 750                    |
| Tlaquepaque, Jalisco                  | 2001 | 480,844          | 1.17                            | 562,587                      | 563                    |
| Toluca, México                        | 2001 | 687,969          | 1.16                            | 798,044                      | 798                    |
| Tonalá, Jalisco                       | 2001 | 350,648          | 1.18                            | 413,765                      | 414                    |
| Torreón, Coahuila                     | 2001 | 533,457          | 0.94                            | 502,516                      | 503                    |
| Tulancingo, Hidalgo                   | 2001 | 124,461          | 0.92                            | 115,002                      | 115                    |
| Tuxpan, Veracruz                      | 2001 | 126,257          | 0.54                            | 67,926                       | 68                     |
| Tuxtla Gutiérrez, Chiapas             | 2001 | 443,782          | 1.05                            | 463,752                      | 464                    |
| Uruapan, Michoacán                    | 2001 | 268,208          | 0.94                            | 252,920                      | 253                    |
| Valle de Chalco Solidaridad, México   | 2001 | 330,885          | 1.20                            | 397,062                      | 397                    |
| Valle de Santiago, Guanajuato         | 2001 | 130,553          | 0.54                            | 70,107                       | 70                     |
| Valles, San Luis Potosí               | 2001 | 147,086          | 0.94                            | 137,967                      | 138                    |
| Veracruz, Veracruz                    | 2001 | 463,812          | 0.92                            | 425,779                      | 426                    |
| Victoria, Tamaulipas                  | 2001 | 266,612          | 0.94                            | 251,415                      | 251                    |
| Villahermosa, Centro, Tabasco         | 2001 | 531,511          | 0.87                            | 462,415                      | 462                    |
| Xalapa, Veracruz                      | 2001 | 404,788          | 0.80                            | 323,830                      | 324                    |
| Zacatecas, Zacatecas                  | 2001 | 124,722          | 0.95                            | 117,862                      | 118                    |
| Zamora, Michoacán                     | 2001 | 161,425          | 0.71                            | 113,966                      | 114                    |
| Zapopan, Jalisco                      | 2001 | 1,018,447        | 1.20                            | 1,222,136                    | 1,222                  |
| Zitacuaro, Michoacán                  | 2001 | 139,514          | 0.53                            | 73,942                       | 74                     |
| <b>Nicaragua</b>                      |      |                  |                                 |                              |                        |
| Chinandega                            | 2001 | 124,107          | 0.61                            | 75,085                       | 75                     |
| León                                  | 2001 | 147,845          | 0.62                            | 90,925                       | 91                     |
| Managua                               | 2001 | 952,068          | 0.71                            | 676,920                      | 677                    |
| Masaya                                | 2001 | 115,369          | 0.61                            | 70,029                       | 70                     |
| Tipitapa                              | 2001 | 108,861          | 0.43                            | 46,266                       | 46                     |
| <b>Panama</b>                         |      |                  |                                 |                              |                        |

**ANNEX F (continued)****MSW Generation Data for Cities Over 100,000**

| City                              | Year | Urban Population | Generation Rate (kg/capita/day) | Total MSW Generated (kg/day) | Total Waste (tons/day) |
|-----------------------------------|------|------------------|---------------------------------|------------------------------|------------------------|
| Arraiján                          | 2001 | 149,918          | 0.66                            | 98,946                       | 99                     |
| Ciudad de Panamá                  | 2001 | 708,438          | 0.94                            | 665,932                      | 666                    |
| Colón                             | 2001 | 174,059          | 0.94                            | 163,615                      | 164                    |
| La Chorrera                       | 2001 | 124,656          | 0.70                            | 87,259                       | 87                     |
| San Miguelito                     | 2001 | 293,745          | 0.61                            | 179,184                      | 179                    |
| Paraguay                          |      |                  |                                 |                              |                        |
| Asunción                          | 2001 | 513,399          | 1.31                            | 673,579                      | 674                    |
| Ciudad del Este                   | 2001 | 223,350          | 1.04                            | 232,507                      | 233                    |
| Luque                             | 2001 | 170,433          | 1.08                            | 184,068                      | 184                    |
| San Lorenzo                       | 2001 | 202,745          | 1.07                            | 217,748                      | 218                    |
| Peru                              |      |                  |                                 |                              |                        |
| Callao, Callao Cercado            | 2001 | 449,282          | 0.81                            | 365,716                      | 366                    |
| Callao, Ventanilla                | 2001 | 148,767          | 0.68                            | 101,162                      | 101                    |
| Junín, El Tambo                   | 2001 | 165,357          | 0.73                            | 121,207                      | 121                    |
| Junín, Huancayo                   | 2001 | 112,203          | 0.64                            | 72,147                       | 72                     |
| Lima, Ate                         | 2001 | 410,734          | 0.56                            | 228,368                      | 228                    |
| Lima, Carabayllo                  | 2001 | 153,112          | 0.57                            | 87,733                       | 88                     |
| Lima, Chorrillos                  | 2001 | 264,645          | 0.58                            | 154,023                      | 154                    |
| Lima, Comas                       | 2001 | 469,747          | 0.52                            | 244,268                      | 244                    |
| Lima, El Agustino                 | 2001 | 166,902          | 0.62                            | 103,479                      | 103                    |
| Lima, Independencia               | 2001 | 200,365          | 0.70                            | 139,454                      | 139                    |
| Lima, La Molina                   | 2001 | 125,034          | 1.20                            | 150,541                      | 151                    |
| Lima, La Victoria                 | 2001 | 205,554          | 1.08                            | 222,409                      | 222                    |
| Lima, Lima Cercado                | 2001 | 286,202          | 1.13                            | 324,267                      | 324                    |
| Lima, Los Olivos                  | 2001 | 344,164          | 0.59                            | 203,745                      | 204                    |
| Lima, Lurigancho                  | 2001 | 123,142          | 0.52                            | 64,034                       | 64                     |
| Lima, Puente Piedra               | 2001 | 183,861          | 0.50                            | 91,379                       | 91                     |
| Lima, Rímac                       | 2001 | 192,449          | 0.59                            | 112,968                      | 113                    |
| Lima, San Borja                   | 2001 | 122,270          | 1.05                            | 128,261                      | 128                    |
| Lima, San Juan de Lurigancho      | 2001 | 751,155          | 0.60                            | 452,195                      | 452                    |
| Lima, San Juan de Miraflores      | 2001 | 387,641          | 0.71                            | 274,837                      | 275                    |
| Lima, San Martín de Porres        | 2001 | 448,345          | 0.79                            | 352,399                      | 352                    |
| Lima, San Miguel                  | 2001 | 134,908          | 0.78                            | 105,363                      | 105                    |
| Lima, Santa Anita                 | 2001 | 148,752          | 0.54                            | 80,177                       | 80                     |
| Lima, Santiago de Surco           | 2001 | 251,567          | 0.87                            | 219,618                      | 220                    |
| Lima, Villa El Salvador           | 2001 | 364,476          | 0.56                            | 202,649                      | 203                    |
| Lima, Villa María del Triunfo     | 2001 | 341,971          | 0.55                            | 186,716                      | 187                    |
| Piura, Castilla                   | 2001 | 106,926          | 0.61                            | 64,690                       | 65                     |
| Ucayali, Callería                 | 2001 | 246,856          | 0.70                            | 173,787                      | 174                    |
| Saint Lucia                       |      |                  |                                 |                              |                        |
| St. Lucia                         | 2001 | 162,157          | 1.18                            | 191,345                      | 191                    |
| Saint Vincent and the Grenadines* |      |                  |                                 |                              |                        |
| St. Vincent                       | 2001 | 106,916          | 0.34                            | 36,351                       | 36                     |
| Suriname                          |      |                  |                                 |                              |                        |
| Greater Paramaribo                | 2001 | 287,131          | 1.00                            | 287,131                      | 287                    |
| Trinidad and Tobago               |      |                  |                                 |                              |                        |
| Couva/Tabaquite/Talparo           | 2001 | 162,779          | 0.70                            | 113,945                      | 114                    |
| Diego Martin                      | 2001 | 105,720          | 0.70                            | 74,004                       | 74                     |
| San Juan/Laventille               | 2001 | 157,295          | 3.20                            | 503,344                      | 503                    |
| Tunapuna/Piarco                   | 2001 | 203,975          | 2.20                            | 448,745                      | 449                    |
| Uruguay                           |      |                  |                                 |                              |                        |

**ANNEX F (continued)****MSW Generation Data for Cities Over 100,000**

| City                                     | Year | Urban Population | Generation Rate (kg/capita/day) | Total MSW Generated (kg/day) | Total Waste (tons/day) |
|--|------|------------------|---------------------------------|------------------------------|------------------------|
| Canelones                                | 2001 | 539,130          | 0.90                            | 485,217                      | 485                    |
| Maldonado                                | 2001 | 137,390          | 0.90                            | 123,651                      | 124                    |
| Montevideo                               | 2001 | 1,303,182        | 1.23                            | 1,602,914                    | 1,603                  |
| <b>Venezuela</b>                         |      |                  |                                 |                              |                        |
| Distrito Capital                         | 2001 | 1,836,286        | 1.10                            | 2,019,915                    | 2,020                  |
| Municipio Barinas Edo Barinas            | 2001 | 283,273          | 0.69                            | 194,325                      | 194                    |
| Municipio Caroni Edo Bolívar             | 2001 | 704,168          | 0.74                            | 521,084                      | 521                    |
| Municipio German Roscio Edo Guarico      | 2001 | 103,706          | 0.85                            | 88,150                       | 88                     |
| Municipio Girardot Edo Aragua            | 2001 | 396,125          | 2.93                            | 1,160,646                    | 1,161                  |
| Municipio Iribarren Edo Lara             | 2001 | 895,989          | 0.52                            | 468,602                      | 469                    |
| Municipio Lagunillas Edo Zulia           | 2001 | 144,345          | 1.50                            | 216,518                      | 217                    |
| Municipio Maracaibo Edo Zulia            | 2001 | 1,405,933        | 1.08                            | 1,518,408                    | 1,518                  |
| Municipio Pedraza Edo Apure              | 2001 | 283,273          | 0.28                            | 80,166                       | 80                     |
| Municipio Simon Rodriguez Edo Anzoategui | 2001 | 147,800          | 1.15                            | 169,970                      | 170                    |
| <b>Middle East &amp; North Africa</b>    |      |                  |                                 |                              |                        |
| Egypt (UNSD 2009)                        |      |                  |                                 |                              |                        |
| Cairo                                    | 2007 | 7,765,000        | 1.77                            | 13,766,234                   | 13,766                 |
| Iran (Damghani et al. 2008)              |      |                  |                                 |                              |                        |
| Tehran                                   | 2005 | 8,203,666        | 0.88                            | 7,044,000                    | 7,044                  |
| Iraq (UNSD 2009)                         |      |                  |                                 |                              |                        |
| Baghdad                                  | 2005 | 6,784,000        | 1.71                            | 11,621,432                   | 11,621                 |
| <b>South Asia</b>                        |      |                  |                                 |                              |                        |
| India (CPCB 2005)                        |      |                  |                                 |                              |                        |
| Agartala                                 | 2005 | 189,998          | 0.40                            | 75,999                       | 76                     |
| Agra                                     | 2005 | 1,275,135        | 0.51                            | 650,319                      | 650                    |
| Ahmedabad                                | 2005 | 3,520,085        | 0.37                            | 1,302,431                    | 1,302                  |
| Aizwal                                   | 2005 | 228,280          | 0.25                            | 57,070                       | 57                     |
| Allahabad                                | 2005 | 975,393          | 0.52                            | 507,204                      | 507                    |
| Amritsar                                 | 2005 | 966,862          | 0.45                            | 435,088                      | 435                    |
| Asansol                                  | 2005 | 475,439          | 0.44                            | 209,193                      | 209                    |
| Banglore                                 | 2005 | 4,301,326        | 0.39                            | 1,677,517                    | 1,678                  |
| Bhopal                                   | 2005 | 1,437,354        | 0.40                            | 574,942                      | 575                    |
| Bhubaneswar                              | 2005 | 648,032          | 0.36                            | 233,292                      | 233                    |
| Chandigarh                               | 2005 | 808,515          | 0.40                            | 323,406                      | 323                    |
| Chennai                                  | 2005 | 4,343,645        | 0.62                            | 2,693,060                    | 2,693                  |
| Coimbatore                               | 2005 | 930,882          | 0.57                            | 530,603                      | 531                    |
| Dehradun                                 | 2005 | 426,674          | 0.31                            | 132,269                      | 132                    |
| Delhi                                    | 2005 | 10,306,452       | 0.57                            | 5,874,678                    | 5,875                  |
| Dhanbad                                  | 2005 | 199,258          | 0.39                            | 77,711                       | 78                     |
| Faridabad                                | 2005 | 1,055,938        | 0.42                            | 443,494                      | 443                    |
| Gandhinagar                              | 2005 | 195,985          | 0.22                            | 43,117                       | 43                     |
| Greater Mumbai                           | 2005 | 11,978,450       | 0.45                            | 5,390,303                    | 5,390                  |
| Guwahati                                 | 2005 | 809,895          | 0.20                            | 161,979                      | 162                    |
| Hyderabad                                | 2005 | 3,843,585        | 0.57                            | 2,190,843                    | 2,191                  |
| Imphal                                   | 2005 | 221,492          | 0.19                            | 42,083                       | 42                     |
| Indore                                   | 2005 | 1,474,968        | 0.38                            | 560,488                      | 560                    |
| Jabalpur                                 | 2005 | 932,484          | 0.23                            | 214,471                      | 214                    |
| Jaipur                                   | 2005 | 2,322,575        | 0.39                            | 905,804                      | 906                    |
| Jammu                                    | 2005 | 369,959          | 0.58                            | 214,576                      | 215                    |
| Jamshedpur                               | 2005 | 1,104,713        | 0.31                            | 342,461                      | 342                    |
| Kanpur                                   | 2005 | 2,551,337        | 0.43                            | 1,097,075                    | 1,097                  |
| Kochi                                    | 2005 | 595,575          | 0.67                            | 399,035                      | 399                    |

**ANNEX F (continued)****MSW Generation Data for Cities Over 100,000**

| City                         | Year | Urban Population | Generation Rate (kg/capita/day) | Total MSW Generated (kg/day) | Total Waste (tons/day) |
|------------------------------|------|------------------|---------------------------------|------------------------------|------------------------|
| Kolkata                      | 2005 | 4,572,876        | 0.58                            | 2,652,268                    | 2,652                  |
| Lucknow                      | 2005 | 2,185,927        | 0.22                            | 480,904                      | 481                    |
| Ludhiana                     | 2005 | 1,398,467        | 0.53                            | 741,188                      | 741                    |
| Madurai                      | 2005 | 928,868          | 0.30                            | 278,660                      | 279                    |
| Meerut                       | 2005 | 1,068,772        | 0.46                            | 491,635                      | 492                    |
| Nagpur                       | 2005 | 2,052,066        | 0.25                            | 513,017                      | 513                    |
| Nashik                       | 2005 | 1,077,236        | 0.19                            | 204,675                      | 205                    |
| Patna                        | 2005 | 1,366,444        | 0.37                            | 505,584                      | 506                    |
| Pondicherry                  | 2005 | 220,865          | 0.59                            | 130,310                      | 130                    |
| Pune                         | 2005 | 2,538,473        | 0.46                            | 1,167,698                    | 1,168                  |
| Raipur                       | 2005 | 605,747          | 0.30                            | 181,724                      | 182                    |
| Rajkot                       | 2005 | 967,476          | 0.21                            | 203,170                      | 203                    |
| Ranchi                       | 2005 | 847,093          | 0.25                            | 211,773                      | 212                    |
| Shillong                     | 2005 | 132,867          | 0.34                            | 45,175                       | 45                     |
| Simla                        | 2005 | 142,555          | 0.27                            | 38,490                       | 38                     |
| Srinagar                     | 2005 | 898,440          | 0.48                            | 431,251                      | 431                    |
| Surat                        | 2005 | 2,433,835        | 0.41                            | 997,872                      | 998                    |
| Tiruvananthapuram            | 2005 | 744,983          | 0.23                            | 171,346                      | 171                    |
| Vadodara                     | 2005 | 1,306,227        | 0.27                            | 352,681                      | 353                    |
| Varanasi                     | 2005 | 1,091,918        | 0.39                            | 425,848                      | 426                    |
| Vijaywada                    | 2005 | 851,282          | 0.44                            | 374,564                      | 375                    |
| Vishakhapatnam               | 2005 | 982,904          | 0.59                            | 579,913                      | 580                    |
| <b>Nepal (Alam 2008)</b>     |      |                  |                                 |                              |                        |
| Kathmandu                    | 2003 | 738,173          | 0.31                            | 226,800                      | 227                    |
| <b>Sri Lanka (UNSD 2009)</b> |      |                  |                                 |                              |                        |
| Dehiwala-Mount Lavinia       | 2007 | 209,787          | 0.73                            | 154,110                      | 154                    |
| Moratuwa                     | 2007 | 189,790          | 0.67                            | 127,854                      | 128                    |

**NOTES:**

\* Denotes domestic waste data as MSW figures are unknown.  
PAHO defines municipal waste and domestic waste as follows:

**PAHO definitions:****Municipal waste**

Solid or semi-solid waste generated in of population centers including domestic and commercial wastes, as well as those originated by the, small-scale industries and institutions (including hospital and clinics); markets street sweeping, and from public cleansing.

**Domestic waste**

Domestic solid or semi-solid waste generated by human activities a the household level.

\*\* China cities have populations over 750,000 inhabitants

**ANNEX G****MSW Collection Data for Cities Over 100,000**

| City   | Year | Urban Population | MSW Collection Coverage (%) |
|--|------|------------------|-----------------------------|
| <b>Africa</b>  |      |                  |                             |
| <b>Benin (UNSD 2009)</b>                             |      |                  |                             |
| Parakou  | 2002 | 148,450          | 10                          |
| <b>Burkina Faso (UNSD 2009)</b>                      |      |                  |                             |
| Ouagadougou  | 1995 | 876,200          | 51                          |
| <b>Cameroon (Parrot et al. 2009)</b>                 |      |                  |                             |
| Yaounde  | 2005 | 1,720,000        | 43                          |
| <b>Chad (Parrot et al. 2009)</b>                     |      |                  |                             |
| Ndjamena   | 2003 | 800,000          | 15 - 20                     |
| <b>Côte d'Ivoire (Parrot et al. 2009)</b>            |      |                  |                             |
| Abidjan  | 2002 | 2,777,000        | 30 - 40                     |
| <b>Guinea (UNSD 2009)</b>                            |      |                  |                             |
| Conakry  | 2007 | 3,000,000        | 76                          |
| <b>Kenya (Parrot et al. 2009)</b>                    |      |                  |                             |
| Nairobi  | 2006 | 2,312,000        | 30 - 45                     |
| <b>Mauritania (Parrot et al. 2009)</b>               |      |                  |                             |
| Nouakchott   | N/A  | 611,883          | 20 - 30                     |
| <b>Niger (UNSD 2009)</b>                             |      |                  |                             |
| Zinder**   | 2007 | 242,800          | 77                          |
| <b>Senegal (Parrot et al. 2009)</b>                  |      |                  |                             |
| Dakar  | 2003 | 1,708,000        | 30 - 40                     |
| <b>Tanzania (Parrot et al. 2009)</b>                 |      |                  |                             |
| Dar es Salaam  | N/A  | 2,500,000        | 48                          |
| <b>Togo (Parrot et al. 2009)</b>                     |      |                  |                             |
| Lome   | 2002 | 1,000,000        | 42                          |
| <b>Zambia (UNSD 2009)</b>                            |      |                  |                             |
| Lusaka   | 2005 | 1,300,000        | 18                          |
| <b>Zimbabwe (UNSD 2009)</b>                          |      |                  |                             |
| Harare   | 2007 | 2,500,000        | 99                          |
| <b>East Asia &amp; Pacific (UNSD 2009)</b>           |      |                  |                             |
| <b>China, Hong Kong SAR</b>                          |      |                  |                             |
| Hong Kong  | 2007 | 6,926,000        | 100                         |
| <b>China, Macao SAR</b>                              |      |                  |                             |
| Macao  | 2007 | 525,760          | 100                         |
| <b>Indonesia</b>                                     |      |                  |                             |
| Jakarta  | 2004 | 8,962,000        | 83                          |
| <b>Philippines</b>                                   |      |                  |                             |
| Manila   | 2007 | 1,660,714        | 95                          |
| <b>Eastern Europe &amp; Central Asia (UNSD 2009)</b> |      |                  |                             |
| <b>Albania</b>                                       |      |                  |                             |
| Tirana   | 2007 | 1,532,000        | 90                          |
| <b>Belarus</b>                                       |      |                  |                             |
| Minsk  | 2007 | 1,806,200        | 100                         |
| <b>Croatia</b>                                       |      |                  |                             |
| Zagreb   | 2006 | 784,900          | 100                         |
| <b>Georgia</b>                                       |      |                  |                             |
| Tbilisi  | 2007 | 1,300,000        | 100                         |
| Batumi   | 2007 | 303,200          | 62                          |
| Kutaisi  | 2007 | 185,960          | 95                          |

**ANNEX G (continued)****MSW Collection Data for Cities Over 100,000**

| City  | Year | Urban Population | MSW Collection Coverage (%) |
|---|------|------------------|-----------------------------|
| <b>Latin America and the Caribbean (PAHO, 2005)</b> |      |                  |                             |
| <b>Argentina</b>                                    |      |                  |                             |
| Area Metropolitana Buenos Aires                     | 2001 | 12,544,018       | 100                         |
| Bahía Blanca  | 2001 | 285,000          | 100                         |
| Cordoba   | 2001 | 1,283,396        | 100                         |
| Neuquen   | 2001 | 202,518          | 100                         |
| Parana  | 2001 | 245,677          | 100                         |
| Rafaela   | 2001 | 100,000          | 100                         |
| Rio Cuarto  | 2001 | 154,127          | 100                         |
| Rosario   | 2001 | 906,004          | 100                         |
| Salta Capital                                       | 2001 | 472,971          | 100                         |
| <b>Bahamas</b>                                      |      |                  |                             |
| Nassau, Bahamas                                     | 2001 | 200,000          | 100                         |
| <b>Barbados*</b>                                    |      |                  |                             |
| Barbados  | 2001 | 268,792          | 100                         |
| <b>Bolivia*</b>                                     |      |                  |                             |
| Cochabamba  | 2001 | 717,026          | 90                          |
| El Alto   | 2001 | 629,955          | 76                          |
| La Paz  | 2001 | 790,353          | 87                          |
| Oruro   | 2001 | 201,230          | 92                          |
| Potosí  | 2001 | 135,783          | 88                          |
| Santa Cruz de la Sierra                             | 2001 | 1,113,000        | 88                          |
| Sucre   | 2001 | 193,876          | 85                          |
| Tarija  | 2001 | 135,783          | 93                          |
| <b>Chile</b>  |      |                  |                             |
| Antofagasta, Antofagasta                            | 2001 | 318,779          | 99                          |
| Antofagasta, Calama                                 | 2001 | 138,402          | 100                         |
| Araucanía, Temuco                                   | 2001 | 245,347          | 100                         |
| B.O'Higgins, Rancagua                               | 2001 | 214,344          | 100                         |
| Biobío, Chillán                                     | 2001 | 161,953          | 100                         |
| Biobío, Concepción                                  | 2001 | 216,061          | 100                         |
| Biobío, Talcahuano                                  | 2001 | 250,348          | 100                         |
| Coquimbo, Coquimbo                                  | 2001 | 163,036          | 100                         |
| Coquimbo, La Serena                                 | 2001 | 160,148          | 100                         |
| Los Lagos, Osorno                                   | 2001 | 145,475          | 100                         |
| Los Lagos, Puerto Montt                             | 2001 | 175,938          | 100                         |
| Los Lagos, Valdivia                                 | 2001 | 140,559          | 100                         |
| Magallanes, Punta Arenas                            | 2001 | 120,874          | 100                         |
| Maule, Curicó                                       | 2001 | 120,299          | 100                         |
| Maule, Talca  | 2001 | 203,231          | 100                         |
| Santiago, Cerro Navia                               | 2001 | 148,312          | 100                         |
| Santiago, La Florida                                | 2001 | 365,674          | 100                         |
| Santiago, La Pintana                                | 2001 | 190,085          | 100                         |
| Santiago, Maipú                                     | 2001 | 468,390          | 100                         |
| Santiago, Providencia                               | 2001 | 120,874          | 100                         |
| Santiago, Recoleta                                  | 2001 | 148,220          | 100                         |
| Santiago, Santiago                                  | 2001 | 200,792          | 100                         |
| Tarapacá, Arica                                     | 2001 | 185,268          | 100                         |
| Valparaíso, Valparaíso                              | 2001 | 275,982          | 100                         |
| Valparaíso, Viña del Mar                            | 2001 | 286,931          | 100                         |

**ANNEX G (continued)****MSW Collection Data for Cities Over 100,000**

| <b>City</b>         | <b>Year</b> | <b>Urban Population</b> | <b>MSW Collection Coverage (%)</b> |
|---------------------|-------------|-------------------------|------------------------------------|
| <b>Colombia</b>     |             |                         |                                    |
| Armenia             | 2001        | 293,000                 | 100                                |
| Barrancabermeja     | 2001        | 183,000                 | 100                                |
| Barranquilla        | 2001        | 1,276,000               | 100                                |
| Bello               | 2001        | 353,000                 | 97                                 |
| Bogotá              | 2001        | 6,558,000               | 100                                |
| Bucaramanga         | 2001        | 543,000                 | 100                                |
| Buenaventura        | 2001        | 230,000                 | 80                                 |
| Buga                | 2001        | 113,000                 | 100                                |
| Cali                | 2001        | 2,181,000               | 97                                 |
| Cartagena           | 2001        | 854,000                 | 97                                 |
| Cartago             | 2001        | 129,000                 | 98                                 |
| Cúcuta              | 2001        | 644,000                 | 100                                |
| Dosquebradas        | 2001        | 166,000                 | 84                                 |
| Envigado            | 2001        | 145,000                 | 99                                 |
| Florencia           | 2001        | 116,000                 | 80                                 |
| Floridablanca       | 2001        | 232,000                 | 95                                 |
| Girardot            | 2001        | 117,000                 | 95                                 |
| Ibagué              | 2001        | 403,000                 | 97                                 |
| Itagüí              | 2001        | 246,000                 | 98                                 |
| Maicao              | 2001        | 115,000                 | 100                                |
| Manizales           | 2001        | 345,000                 | 100                                |
| Medellín            | 2001        | 1,909,000               | 100                                |
| Montería            | 2001        | 256,000                 | 100                                |
| Neiva               | 2001        | 317,000                 | 98                                 |
| Palmira             | 2001        | 234,000                 | 100                                |
| Pasto               | 2001        | 349,000                 | 100                                |
| Pereira             | 2001        | 401,000                 | 94                                 |
| Popayán             | 2001        | 206,000                 | 98                                 |
| Santa Marta         | 2001        | 382,000                 | 97                                 |
| Sincelejo           | 2001        | 234,000                 | 100                                |
| Soacha              | 2001        | 285,000                 | 95                                 |
| Sogamoso            | 2001        | 114,000                 | 81                                 |
| Soledad             | 2001        | 310,000                 | 100                                |
| Tuluá               | 2001        | 157,000                 | 100                                |
| Tunja               | 2001        | 112,000                 | 100                                |
| Valledupar          | 2001        | 278,000                 | 98                                 |
| Villavicencio       | 2001        | 289,000                 | 98                                 |
| <b>Costa Rica</b>   |             |                         |                                    |
| Alajuela            | 2001        | 234,737                 | 82                                 |
| Desamparados        | 2001        | 203,770                 | 40                                 |
| San José            | 2001        | 326,384                 | 100                                |
| <b>Cuba</b>         |             |                         |                                    |
| Bayamo              | 2001        | 154,832                 | 100                                |
| Camagüey            | 2001        | 308,288                 | 100                                |
| Ciego de Ávila      | 2001        | 118,935                 | 100                                |
| Cienfuegos          | 2001        | 154,897                 | 97                                 |
| Ciudad de La Habana | 2001        | 2,186,632               | 100                                |
| Guantánamo          | 2001        | 222,217                 | 100                                |
| Holguín             | 2001        | 268,843                 | 100                                |
| Manzanillo          | 2001        | 110,846                 | 100                                |

**ANNEX G (continued)****MSW Collection Data for Cities Over 100,000**

| City  | Year | Urban Population | MSW Collection Coverage (%) |
|---|------|------------------|-----------------------------|
| Matanzas  | 2001 | 133,177          | 100                         |
| Pinar del Río   | 2001 | 162,078          | 100                         |
| Sancti Spíritus   | 2001 | 109,220          | 91                          |
| Santa Clara   | 2001 | 220,345          | 98                          |
| Santiago de Cuba  | 2001 | 452,307          | 100                         |
| Tunas   | 2001 | 144,381          | 100                         |
| <b>Dominican Republic</b>                                 |      |                  |                             |
| La Romana   | 2001 | 201,700          | 100                         |
| Quito   | 2001 | 2,774,926        | 60                          |
| Santo Domingo de los Colorados                            | 2001 | 244,039          | 90                          |
| <b>Ecuador*</b>   |      |                  |                             |
| Quito   | 2001 | 1,841,200        | 80                          |
| Santo Domingo de los Colorados                            | 2001 | 200,421          | 83                          |
| <b>El Salvador</b>  |      |                  |                             |
| La Libertad - Nueva San Salvador                          | 2001 | 136,909          | 94                          |
| San Miguel, San Miguel                                    | 2001 | 172,203          | 82                          |
| San Salvador - Apopa                                      | 2001 | 139,802          | 73                          |
| San Salvador - Ilopango,                                  | 2001 | 115,358          | 50                          |
| San Salvador - Mejicanos                                  | 2001 | 172,548          | 85                          |
| San Salvador - Soyapango                                  | 2001 | 285,286          | 95                          |
| San Salvador, San Salvador                                | 2001 | 479,605          | 81                          |
| Santa Ana, Santa Ana                                      | 2001 | 167,975          | 83                          |
| <b>Grenada</b>  |      |                  |                             |
| Grenada   | 2001 | 95,551           | 100                         |
| <b>Guatemala</b>  |      |                  |                             |
| Antigua Guatemala   | 2001 | 248,019          | 80                          |
| Guatemala   | 2001 | 2,541,581        | 70                          |
| Quetzaltenango  | 2001 | 122,157          | 90                          |
| San Benito  | 2001 | 366,735          | 80                          |
| <b>Guyana</b>   |      |                  |                             |
| Georgetown  | 2001 | 180,000          | 100                         |
| <b>Haiti</b>  |      |                  |                             |
| Cap-Haïtien   | 2001 | 141,061          | 45                          |
| Carrefour   | 2001 | 416,301          | 16                          |
| Croix des Bouquets  | 2001 | 143,803          | 40                          |
| Delmas  | 2001 | 335,866          | 16                          |
| Gonaïves  | 2001 | 138,480          | 45                          |
| Jacmel  | 2001 | 138,504          | 80                          |
| Les Cayes   | 2001 | 152,845          | 45                          |
| Pétion Ville  | 2001 | 143,452          | 22                          |
| Port-au-Prince  | 2001 | 1,100,085        | 22                          |
| Saint Marc  | 2001 | 164,868          | 45                          |
| <b>Honduras</b>   |      |                  |                             |
| San Pedro Sula  | 2001 | 483,384          | 85                          |
| <b>Jamaica*</b>   |      |                  |                             |
| North Eastern Wasteshed( Portland, St.Mary and St.Ann)    | 2001 | 357,265          | 56                          |
| Retirement(Westmoreland,Hanover,Trelawny & St.James)      | 2001 | 452,724          | 68                          |
| Riverton ( Kgn, St.And, St.Cath. Clarendon and St.Thomas) | 2001 | 1,458,155        | 66                          |
| Southern(Manchester, St. Elizabeth)                       | 2001 | 331,190          | 48                          |
| <b>Mexico</b>   |      |                  |                             |
| Acapulco, Guerrero  | 2001 | 728,010          | 85                          |
| Acuña, Coahuila   | 2001 | 117,271          | 85                          |
| Aguascalientes, Aguascalientes                            | 2001 | 656,245          | 90                          |
| Altamira, Tamaulipas                                      | 2001 | 130,425          | 85                          |
| Apatzingan, Michoacán                                     | 2001 | 108,466          | 85                          |
| Apodaca, Nuevo León                                       | 2001 | 297,776          | 100                         |

**ANNEX G (continued)****MSW Collection Data for Cities Over 100,000**

| <b>City</b>                             | <b>Year</b> | <b>Urban Population</b> | <b>MSW Collection Coverage (%)</b> |
|---|-------------|-------------------------|------------------------------------|
| Atizapan de Zaragoza, México            | 2001        | 475,683                 | 90                                 |
| Atlixco, Puebla                         | 2001        | 117,929                 | 85                                 |
| Boca del Río, Veracruz                  | 2001        | 135,875                 | 85                                 |
| Campeche, Campeche                      | 2001        | 219,281                 | 80                                 |
| Cancún, Benito Juárez, Quintana Roo     | 2001        | 444,870                 | 90                                 |
| Cárdenas, Tabasco                       | 2001        | 219,414                 | 80                                 |
| Carmen, Campeche                        | 2001        | 169,784                 | 85                                 |
| Celaya, Guanajuato                      | 2001        | 388,012                 | 95                                 |
| Chalco, México                          | 2001        | 232,956                 | 85                                 |
| Chetumal, Othon P. Blanco, Quintana Roo | 2001        | 209,241                 | 80                                 |
| Chihuahua, Chihuahua                    | 2001        | 676,160                 | 95                                 |
| Chilpancingo, Guerrero                  | 2001        | 197,275                 | 85                                 |
| Coatzacoalcos, Veracruz                 | 2001        | 268,673                 | 80                                 |
| Colima, Colima                          | 2001        | 131,268                 | 85                                 |
| Comitán de Domínguez, Chiapas           | 2001        | 107,065                 | 85                                 |
| Córdoba, Veracruz                       | 2001        | 178,672                 | 90                                 |
| Cuauhtémoc, Chihuahua                   | 2001        | 125,105                 | 85                                 |
| Cuautla, Morelos                        | 2001        | 155,363                 | 90                                 |
| Cuernavaca, Morelos                     | 2001        | 342,374                 | 85                                 |
| Culiacán, Sinaloa                       | 2001        | 755,017                 | 90                                 |
| Delicias, Chihuahua                     | 2001        | 117,215                 | 85                                 |
| Dolores Hidalgo, Guanajuato             | 2001        | 130,748                 | 85                                 |
| Durango, Durango                        | 2001        | 495,962                 | 90                                 |
| Ecatepec, México                        | 2001        | 1,655,225               | 90                                 |
| Ensenada, Baja California               | 2001        | 381,747                 | 95                                 |
| Fresnillo, Zacatecas                    | 2001        | 183,941                 | 85                                 |
| General Escobedo, Nuevo León            | 2001        | 246,166                 | 100                                |
| Gómez Palacio, Durango                  | 2001        | 276,085                 | 85                                 |
| Guadalajara, Jalisco                    | 2001        | 1,650,776               | 90                                 |
| Guadalupe, Nuevo León                   | 2001        | 679,230                 | 100                                |
| Guadalupe, Zacatecas                    | 2001        | 109,179                 | 85                                 |
| Guanajuato, Guanajuato                  | 2001        | 144,166                 | 90                                 |
| Guasave, Sinaloa                        | 2001        | 279,878                 | 85                                 |
| Guaymas, Sonora                         | 2001        | 129,236                 | 85                                 |
| Hermosillo, Sonora                      | 2001        | 619,185                 | 100                                |
| Hidalgo del Parral, Chihuahua           | 2001        | 101,390                 | 85                                 |
| Hidalgo, Michoacán                      | 2001        | 106,922                 | 85                                 |
| Huixquilucan, México                    | 2001        | 198,564                 | 85                                 |
| Iguala, Guerrero                        | 2001        | 125,395                 | 85                                 |
| Irapuato, Guanajuato                    | 2001        | 445,778                 | 90                                 |
| Juárez, Chihuahua                       | 2001        | 1,264,121               | 90                                 |
| La Paz, Baja California Sur             | 2001        | 199,712                 | 85                                 |
| Lagos de Moreno, Jalisco                | 2001        | 128,407                 | 85                                 |
| Lázaro Cárdenas, Michoacán              | 2001        | 174,205                 | 85                                 |
| León, Guanajuato                        | 2001        | 1,153,998               | 90                                 |
| Lerdo, Durango                          | 2001        | 113,705                 | 85                                 |
| Lerma, México                           | 2001        | 103,909                 | 85                                 |
| Los Cabos, Baja California Sur          | 2001        | 113,727                 | 85                                 |
| Los Mochis-Topolobampo, Ahome, Sinaloa  | 2001        | 362,442                 | 85                                 |
| Madero, Tamaulipas                      | 2001        | 184,289                 | 85                                 |
| Mante, Tamaulipas                       | 2001        | 111,671                 | 85                                 |
| Manzanillo, Colima                      | 2001        | 127,443                 | 85                                 |
| Matamoros, Tamaulipas                   | 2001        | 427,966                 | 85                                 |
| Mazatlán, Sinaloa                       | 2001        | 385,047                 | 85                                 |
| Mérida, Yucatán                         | 2001        | 714,689                 | 95                                 |
| Metepec, México                         | 2001        | 197,699                 | 85                                 |

**ANNEX G (continued)****MSW Collection Data for Cities Over 100,000**

| City                                  | Year | Urban Population | MSW Collection Coverage (%) |
|---------------------------------------|------|------------------|-----------------------------|
| Mexicali, Baja California             | 2001 | 779,523          | 80                          |
| México, Federal District              | 2001 | 8,615,955        | 100                         |
| Minatitlán, Veracruz                  | 2001 | 144,574          | 85                          |
| Monclova, Coahuila                    | 2001 | 194,458          | 85                          |
| Monterrey, Nuevo León                 | 2001 | 1,112,636        | 100                         |
| Morelia, Michoacán                    | 2001 | 628,801          | 85                          |
| Naucalpan, México                     | 2001 | 861,173          | 90                          |
| Navojoa, Sonora                       | 2001 | 141,412          | 85                          |
| Nezahualcoyotl, México                | 2001 | 1,223,180        | 80                          |
| Nogales, Sonora                       | 2001 | 164,819          | 85                          |
| Nuevo Laredo, Tamaulipas              | 2001 | 317,877          | 100                         |
| Oaxaca, Oaxaca                        | 2001 | 259,343          | 80                          |
| Obregón, Cajeme, Sonora               | 2001 | 357,857          | 85                          |
| Orizaba, Veracruz                     | 2001 | 119,405          | 90                          |
| Pachuca, Hidalgo                      | 2001 | 249,838          | 95                          |
| Piedras Negras, Coahuila              | 2001 | 130,398          | 100                         |
| Poza Rica, Veracruz                   | 2001 | 152,318          | 85                          |
| Puebla, Puebla                        | 2001 | 1,372,446        | 95                          |
| Puerto Vallarta, Jalisco              | 2001 | 191,424          | 85                          |
| Querétaro, Querétaro                  | 2001 | 657,447          | 100                         |
| Reynosa, Tamaulipas                   | 2001 | 438,696          | 85                          |
| Río Bravo, Tamaulipas                 | 2001 | 104,620          | 85                          |
| Salamanca, Guanajuato                 | 2001 | 228,239          | 90                          |
| Saltillo, Coahuila                    | 2001 | 587,730          | 90                          |
| San Andrés Tuxtla, Veracruz           | 2001 | 143,235          | 85                          |
| San Cristóbal de las Casas, Chiapas   | 2001 | 135,731          | 85                          |
| San Francisco del Rincón, Guanajuato  | 2001 | 100,805          | 90                          |
| San Juan Bautista de Tuxtepec, Oaxaca | 2001 | 134,895          | 85                          |
| San Juan del Río, Querétaro           | 2001 | 184,679          | 90                          |
| San Luis Potosí, San Luis Potosí      | 2001 | 678,645          | 85                          |
| San Luis Río Colorado, Sonora         | 2001 | 147,912          | 90                          |
| San Martín Texmelucan, Puebla         | 2001 | 123,072          | 85                          |
| San Miguel de Allende, Guanajuato     | 2001 | 138,393          | 90                          |
| San Nicolás de los Garza, Nuevo León  | 2001 | 497,078          | 100                         |
| San Pedro Garza García, Nuevo León    | 2001 | 127,254          | 100                         |
| Santa Catarina, Nuevo León            | 2001 | 231,809          | 100                         |
| Silao, Guanajuato                     | 2001 | 134,539          | 90                          |
| Soledad de Graciano, San Luis Potosí  | 2001 | 185,063          | 85                          |
| Tampico, Tamaulipas                   | 2001 | 298,063          | 85                          |
| Tapachula, Chiapas                    | 2001 | 276,743          | 85                          |
| Taxco, Guerrero                       | 2001 | 100,889          | 85                          |
| Tecomán, Colima                       | 2001 | 101,049          | 85                          |
| Tehuacán, Puebla                      | 2001 | 233,807          | 90                          |
| Tepatitlán, Jalisco                   | 2001 | 121,076          | 85                          |
| Tepic, Nayarit                        | 2001 | 307,550          | 80                          |
| Tijuana, Baja California              | 2001 | 1,262,520        | 95                          |
| Tlajomulco, Jalisco                   | 2001 | 128,339          | 85                          |
| Tlalnepantla, México                  | 2001 | 722,279          | 95                          |
| Tlaquepaque, Jalisco                  | 2001 | 480,844          | 95                          |
| Toluca, México                        | 2001 | 687,969          | 85                          |
| Tonalá, Jalisco                       | 2001 | 350,648          | 95                          |
| Torreón, Coahuila                     | 2001 | 533,457          | 100                         |
| Tulancingo, Hidalgo                   | 2001 | 124,461          | 85                          |
| Tuxpan, Veracruz                      | 2001 | 126,257          | 85                          |

**ANNEX G (continued)****MSW Collection Data for Cities Over 100,000**

| <b>City</b>                         | <b>Year</b> | <b>Urban Population</b> | <b>MSW Collection Coverage (%)</b> |
|-------------------------------------|-------------|-------------------------|------------------------------------|
| Tuxtla Gutiérrez, Chiapas           | 2001        | 443,782                 | 85                                 |
| Uruapan, Michoacán                  | 2001        | 268,208                 | 85                                 |
| Valle de Chalco Solidaridad, México | 2001        | 330,885                 | 80                                 |
| Valle de Santiago, Guanajuato       | 2001        | 130,553                 | 85                                 |
| Valles, San Luis Potosí             | 2001        | 147,086                 | 85                                 |
| Veracruz, Veracruz                  | 2001        | 463,812                 | 90                                 |
| Victoria, Tamaulipas                | 2001        | 266,612                 | 90                                 |
| Villahermosa, Centro, Tabasco       | 2001        | 531,511                 | 80                                 |
| Xalapa, Veracruz                    | 2001        | 404,788                 | 90                                 |
| Zacatecas, Zacatecas                | 2001        | 124,722                 | 85                                 |
| Zamora, Michoacán                   | 2001        | 161,425                 | 90                                 |
| Zapopan, Jalisco                    | 2001        | 1,018,447               | 90                                 |
| Zitacuaro, Michoacán                | 2001        | 139,514                 | 85                                 |
| <b>Nicaragua</b>                    |             |                         |                                    |
| Chinandega                          | 2001        | 124,107                 | 80                                 |
| Leon                                | 2001        | 147,845                 | 70                                 |
| Managua                             | 2001        | 952,068                 | 80                                 |
| <b>Panama</b>                       |             |                         |                                    |
| Arraiján                            | 2001        | 149,918                 | 63                                 |
| Ciudad de Panamá                    | 2001        | 708,438                 | 80                                 |
| Colón                               | 2001        | 174,059                 | 66                                 |
| La Chorrera                         | 2001        | 124,656                 | 64                                 |
| San Miguelito                       | 2001        | 293,745                 | 95                                 |
| <b>Paraguay</b>                     |             |                         |                                    |
| Asunción                            | 2001        | 513,399                 | 99                                 |
| Capiatá                             | 2001        | 154,469                 | 35                                 |
| Ciudad del Este                     | 2001        | 223,350                 | 60                                 |
| Fernando de la Mora                 | 2001        | 114,332                 | 97                                 |
| Lambaré                             | 2001        | 119,984                 | 42                                 |
| Luque                               | 2001        | 170,433                 | 54                                 |
| San Lorenzo                         | 2001        | 202,745                 | 26                                 |
| <b>Peru</b>                         |             |                         |                                    |
| Callao, Callao Cercado              | 2001        | 449,282                 | 75                                 |
| Callao, Ventanilla                  | 2001        | 148,767                 | 57                                 |
| Junín, El Tambo                     | 2001        | 165,357                 | 66                                 |
| Junín, Huancayo                     | 2001        | 112,203                 | 70                                 |
| Lima, Ate                           | 2001        | 410,734                 | 89                                 |
| Lima, Carabayllo                    | 2001        | 153,112                 | 78                                 |
| Lima, Chorrillos                    | 2001        | 264,645                 | 89                                 |
| Lima, Comas                         | 2001        | 469,747                 | 90                                 |
| Lima, El Agustino                   | 2001        | 166,902                 | 80                                 |
| Lima, Independencia                 | 2001        | 200,365                 | 66                                 |
| Lima, La Molina                     | 2001        | 125,034                 | 75                                 |
| Lima, La Victoria                   | 2001        | 205,554                 | 75                                 |
| Lima, Lima Cercado                  | 2001        | 286,202                 | 85                                 |
| Lima, Los Olivos                    | 2001        | 344,164                 | 87                                 |
| Lima, Lurigancho                    | 2001        | 123,142                 | 65                                 |
| Lima, Puente Piedra                 | 2001        | 183,861                 | 73                                 |
| Lima, Rímac                         | 2001        | 192,449                 | 89                                 |
| Lima, San Borja                     | 2001        | 122,270                 | 63                                 |
| Lima, San Juan de Lurigancho        | 2001        | 751,155                 | 47                                 |
| Lima, San Juan de Miraflores        | 2001        | 387,641                 | 65                                 |
| Lima, San Martín de Porres          | 2001        | 448,345                 | 74                                 |
| Lima, San Miguel                    | 2001        | 134,908                 | 80                                 |

**ANNEX G (continued)****MSW Collection Data for Cities Over 100,000**

| City  | Year | Urban Population | MSW Collection Coverage (%) |
|---|------|------------------|-----------------------------|
| Lima, Santa Anita                                 | 2001 | 148,752          | 71                          |
| Lima, Santiago de Surco                           | 2001 | 251,567          | 79                          |
| Lima, Villa El Salvador                           | 2001 | 364,476          | 77                          |
| Lima, Villa María del Triunfo                     | 2001 | 341,971          | 80                          |
| Piura, Castilla                                   | 2001 | 106,926          | 77                          |
| Ucayali, Callería                                 | 2001 | 246,856          | 70                          |
| <b>Saint Lucia</b>                                |      |                  |                             |
| St. Lucia   | 2001 | 162,157          | 100                         |
| <b>Saint Vincent and the Grenadines*</b>          |      |                  |                             |
| St. Vincent                                       | 2001 | 106,916          | 90                          |
| <b>Suriname</b>                                   |      |                  |                             |
| Greater Paramaribo                                | 2001 | 287,131          | 82                          |
| <b>Trinidad and Tobago</b>                        |      |                  |                             |
| Couva/Tabaquite/Talparo                           | 2001 | 162,779          | 100                         |
| Diego Martin                                      | 2001 | 105,720          | 100                         |
| San Juan/Laventille                               | 2001 | 157,295          | 100                         |
| Tunapuna/Piarco                                   | 2001 | 203,975          | 100                         |
| <b>Uruguay</b>                                    |      |                  |                             |
| Canelones   | 2001 | 539,130          | 75                          |
| Maldonado   | 2001 | 137,390          | 95                          |
| Montevideo  | 2001 | 1,303,182        | 90                          |
| <b>Venezuela</b>                                  |      |                  |                             |
| Distrito Capital                                  | 2001 | 1,836,286        | 80                          |
| Municipio Barinas Edo Barinas                     | 2001 | 283,273          | 100                         |
| Municipio Caroni Edo Bolívar                      | 2001 | 704,168          | 68                          |
| Municipio Girardot Edo Aragua                     | 2001 | 396,125          | 88                          |
| Municipio Iribarren Edo Lara                      | 2001 | 895,989          | 80                          |
| Municipio Lagunillas Edo Zulia                    | 2001 | 144,345          | 90                          |
| Municipio Maracaibo Edo Zulia                     | 2001 | 1,405,933        | 87                          |
| Municipio Pedraza Edo Apure                       | 2001 | 283,273          | 100                         |
| Municipio Simón Bolívar Edo Anzoátegui            | 2001 | 344,593          | 80                          |
| Municipio Simón Rodríguez Edo Anzoátegui          | 2001 | 147,800          | 100                         |
| <b>Middle East &amp; North Africa (UNSD 2009)</b> |      |                  |                             |
| <b>Egypt</b>                                      |      |                  |                             |
| Cairo   | 2007 | 7,765,000        | 77                          |
| <b>Iraq</b>                                       |      |                  |                             |
| Baghdad   | 2005 | 6,784,000        | 86                          |
| <b>South Asia</b>                                 |      |                  |                             |
| <b>Nepal (Alam 2008)</b>                          |      |                  |                             |
| Kathmandu   | 2003 | 738,173          | 94                          |
| <b>Sri Lanka (UNSD 2009)</b>                      |      |                  |                             |
| Dehiwala-Mount Lavinia                            | 2007 | 209,787          | 96                          |
| Moratuwa  | 2007 | 189,790          | 90                          |

**NOTES:**

\* Domestic waste data used as MSW figures not available; hence it is assumed that waste collection coverage is for domestic waste and not MSW  
 \*\* Urban population data from 2007; Waste collection coverage data from 2006

**PAHO definitions:****Municipal waste**

Solid or semi-solid waste generated in of population centers including domestic and commercial wastes, as well as those originated by the, small-scale industries and institutions (including hospital and clinics); markets street sweeping, and from public cleansing.

**Domestic waste**

Domestic solid or semi-solid waste generated by human activities at the household level.

**ANNEX H****MSW Disposal Methods for Cities Over 100,000**

| City   | Urban Population | Sanitary Landfill (%) | Controlled Landfill (%) | Open Dump (%) | Water-courses (%) | Other (%) |
|--|------------------|-----------------------|-------------------------|---------------|-------------------|-----------|
| <b>Latin America &amp; Caribbean (PAHO 2005)</b> |                  |                       |                         |               |                   |           |
| <b>Argentina</b>                                 |                  |                       |                         |               |                   |           |
| Area Metropolitana Buenos Aires                  | 12,544,018       | 100                   | 0                       | 0             | 0                 | 0         |
| Bahia Blanca                                     | 285,000          | 80                    | 0                       | 0             | 0                 | 0         |
| Neuquen  | 202,518          | 100                   | 0                       | 0             | 0                 | 0         |
| Parana   | 245,677          | 0                     | 0                       | 100           | 0                 | 0         |
| Salta Capital                                    | 472,971          | 100                   | 0                       | 0             | 0                 | 0         |
| <b>Bolivia</b>                                   |                  |                       |                         |               |                   |           |
| Cochabamba                                       | 717,026          | 87                    | 0                       | 0             | 0                 | 13        |
| El Alto  | 629,955          | 0                     | 74                      | 16            | N.A.              | 11        |
| La Paz   | 790,353          | 87                    | 0                       | 0             | N.A.              | 13        |
| Oruro  | 201,230          | 89                    | 0                       | 5             | 0                 | 7         |
| Potosi   | 135,783          | 85                    | 0                       | 0             | 0                 | 15        |
| Santa Cruz de la Sierra                          | 1,113,000        | 85                    | 0                       | 0             | 9                 | 6         |
| Sucre  | 193,876          | 83                    | 0                       | 9             | 0                 | 9         |
| Tarija   | 135,783          | 90                    | 0                       | 0             | 0                 | 10        |
| <b>Barbados</b>                                  |                  |                       |                         |               |                   |           |
| Antofagasta, Antofagasta                         | 318,779          | 0                     | 100                     | 0             | 0                 | 0         |
| Antofagasta, Calama                              | 138,402          | 0                     | 75                      | 0             | 0                 | 25        |
| Araucanía, Temuco                                | 245,347          | 98                    | 0                       | 0             | 0                 | 2         |
| B.O'Higgins, Rancagua                            | 214,344          | 100                   | 0                       | 0             | 0                 | 0         |
| Barbados   | 268,792          | 35                    | 48                      | 0             | N.A.              | 17        |
| Biobío, Chillán                                  | 161,953          | 0                     | 0                       | 100           | 0                 | 0         |
| Biobío, Concepción                               | 216,061          | 0                     | 100                     | 0             | 0                 | 0         |
| Biobío, Talcahuano                               | 250,348          | 0                     | 75                      | 0             | 0                 | 25        |
| Coquimbo, Coquimbo                               | 163,036          | 0                     | 100                     | 0             | 0                 | 0         |
| Coquimbo, La Serena                              | 160,148          | 0                     | 100                     | 0             | 0                 | 0         |
| Los Lagos, Osorno                                | 145,475          | 100                   | 0                       | 0             | 0                 | 0         |
| Los Lagos, Puerto Montt                          | 175,938          | 0                     | 96                      | 0             | 0                 | 4         |
| Los Lagos, Valdivia                              | 140,559          | 83                    | 0                       | 0             | 0                 | 17        |
| Magallanes, Punta Arenas                         | 120,874          | 0                     | 85                      | 0             | 0                 | 15        |
| Maule, Curicó                                    | 120,299          | 100                   | 0                       | 0             | 0                 | 0         |
| Maule, Talca                                     | 203,231          | 100                   | 0                       | 0             | 0                 | 0         |
| Santiago, Cerro Navia                            | 148,312          | 100                   | 0                       | 0             | 0                 | 0         |
| Santiago, La Florida                             | 365,674          | 100                   | 0                       | 0             | 0                 | 0         |
| Santiago, Maipú                                  | 468,390          | 99                    | 0                       | 0             | 0                 | 2         |
| Santiago, Providencia                            | 120,874          | 100                   | 0                       | 0             | 0                 | 0         |
| Santiago, Recoleta                               | 148,220          | 100                   | 0                       | 0             | 0                 | 0         |
| Santiago, Santiago                               | 200,792          | 86                    | 0                       | 0             | 0                 | 14        |
| Tarapacá, Arica                                  | 185,268          | 0                     | 95                      | 0             | 0                 | 5         |
| Valparaíso, Valparaíso                           | 275,982          | 100                   | 0                       | 0             | 0                 | 0         |
| Valparaíso, Viña del Mar                         | 286,931          | 0                     | 99                      | 0             | 0                 | 1         |
| <b>Cuba</b>                                      |                  |                       |                         |               |                   |           |
| Bayamo   | 154,832          | 0                     | 9                       | 90            | 0                 | 1         |
| Camagüey   | 308,288          | 0                     | 100                     | 0             | 0                 | 0         |
| Ciego de Ávila                                   | 118,935          | 0                     | 100                     | 0             | 0                 | 0         |
| Cienfuegos                                       | 154,897          | 14                    | 0                       | 85            | 0                 | 1         |
| Ciudad de La Habana                              | 2,186,632        | 0                     | 90                      | 11            | 0                 | 0         |
| Guantánamo                                       | 222,217          | 0                     | 100                     | 0             | 0                 | 0         |
| Holguín  | 268,843          | 20                    | 80                      | 0             | 0                 | 0         |
| Manzanillo                                       | 110,846          | 20                    | 0                       | 80            | 0                 | 0         |

**ANNEX H (continued)****MSW Disposal Methods for Cities Over 100,000**

| City                       | Urban Population | Sanitary Landfill (%) | Controlled Landfill (%) | Open Dump (%) | Water-courses (%) | Other (%) |
|----------------------------|------------------|-----------------------|-------------------------|---------------|-------------------|-----------|
| Matanzas                   | 133,177          | 0                     | 100                     | 0             | 0                 | 0         |
| Pinar del Río              | 162,078          | 20                    | 80                      | 0             | 0                 | 0         |
| Sancti Spíritus            | 109,220          | 0                     | 88                      | 13            | 0                 | 0         |
| Santa Clara                | 220,345          | 93                    | 0                       | 5             | 0                 | 2         |
| Santiago de Cuba           | 452,307          | 100                   | 0                       | 0             | 0                 | 0         |
| Tunas                      | 144,381          | 81                    | 0                       | 19            | 0                 | 0         |
| <b>Colombia</b>            |                  |                       |                         |               |                   |           |
| Armenia                    | 293,000          | 100                   | 0                       | 0             | 0                 | 0         |
| Barrancabermeja            | 183,000          | 0                     | 0                       | 100           | 0                 | 0         |
| Barranquilla               | 1,276,000        | 100                   | 0                       | 0             | 0                 | 0         |
| Bello                      | 353,000          | 97                    | 0                       | 0             | 0                 | 3         |
| Bogotá                     | 6,558,000        | 100                   | 0                       | 0             | 0                 | 0         |
| Bucaramanga                | 543,000          | 0                     | 98                      | 0             | 0                 | 2         |
| Buenaventura               | 230,000          | 0                     | 0                       | 0             | 100               | 0         |
| Buga                       | 113,000          | 100                   | 0                       | 0             | 0                 | 0         |
| Cali                       | 2,181,000        | 0                     | 0                       | 100           | 0                 | 0         |
| Cartagena                  | 854,000          | 100                   | 0                       | 0             | 0                 | 0         |
| Cartago                    | 129,000          | 82                    | 0                       | 0             | 0                 | 18        |
| Dosquebradas               | 166,000          | 100                   | 0                       | 0             | 0                 | 0         |
| Envigado                   | 145,000          | 99                    | 0                       | 0             | 0                 | 1         |
| Florencia                  | 116,000          | 0                     | 0                       | 100           | 0                 | 0         |
| Floridablanca              | 232,000          | 0                     | 90                      | 0             | 0                 | 10        |
| Ibagué                     | 403,000          | 99                    | 0                       | 0             | 0                 | 1         |
| Itagüí                     | 246,000          | 98                    | 0                       | 0             | 0                 | 2         |
| Maicao                     | 115,000          | 0                     | 0                       | 0             | 100               | 0         |
| Manizales                  | 345,000          | 100                   | 0                       | 0             | 0                 | 0         |
| Medellín                   | 1,909,000        | 100                   | 0                       | 0             | 0                 | 0         |
| Montería                   | 256,000          | 0                     | 0                       | 100           | 0                 | 0         |
| Palmira                    | 234,000          | 100                   | 0                       | 0             | 0                 | 0         |
| Pasto                      | 349,000          | 99                    | 0                       | 0             | 0                 | 1         |
| Popayán                    | 206,000          | 0                     | 98                      | 0             | 0                 | 2         |
| Santa Marta                | 382,000          | 0                     | 86                      | 0             | 0                 | 14        |
| Sincelejo                  | 234,000          | 100                   | 0                       | 0             | 0                 | 0         |
| Soacha                     | 285,000          | 0                     | 0                       | 100           | 0                 | 0         |
| Sogamoso                   | 114,000          | 100                   | 0                       | 0             | 0                 | 0         |
| Soledad                    | 310,000          | 0                     | 0                       | 100           | 0                 | 0         |
| Tuluá                      | 157,000          | 100                   | 0                       | 0             | 0                 | 0         |
| Valledupar                 | 278,000          | 95                    | 0                       | 0             | 0                 | 5         |
| <b>Costa Rica</b>          |                  |                       |                         |               |                   |           |
| Alajuela                   | 234,737          | 100                   | 0                       | 0             | 0                 | 0         |
| Cartago                    | 138,940          | 100                   | 0                       | 0             | 0                 | 0         |
| Desamparados               | 203,770          | 90                    | 0                       | 0             | 0                 | 10        |
| Goicoechea                 | 123,375          | 100                   | 0                       | 0             | 0                 | 0         |
| Heredia                    | 109,398          | 100                   | 0                       | 0             | 0                 | 0         |
| Pérez Zeledón              | 129,219          | 0                     | 30                      | 0             | 0                 | 70        |
| Pococí                     | 109,367          | 0                     | 100                     | 0             | 0                 | 0         |
| Puntarenas                 | 108,214          | 0                     | 0                       | 100           | 0                 | 0         |
| San Carlos                 | 135,133          | 0                     | 0                       | 97            | 0                 | 3         |
| San José                   | 326,384          | 98                    | 0                       | 0             | 0                 | 2         |
| <b>Dominican Republic</b>  |                  |                       |                         |               |                   |           |
| San Francisco de Macorís   | 210,580          | 0                     | 0                       | 100           | 0                 | 0         |
| Santiago de los Caballeros | 594,424          | 0                     | 0                       | 100           | 0                 | 0         |
| Santo Domingo              | 2,774,926        | 83                    | 10                      | 0             | 3                 | 4         |

**ANNEX H (continued)****MSW Disposal Methods for Cities Over 100,000**

| City  | Urban Population | Sanitary Landfill (%) | Controlled Landfill (%) | Open Dump (%) | Water-courses (%) | Other (%) |
|---|------------------|-----------------------|-------------------------|---------------|-------------------|-----------|
| <b>Ecuador</b>  |                  |                       |                         |               |                   |           |
| Quito   | 1,841,200        | 84                    | 0                       | 0             | 0                 | 16        |
| Santo Domingo de los Colrados                             | 200,421          | 0                     | 91                      | 0             | 0                 | 9         |
| <b>El Salvador</b>  |                  |                       |                         |               |                   |           |
| San Salvador, San Salvador                                | 479,605          | 81                    | 0                       | 0             | 0                 | 19        |
| San Salvador - Soyapango                                  | 285,286          | 95                    | 0                       | 0             | 0                 | 5         |
| <b>Grenada</b>  |                  |                       |                         |               |                   |           |
| Grenada   | 95,551           | 90                    | 0                       | 0             | 0                 | 10        |
| <b>Guatemala</b>  |                  |                       |                         |               |                   |           |
| Guatemala   | 2,541,581        | 0                     | 40                      | 0             | 0                 | 60        |
| <b>Guyana</b>   |                  |                       |                         |               |                   |           |
| Georgetown  | 180,000          | 0                     | 90                      | 0             | 10                | 0         |
| <b>Haiti</b>  |                  |                       |                         |               |                   |           |
| Cap-Haïtien   | 141,061          | 0                     | 0                       | 65            | 25                | 10        |
| Carrefour   | 416,301          | 0                     | 0                       | 38            | 0                 | 62        |
| Croix des Bouquets  | 143,803          | 0                     | 0                       | 80            | 0                 | 20        |
| Delmas  | 335,866          | 0                     | 0                       | 44            | 0                 | 56        |
| Gonaïves  | 138,480          | 0                     | 0                       | 60            | 0                 | 40        |
| Jacmel  | 138,504          | 0                     | 0                       | 35            | 0                 | 65        |
| Les Cayes   | 152,845          | 0                     | 0                       | 54            | 23                | 23        |
| Pétion Ville  | 143,452          | 0                     | 0                       | 38            | 26                | 36        |
| Port-au-Prince  | 1,100,085        | 0                     | 0                       | 30            | 0                 | 70        |
| Saint Marc  | 164,868          | 0                     | 0                       | 54            | 23                | 23        |
| <b>Honduras</b>   |                  |                       |                         |               |                   |           |
| Distrito Central  | 819,867          | 0                     | 100                     | 0             | 0                 | 0         |
| <b>Jamaica</b>  |                  |                       |                         |               |                   |           |
| North Eastern Wasteshed( Portland, St.Mary and St.Ann)    | 357,265          | 0                     | 100                     | 0             | 0                 | 0         |
| Portmore  | 159,974          | 0                     | 100                     | 0             | 0                 | 0         |
| Retirement(Westmoreland,Hanover,Trelawny & St.James)      | 452,724          | 0                     | 100                     | 0             | 0                 | 0         |
| Riverton ( Kgn, St.And, St.Cath. Clarendon and St.Thomas) | 1,458,155        | 0                     | 100                     | 0             | 0                 | 0         |
| Southern(Manchester, St.Elizabeth)                        | 331,190          | 0                     | 100                     | 0             | 0                 | 0         |
| Southern(Manchester, St.Elizabeth)                        | 331,190          | 0                     | 100                     | 0             | 0                 | 0         |
| <b>Mexico</b>   |                  |                       |                         |               |                   |           |
| Acapulco, Guerrero  | 728,010          | 94                    | 0                       | 0             | 0                 | 6         |
| Acuña, Coahuila   | 117,271          | 0                     | 0                       | 94            | 0                 | 6         |
| Aguascalientes, Aguascalientes                            | 656,245          | 94                    | 0                       | 0             | 0                 | 6         |
| Altamira, Tamaulipas                                      | 130,425          | 0                     | 94                      | 0             | 0                 | 6         |
| Apatzingan, Michoacán                                     | 108,466          | 0                     | 0                       | 94            | 0                 | 6         |
| Apodaca, Nuevo León                                       | 297,776          | 93                    | 0                       | 0             | 0                 | 7         |
| Atizapan de Zaragoza, México                              | 475,683          | 94                    | 0                       | 0             | 0                 | 6         |
| Atlíxco, Puebla   | 117,929          | 0                     | 0                       | 94            | 0                 | 6         |
| Boca del Río, Veracruz                                    | 135,875          | 0                     | 94                      | 0             | 0                 | 6         |
| Campeche, Campeche  | 219,281          | 0                     | 0                       | 94            | 0                 | 6         |
| Cancún, Benito Juárez, Quintana Roo                       | 444,870          | 94                    | 0                       | 0             | 0                 | 6         |
| Cárdenas, Tabasco   | 219,414          | 0                     | 0                       | 94            | 0                 | 6         |
| Carmen, Campeche  | 169,784          | 0                     | 0                       | 94            | 0                 | 6         |
| Celaya, Guanajuato  | 388,012          | 94                    | 0                       | 0             | 0                 | 6         |
| Chalco, México  | 232,956          | 0                     | 0                       | 94            | 0                 | 6         |
| Chetumal, Othon P. Blanco, Quintana Roo                   | 209,241          | 0                     | 0                       | 94            | 0                 | 6         |
| Chihuahua, Chihuahua                                      | 676,160          | 93                    | 0                       | 0             | 0                 | 7         |
| Chiapas, Chiapas  | 197,275          | 0                     | 0                       | 94            | 0                 | 6         |
| Coatzacoalcos, Veracruz                                   | 268,673          | 0                     | 0                       | 94            | 0                 | 6         |
| Colima, Colima  | 131,268          | 94                    | 0                       | 0             | 0                 | 6         |

**ANNEX H (continued)****MSW Disposal Methods for Cities Over 100,000**

| City                                   | Urban Population | Sanitary Landfill (%) | Controlled Landfill (%) | Open Dump (%) | Water-courses (%) | Other (%) |
|--|------------------|-----------------------|-------------------------|---------------|-------------------|-----------|
| Comitán de Domínguez, Chiapas          | 107,065          | 0                     | 0                       | 94            | 0                 | 6         |
| Córdoba, Veracruz                      | 178,672          | 0                     | 0                       | 94            | 0                 | 6         |
| Cuauhtémoc, Chihuahua                  | 125,105          | 0                     | 0                       | 94            | 0                 | 6         |
| Cuautla, Morelos                       | 155,363          | 94                    | 0                       | 0             | 0                 | 6         |
| Cuernavaca, Morelos                    | 342,374          | 0                     | 0                       | 94            | 0                 | 6         |
| Culiacán, Sinaloa                      | 755,017          | 94                    | 0                       | 0             | 0                 | 6         |
| Delicias, Chihuahua                    | 117,215          | 0                     | 0                       | 94            | 0                 | 6         |
| Dolores Hidalgo, Guanajuato            | 130,748          | 0                     | 0                       | 94            | 0                 | 6         |
| Durango, Durango                       | 495,962          | 92                    | 0                       | 0             | 0                 | 8         |
| Ecatepec, México                       | 1,655,225        | 94                    | 0                       | 0             | 0                 | 6         |
| Ensenada, Baja California              | 381,747          | 0                     | 0                       | 94            | 0                 | 6         |
| Fresnillo, Zacatecas                   | 183,941          | 0                     | 94                      | 0             | 0                 | 6         |
| General Escobedo, Nuevo León           | 246,166          | 93                    | 0                       | 0             | 0                 | 7         |
| Gómez Palacio, Durango                 | 276,085          | 0                     | 92                      | 0             | 0                 | 8         |
| Guadalajara, Jalisco                   | 1,650,776        | 0                     | 94                      | 0             | 0                 | 6         |
| Guadalupe, Nuevo León                  | 679,230          | 93                    | 0                       | 0             | 0                 | 7         |
| Guadalupe, Zacatecas                   | 109,179          | 0                     | 0                       | 94            | 0                 | 6         |
| Guanajuato, Guanajuato                 | 144,166          | 94                    | 0                       | 0             | 0                 | 6         |
| Guasave, Sinaloa                       | 279,878          | 94                    | 0                       | 0             | 0                 | 6         |
| Guaymas, Sonora                        | 129,236          | 0                     | 0                       | 94            | 0                 | 6         |
| Hermosillo, Sonora                     | 619,185          | 94                    | 0                       | 0             | 0                 | 6         |
| Hidalgo del Parral, Chihuahua          | 101,390          | 0                     | 0                       | 94            | 0                 | 6         |
| Hidalgo, Michoacán                     | 106,922          | 0                     | 0                       | 94            | 0                 | 6         |
| Huixquilucan, México                   | 198,564          | 0                     | 94                      | 0             | 0                 | 6         |
| Iguala, Guerrero                       | 125,395          | 0                     | 0                       | 92            | 0                 | 8         |
| Irapuato, Guanajuato                   | 445,778          | 0                     | 94                      | 0             | 0                 | 6         |
| Juárez, Chihuahua                      | 1,264,121        | 92                    | 0                       | 0             | 0                 | 8         |
| La Paz, Baja California Sur            | 199,712          | 0                     | 0                       | 92            | 0                 | 8         |
| Lagos de Moreno, Jalisco               | 128,407          | 0                     | 0                       | 94            | 0                 | 6         |
| Lázaro Cárdenas, Michoacán             | 174,205          | 0                     | 94                      | 0             | 0                 | 6         |
| León, Guanajuato                       | 1,153,998        | 92                    | 0                       | 0             | 0                 | 8         |
| Lerdo, Durango                         | 113,705          | 0                     | 0                       | 94            | 0                 | 6         |
| Lerma, México                          | 103,909          | 0                     | 0                       | 94            | 0                 | 6         |
| Los Cabos, Baja California Sur         | 113,727          | 94                    | 0                       | 0             | 0                 | 6         |
| Los Mochis-Topolobampo, Ahome, Sinaloa | 362,442          | 94                    | 0                       | 0             | 0                 | 6         |
| Madero, Tamaulipas                     | 184,289          | 0                     | 0                       | 94            | 0                 | 6         |
| Mante, Tamaulipas                      | 111,671          | 0                     | 0                       | 94            | 0                 | 6         |
| Manzanillo, Colima                     | 127,443          | 0                     | 0                       | 94            | 0                 | 6         |
| Matamoros, Tamaulipas                  | 427,966          | 94                    | 0                       | 0             | 0                 | 6         |
| Mazatlán, Sinaloa                      | 385,047          | 0                     | 94                      | 0             | 0                 | 6         |
| Mérida, Yucatán                        | 714,689          | 93                    | 0                       | 0             | 0                 | 7         |
| Metepec, México                        | 197,699          | 0                     | 94                      | 0             | 0                 | 6         |
| Mexicali, Baja California              | 779,523          | 0                     | 94                      | 0             | 0                 | 6         |
| México, Distrito Federal               | 8,615,955        | 92                    | 0                       | 0             | 0                 | 8         |
| Minatitlán, Veracruz                   | 144,574          | 0                     | 0                       | 94            | 0                 | 6         |
| Monclova, Coahuila                     | 194,458          | 0                     | 0                       | 94            | 0                 | 6         |
| Monterrey, Nuevo León                  | 1,112,636        | 93                    | 0                       | 0             | 0                 | 7         |
| Morelia, Michoacán                     | 628,801          | 0                     | 0                       | 94            | 0                 | 6         |
| Naucalpan, México                      | 861,173          | 0                     | 94                      | 0             | 0                 | 6         |
| Navojoa, Sonora                        | 141,412          | 0                     | 0                       | 94            | 0                 | 6         |
| Nezahualcoyotl, México                 | 1,223,180        | 0                     | 70                      | 23            | 0                 | 7         |
| Nogales, Sonora                        | 164,819          | 94                    | 0                       | 0             | 0                 | 6         |

**ANNEX H (continued)****MSW Disposal Methods for Cities Over 100,000**

| City                                  | Urban Population | Sanitary Landfill (%) | Controlled Landfill (%) | Open Dump (%) | Water-courses (%) | Other (%) |
|---------------------------------------|------------------|-----------------------|-------------------------|---------------|-------------------|-----------|
| Nuevo Laredo, Tamaulipas              | 317,877          | 96                    | 0                       | 0             | 0                 | 4         |
| Oaxaca, Oaxaca                        | 259,343          | 0                     | 0                       | 94            | 0                 | 6         |
| Obregón, Cajeme, Sonora               | 357,857          | 0                     | 0                       | 94            | 0                 | 6         |
| Orizaba, Veracruz                     | 119,405          | 94                    | 0                       | 0             | 0                 | 6         |
| Pachuca, Hidalgo                      | 249,838          | 94                    | 0                       | 0             | 0                 | 6         |
| Piedras Negras, Coahuila              | 130,398          | 94                    | 0                       | 0             | 0                 | 6         |
| Poza Rica, Veracruz                   | 152,318          | 94                    | 0                       | 0             | 0                 | 6         |
| Puebla, Puebla                        | 1,372,446        | 93                    | 0                       | 0             | 0                 | 7         |
| Puerto Vallarta, Jalisco              | 191,424          | 94                    | 0                       | 0             | 0                 | 6         |
| Querétaro, Querétaro                  | 657,447          | 94                    | 0                       | 0             | 0                 | 6         |
| Reynosa, Tamaulipas                   | 438,696          | 0                     | 0                       | 94            | 0                 | 6         |
| Río Bravo, Tamaulipas                 | 104,620          | 94                    | 0                       | 0             | 0                 | 6         |
| Salamanca, Guanajuato                 | 228,239          | 0                     | 0                       | 94            | 0                 | 6         |
| Saltillo, Coahuila                    | 587,730          | 94                    | 0                       | 0             | 0                 | 6         |
| San Andrés Tuxtla, Veracruz           | 143,235          | 0                     | 0                       | 94            | 0                 | 6         |
| San Cristóbal de las Casas, Chiapas   | 135,731          | 0                     | 0                       | 94            | 0                 | 6         |
| San Francisco del Rincón, Guanajuato  | 100,805          | 0                     | 0                       | 92            | 0                 | 8         |
| San Juan Bautista de Tuxtepec, Oaxaca | 134,895          | 0                     | 0                       | 94            | 0                 | 6         |
| San Juan del Río, Querétaro           | 184,679          | 94                    | 0                       | 0             | 0                 | 6         |
| San Luis Potosí, San Luis Potosí      | 678,645          | 94                    | 0                       | 0             | 0                 | 6         |
| San Luis Río Colorado, Sonora         | 147,912          | 0                     | 0                       | 94            | 0                 | 6         |
| San Martín Texmelucan, Puebla         | 123,072          | 0                     | 0                       | 94            | 0                 | 6         |
| San Miguel de Allende, Guanajuato     | 138,393          | 94                    | 0                       | 0             | 0                 | 6         |
| San Nicolás de los Garza, Nuevo León  | 497,078          | 93                    | 0                       | 0             | 0                 | 7         |
| San Pedro Garza García, Nuevo León    | 127,254          | 93                    | 0                       | 0             | 0                 | 7         |
| Santa Catarina, Nuevo León            | 231,809          | 93                    | 0                       | 0             | 0                 | 7         |
| Silao, Guanajuato                     | 134,539          | 94                    | 0                       | 0             | 0                 | 6         |
| Soledad de Graciano, San Luis Potosí  | 185,063          | 0                     | 0                       | 94            | 0                 | 6         |
| Tampico, Tamaulipas                   | 298,063          | 0                     | 0                       | 94            | 0                 | 6         |
| Tapachula, Chiapas                    | 276,743          | 94                    | 0                       | 0             | 0                 | 6         |
| Taxco, Guerrero                       | 100,889          | 0                     | 0                       | 94            | 0                 | 6         |
| Tecomán, Colima                       | 101,049          | 0                     | 0                       | 94            | 0                 | 6         |
| Tehuacán, Puebla                      | 233,807          | 0                     | 94                      | 0             | 0                 | 6         |
| Tepatitlán, Jalisco                   | 121,076          | 0                     | 94                      | 0             | 0                 | 6         |
| Tepic, Nayarit                        | 307,550          | 94                    | 0                       | 0             | 0                 | 6         |
| Tijuana, Baja California              | 1,262,520        | 94                    | 0                       | 0             | 0                 | 6         |
| Tlajomulco, Jalisco                   | 128,339          | 92                    | 0                       | 0             | 0                 | 8         |
| Tlalnepantla, México                  | 722,279          | 94                    | 0                       | 0             | 0                 | 6         |
| Tlaquepaque, Jalisco                  | 480,844          | 0                     | 94                      | 0             | 0                 | 6         |
| Toluca, México                        | 687,969          | 0                     | 94                      | 0             | 0                 | 6         |
| Tonalá, Jalisco                       | 350,648          | 0                     | 94                      | 0             | 0                 | 6         |
| Torreón, Coahuila                     | 533,457          | 94                    | 0                       | 0             | 0                 | 6         |
| Tulancingo, Hidalgo                   | 124,461          | 0                     | 0                       | 94            | 0                 | 6         |
| Tuxpan, Veracruz                      | 126,257          | 94                    | 0                       | 0             | 0                 | 6         |
| Tuxtla Gutiérrez, Chiapas             | 443,782          | 0                     | 0                       | 94            | 0                 | 6         |
| Uruapan, Michoacán                    | 268,208          | 0                     | 0                       | 94            | 0                 | 6         |
| Valle de Chalco Solidaridad, México   | 330,885          | 0                     | 0                       | 94            | 0                 | 6         |
| Valle de Santiago, Guanajuato         | 130,553          | 0                     | 0                       | 94            | 0                 | 6         |
| Valles, San Luis Potosí               | 147,086          | 0                     | 0                       | 94            | 0                 | 6         |
| Veracruz, Veracruz                    | 463,812          | 0                     | 94                      | 0             | 0                 | 6         |
| Victoria, Tamaulipas                  | 266,612          | 94                    | 0                       | 0             | 0                 | 6         |
| Villahermosa, Centro, Tabasco         | 531,511          | 0                     | 0                       | 94            | 0                 | 6         |

**ANNEX H (continued)****MSW Disposal Methods for Cities Over 100,000**

| City                          | Urban Population | Sanitary Landfill (%) | Controlled Landfill (%) | Open Dump (%) | Water-courses (%) | Other (%) |
|-------------------------------|------------------|-----------------------|-------------------------|---------------|-------------------|-----------|
| Xalapa, Veracruz              | 404,788          | 0                     | 0                       | 94            | 0                 | 6         |
| Zacatecas, Zacatecas          | 124,722          | 0                     | 0                       | 94            | 0                 | 6         |
| Zamora, Michoacán             | 161,425          | 0                     | 0                       | 94            | 0                 | 6         |
| Zapopan, Jalisco              | 1,018,447        | 92                    | 0                       | 0             | 0                 | 8         |
| Zitácuaro, Michoacán          | 139,514          | 0                     | 0                       | 94            | 0                 | 6         |
| <b>Nicaragua</b>              |                  |                       |                         |               |                   |           |
| Chinandega                    | 124,107          | 0                     | 0                       | 58            | 0                 | 42        |
| Managua                       | 952,068          | 0                     | 49                      | 0             | 0                 | 51        |
| Masaya                        | 115,369          | 0                     | 0                       | 71            | 0                 | 29        |
| Tipitapa                      | 108,861          | 0                     | 0                       | 61            | 0                 | 39        |
| <b>Panama</b>                 |                  |                       |                         |               |                   |           |
| Arraiján                      | 149,918          | 0                     | 0                       | 63            | N.D.              | 37        |
| Ciudad de Panamá              | 708,438          | 80                    | 0                       | N.D.          | N.D.              | 20        |
| Colón                         | 174,059          | 0                     | 0                       | 66            | N.D.              | 34        |
| La Chorrera                   | 124,656          | 0                     | 0                       | 64            | N.D.              | 36        |
| San Miguelito                 | 293,745          | 95                    | 0                       | N.D.          | N.D.              | 5         |
| <b>Paraguay</b>               |                  |                       |                         |               |                   |           |
| Asunción                      | 513,399          | 37                    | 61                      | 0             | 0                 | 2         |
| Luque                         | 170,433          | 0                     | 100                     | 0             | 0                 | 0         |
| <b>Peru</b>                   |                  |                       |                         |               |                   |           |
| Callao, Callao Cercado        | 449,282          | 0                     | 67                      | 18            | 0                 | 15        |
| Callao, Ventanilla            | 148,767          | 0                     | 51                      | 35            | 0                 | 14        |
| Junín, El Tambo               | 165,357          | 0                     | 59                      | 26            | 0                 | 15        |
| Junín, Huancayo               | 112,203          | 0                     | 63                      | 21            | 0                 | 16        |
| Lima, Ate                     | 410,734          | 0                     | 79                      | 3             | 0                 | 18        |
| Lima, Carabayllo              | 153,112          | 70                    | 0                       | 14            | 0                 | 16        |
| Lima, Chorrillos              | 264,645          | 0                     | 79                      | 3             | 0                 | 18        |
| Lima, Comas                   | 469,747          | 80                    | 0                       | 2             | 0                 | 18        |
| Lima, El Agustino             | 166,902          | 0                     | 71                      | 12            | 0                 | 17        |
| Lima, Independencia           | 200,365          | 0                     | 59                      | 28            | 0                 | 13        |
| Lima, La Molina               | 125,034          | 0                     | 67                      | 20            | 0                 | 13        |
| Lima, La Victoria             | 205,554          | 0                     | 66                      | 21            | 0                 | 13        |
| Lima, Lima Cercado            | 286,202          | 76                    | 0                       | 11            | 0                 | 13        |
| Lima, Los Olivos              | 344,164          | 78                    | 0                       | 5             | 0                 | 17        |
| Lima, Lurigancho              | 123,142          | 0                     | 58                      | 27            | 0                 | 15        |
| Lima, Puente Piedra           | 183,861          | 0                     | 65                      | 19            | 0                 | 16        |
| Lima, Rímac                   | 192,449          | 0                     | 79                      | 3             | 0                 | 18        |
| Lima, San Borja               | 122,270          | 0                     | 56                      | 32            | 0                 | 12        |
| Lima, San Juan de Lurigancho  | 751,155          | 0                     | 42                      | 46            | 0                 | 12        |
| Lima, San Juan de Miraflores  | 387,641          | 0                     | 58                      | 29            | 0                 | 13        |
| Lima, San Martín de Porres    | 448,345          | 66                    | 0                       | 20            | 0                 | 14        |
| Lima, San Miguel              | 134,908          | 0                     | 71                      | 13            | 0                 | 16        |
| Lima, Santa Anita             | 148,752          | 0                     | 63                      | 21            | 0                 | 16        |
| Lima, Santiago de Surco       | 251,567          | 70                    | 0                       | 15            | 0                 | 15        |
| Lima, Villa El Salvador       | 364,476          | 0                     | 68                      | 16            | 0                 | 16        |
| Lima, Villa María del Triunfo | 341,971          | 0                     | 71                      | 12            | 0                 | 17        |
| Piura, Castilla               | 106,926          | 0                     | 69                      | 16            | 0                 | 15        |
| Ucayali, Callería             | 246,856          | 0                     | 62                      | 23            | 0                 | 15        |

**ANNEX H (continued)****MSW Disposal Methods for Cities Over 100,000**

| City                                  | Urban Population | Sanitary Landfill (%) | Controlled Landfill (%) | Open Dump (%) | Water-courses (%) | Other (%) |
|---------------------------------------|------------------|-----------------------|-------------------------|---------------|-------------------|-----------|
| <b>St. Lucia</b>                      |                  |                       |                         |               |                   |           |
| St. Lucia                             | 162,157          | 70                    | 18                      | 0             | 0                 | 13        |
| <b>St. Vincent and the Grenadines</b> |                  |                       |                         |               |                   |           |
| St. Vincent                           | 106,916          | 80                    | 0                       | 0             | 0                 | 20        |
| <b>Suriname</b>                       |                  |                       |                         |               |                   |           |
| Greater Paramaribo                    | 287,131          | 0                     | 0                       | 100           | 0                 | 0         |
| <b>Trinidad and Tobago</b>            |                  |                       |                         |               |                   |           |
| Couva/Tabaquite/Talparo               | 162,779          | 0                     | 100                     | 0             | 0                 | 0         |
| Diego Martin                          | 105,720          | 0                     | 100                     | 0             | 0                 | 0         |
| San Juan/Laventille                   | 157,295          | 0                     | 100                     | 0             | 0                 | 0         |
| Tunapuna/Piarco                       | 203,975          | 0                     | 100                     | 0             | 0                 | 0         |
| <b>Uruguay</b>                        |                  |                       |                         |               |                   |           |
| Canelones                             | 539,130          | 0                     | 0                       | 100           | 0                 | 0         |
| Maldonado                             | 137,390          | 100                   | 0                       | 0             | 0                 | 0         |
| Montevideo                            | 1,303,182        | 0                     | 100                     | 0             | 0                 | 0         |
| <b>Venezuela</b>                      |                  |                       |                         |               |                   |           |
| Municipio Guacara Carabobo            | 142,227          | 0                     | 0                       | 100           | 0                 | 0         |
| Municipio Valencia Edo Carabobo       | 742,145          | 0                     | 100                     | 0             | 0                 | 0         |

**ANNEX I****MSW Composition Data for Cities Over 100,000**

| Region/Country/<br>City                           | Year | Urban<br>Population | Organic<br>(%) | Total<br>Recyclables<br>(%) | Paper (%) | Plastic<br>(%) | Glass (%) | Metal (%) | Other (%) |
|---|------|---------------------|----------------|-----------------------------|-----------|----------------|-----------|-----------|-----------|
| <b>Africa</b>                                     |      |                     |                |                             |           |                |           |           |           |
| <b>Ghana (Asase 2009)</b>                         |      |                     |                |                             |           |                |           |           |           |
| Kumasi  | 2008 | 1,610,867           | 64             | —                           | 3         | 4              | —         | 1         | 28        |
| <b>East Asia &amp; Pacific</b>                    |      |                     |                |                             |           |                |           |           |           |
| <b>Cambodia (Kum et al. 2005)</b>                 |      |                     |                |                             |           |                |           |           |           |
| Phnom Penh  | 2002 |                     | 65             | —                           | 4         | 13             | 5         | 1         | 12        |
| <b>Middle East &amp; North Africa (Al-Yousfi)</b> |      |                     |                |                             |           |                |           |           |           |
| <b>Egypt</b>                                      |      |                     |                |                             |           |                |           |           |           |
| Cairo   | 2002 |                     | 67             | —                           | 18        | 3              | 3         | 2         | 7         |
| <b>Jordan</b>                                     |      |                     |                |                             |           |                |           |           |           |
| Amman   | 2002 |                     | 55             | —                           | 14        | 13             | 3         | 2         | 13        |
| <b>Saudi Arabia</b>                               |      |                     |                |                             |           |                |           |           |           |
| Riyadh  | 2002 |                     | 34             | —                           | 31        | 2              | 3         | 16        | 14        |
| <b>Syria</b>                                      |      |                     |                |                             |           |                |           |           |           |
| Aleppo  | 2002 |                     | 59             | —                           | 13        | 12             | 8         | 1         | 8         |
| <b>Tunisia</b>                                    |      |                     |                |                             |           |                |           |           |           |
| Tunis   | 2002 |                     | 68             | —                           | 10        | 11             | 3         | 2         | 6         |
| <b>Yemen</b>                                      |      |                     |                |                             |           |                |           |           |           |
| Aden  | 2002 |                     | 57             | —                           | 11        | 11             | 3         | 5         | 14        |
| <b>South Asia</b>                                 |      |                     |                |                             |           |                |           |           |           |
| <b>India (CPCB 2005)</b>                          |      |                     |                |                             |           |                |           |           |           |
| Agartala  | 2005 | 1,89,998            | 59             | 14                          | —         | —              | —         | —         | 28        |
| Agra  | 2005 | 12,75,135           | 46             | 16                          | —         | —              | —         | —         | 38        |
| Ahmedabad   | 2005 | 35,20,085           | 41             | 12                          | —         | —              | —         | —         | 48        |
| Aizwal  | 2005 | 2,28,280            | 54             | 21                          | —         | —              | —         | —         | 25        |
| Allahabad   | 2005 | 9,75,393            | 35             | 19                          | —         | —              | —         | —         | 45        |
| Amritsar  | 2005 | 9,66,862            | 65             | 14                          | —         | —              | —         | —         | 21        |
| Asansol   | 2005 | 4,75,439            | 50             | 14                          | —         | —              | —         | —         | 35        |
| Bangalore   | 2005 | 43,01,326           | 52             | 22                          | —         | —              | —         | —         | 26        |
| Bhopal  | 2005 | 14,37,354           | 52             | 22                          | —         | —              | —         | —         | 25        |
| Bhubaneswar                                       | 2005 | 6,48,032            | 50             | 13                          | —         | —              | —         | —         | 38        |
| Chandigarh  | 2005 | 8,08,515            | 57             | 11                          | —         | —              | —         | —         | 32        |
| Chennai   | 2005 | 43,43,645           | 41             | 16                          | —         | —              | —         | —         | 42        |
| Coimbatore  | 2005 | 9,30,882            | 50             | 16                          | —         | —              | —         | —         | 34        |
| Daman   | 2005 | 35,770              | 30             | 22                          | —         | —              | —         | —         | 48        |
| Dehradun  | 2005 | 4,26,674            | 51             | 20                          | —         | —              | —         | —         | 29        |
| Delhi   | 2005 | 1,03,06,452         | 54             | 16                          | —         | —              | —         | —         | 30        |
| Dhanbad   | 2005 | 1,99,258            | 47             | 16                          | —         | —              | —         | —         | 37        |
| Faridabad   | 2005 | 10,55,938           | 42             | 23                          | —         | —              | —         | —         | 35        |
| Gandhinagar                                       | 2005 | 1,95,985            | 34             | 13                          | —         | —              | —         | —         | 53        |
| Gangtok   | 2005 | 29,354              | 47             | 16                          | —         | —              | —         | —         | 37        |
| Greater Mumbai                                    | 2005 | 1,19,78,450         | 62             | 17                          | —         | —              | —         | —         | 21        |
| Guwahati  | 2005 | 8,09,895            | 54             | 23                          | —         | —              | —         | —         | 23        |
| Hyderabad   | 2005 | 38,43,585           | 54             | 22                          | —         | —              | —         | —         | 24        |
| Imphal  | 2005 | 2,21,492            | 60             | 19                          | —         | —              | —         | —         | 21        |
| Indore  | 2005 | 14,74,968           | 49             | 13                          | —         | —              | —         | —         | 38        |
| Itanagar  | 2005 | 35,022              | 52             | 21                          | —         | —              | —         | —         | 27        |
| Jabalpur  | 2005 | 9,32,484            | 58             | 17                          | —         | —              | —         | —         | 25        |
| Jaipur  | 2005 | 23,22,575           | 46             | 12                          | —         | —              | —         | —         | 42        |
| Jammu   | 2005 | 3,69,959            | 52             | 21                          | —         | —              | —         | —         | 27        |
| Jamshedpur  | 2005 | 11,04,713           | 43             | 16                          | —         | —              | —         | —         | 41        |

**ANNEX I (continued)****MSW Composition Data for Cities Over 100,000**

| Region/Country/<br>City                  | Year | Urban<br>Population | Organic<br>(%) | Total<br>Recyclables<br>(%) | Paper (%) | Plastic<br>(%) | Glass (%) | Metal (%) | Other (%) |
|--|------|---------------------|----------------|-----------------------------|-----------|----------------|-----------|-----------|-----------|
| Kanpur                                   | 2005 | 25,51,337           | 48             | 12                          | —         | —              | —         | —         | 41        |
| Kavarati                                 | 2005 | 10,119              | 46             | 27                          | —         | —              | —         | —         | 27        |
| Kochi                                    | 2005 | 5,95,575            | 57             | 19                          | —         | —              | —         | —         | 23        |
| Kohima                                   | 2005 | 77,030              | 57             | 23                          | —         | —              | —         | —         | 20        |
| Kolkata                                  | 2005 | 45,72,876           | 51             | 11                          | —         | —              | —         | —         | 38        |
| Lucknow                                  | 2005 | 21,85,927           | 47             | 16                          | —         | —              | —         | —         | 37        |
| Ludhiana                                 | 2005 | 13,98,467           | 50             | 19                          | —         | —              | —         | —         | 31        |
| Madurai                                  | 2005 | 9,28,868            | 55             | 17                          | —         | —              | —         | —         | 27        |
| Meerut                                   | 2005 | 10,68,772           | 55             | 11                          | —         | —              | —         | —         | 35        |
| Nagpur                                   | 2005 | 20,52,066           | 47             | 16                          | —         | —              | —         | —         | 37        |
| Nasik                                    | 2005 | 10,77,236           | 40             | 25                          | —         | —              | —         | —         | 35        |
| Panjim                                   | 2005 | 59,066              | 62             | 17                          | —         | —              | —         | —         | 21        |
| Patna                                    | 2005 | 13,66,444           | 52             | 13                          | —         | —              | —         | —         | 35        |
| Pondicherry                              | 2005 | 2,20,865            | 50             | 24                          | —         | —              | —         | —         | 26        |
| Port Blair                               | 2005 | 99,984              | 48             | 28                          | —         | —              | —         | —         | 24        |
| Pune                                     | 2005 | 25,38,473           | 62             | 17                          | —         | —              | —         | —         | 21        |
| Raipur                                   | 2005 | 6,05,747            | 51             | 16                          | —         | —              | —         | —         | 32        |
| Rajkot                                   | 2005 | 9,67,476            | 42             | 11                          | —         | —              | —         | —         | 47        |
| Ranchi                                   | 2005 | 8,47,093            | 51             | 10                          | —         | —              | —         | —         | 39        |
| Shillong                                 | 2005 | 1,32,867            | 63             | 17                          | —         | —              | —         | —         | 20        |
| Silvassa                                 | 2005 | 50,463              | 72             | 14                          | —         | —              | —         | —         | 14        |
| Simla                                    | 2005 | 1,42,555            | 43             | 37                          | —         | —              | —         | —         | 20        |
| Srinagar                                 | 2005 | 8,98,440            | 62             | 18                          | —         | —              | —         | —         | 20        |
| Surat                                    | 2005 | 24,33,835           | 57             | 11                          | —         | —              | —         | —         | 32        |
| Tiruvananthapuram                        | 2005 | 7,44,983            | 73             | 14                          | —         | —              | —         | —         | 13        |
| Vadodara                                 | 2005 | 13,06,227           | 47             | 15                          | —         | —              | —         | —         | 38        |
| Varanasi                                 | 2005 | 10,91,918           | 45             | 17                          | —         | —              | —         | —         | 38        |
| Vijaywada                                | 2005 | 8,51,282            | 59             | 17                          | —         | —              | —         | —         | 23        |
| Visakhapatnam                            | 2005 | 9,82,904            | 46             | 24                          | —         | —              | —         | —         | 30        |
| <b>Nepal (calculated from Alam 2008)</b> |      |                     |                |                             |           |                |           |           |           |
| Kathmandu                                |      | 738,173             | 68             | —                           | 8         | —              | 2         | 11        | 11        |

**ANNEX J****MSW Generation by Country – Current Data and Projections for 2025**

| Country                  | Income Level | Region | Current Available Data |   |                                   | 2025             |                  |   |                                   |
|--------------------------|--------------|--------|------------------------|---|-----------------------------------|------------------|------------------|---|-----------------------------------|
|                          |              |        | Total Urban Population | MSW Generation Per Capita (kg/capita/day) | Total MSW Generation (tonnes/day) | Total Population | Urban Population | MSW Generation Per Capita (kg/capita/day) | Total MSW Generation (tonnes/day) |
| Albania                  | LMI          | ECA    | 1,418,524              | 0.77                                      | 1,088                             | 3,488,000        | 2,006,000        | 1.2                                       | 2,407                             |
| Algeria                  | LMI          | MENA   | 19,225,335             | 1.21                                      | 23,288                            | 42,882,000       | 31,778,000       | 1.45                                      | 46,078                            |
| Angola                   | LMI          | AFR    | 8,973,498              | 0.48                                      | 4,329                             | 27,324,000       | 18,862,000       | 0.7                                       | 13,203                            |
| Antigua and Barbuda      | HIC          | LCR    | 24,907                 | 5.50                                      | 137                               | 101,000          | 35,000           | 4.3                                       | 151                               |
| Argentina                | UMI          | LCR    | 33,681,145             | 1.22                                      | 41,096                            | 46,115,000       | 43,470,000       | 1.85                                      | 80,420                            |
| Armenia                  | LMI          | ECA    | 1,964,525              | 0.68                                      | 1,342                             | 2,908,000        | 1,947,000        | 1.2                                       | 2,336                             |
| Australia                | HIC          | OECD   | 16,233,664             | 2.23                                      | 36,164                            | 24,393,000       | 22,266,000       | 2.1                                       | 46,759                            |
| Austria                  | HIC          | OECD   | 5,526,033              | 2.40                                      | 13,288                            | 8,622,000        | 6,204,000        | 2.15                                      | 13,339                            |
| Bahamas, The             | HIC          | LCR    | 252,689                | 3.25                                      | 822                               | 397,000          | 346,000          | 2.9                                       | 1,003                             |
| Bahrain                  | HIC          | MENA   | 574,671                | 1.10                                      | 630                               | 972,000          | 875,000          | 1.6                                       | 1,400                             |
| Bangladesh               | LI           | SAR    | 38,103,596             | 0.43                                      | 16,384                            | 206,024,000      | 76,957,000       | 0.75                                      | 57,718                            |
| Barbados                 | HIC          | LCR    | 92,289                 | 4.75                                      | 438                               | 303,000          | 152,000          | 4   | 608                               |
| Belarus                  | UMI          | ECA    | 7,057,977              | 0.78                                      | 5,479                             | 8,668,000        | 6,903,000        | 1.2                                       | 8,284                             |
| Belgium                  | HIC          | OECD   | 10,265,273             | 1.33                                      | 13,690                            | 10,742,000       | 10,511,000       | 1.8                                       | 18,920                            |
| Belize                   | UMI          | LCR    | 124,224                | 2.87                                      | 356                               | 389,000          | 237,000          | 2.3                                       | 545                               |
| Benin                    | LI           | AFR    | 3,147,050              | 0.54                                      | 1,699                             | 14,460,000       | 7,286,000        | 0.75                                      | 5,465                             |
| Bhutan                   | LMI          | SAR    | 225,257                | 1.46                                      | 329                               | 819,000          | 428,000          | 1.7                                       | 728                               |
| Bolivia                  | LMI          | LCR    | 5,587,410              | 0.33                                      | 1,863                             | 12,368,000       | 9,047,000        | 0.7                                       | 6,333                             |
| Botswana                 | UMI          | AFR    | 860,779                | 1.03                                      | 890                               | 2,265,000        | 1,591,000        | 1.4                                       | 2,227                             |
| Brazil                   | UMI          | LCR    | 144,507,175            | 1.03                                      | 149,096                           | 228,833,000      | 206,850,000      | 1.6                                       | 330,960                           |
| Brunei Darussalam        | HIC          | EAP    | 282,415                | 0.87                                      | 247                               | 526,000          | 426,000          | 1.3                                       | 554                               |
| Bulgaria                 | UMI          | ECA    | 5,423,113              | 1.28                                      | 6,959                             | 6,551,000        | 5,011,000        | 1.6                                       | 8,018                             |
| Burkina Faso             | LI           | AFR    | 2,549,805              | 0.51                                      | 1,288                             | 23,729,000       | 6,899,000        | 0.75                                      | 5,174                             |
| Burundi                  | LI           | AFR    | 700,922                | 0.55                                      | 384                               | 15,040,000       | 2,577,000        | 0.8                                       | 2,062                             |
| Cameroon                 | LMI          | AFR    | 7,914,528              | 0.77                                      | 6,082                             | 25,136,000       | 17,194,000       | 1   | 17,194                            |
| Canada                   | HIC          | OECD   | 21,287,906             | 2.33                                      | 49,616                            | 37,912,000       | 31,445,000       | 2.2                                       | 69,179                            |
| Cape Verde               | LMI          | AFR    | 274,049                | 0.50                                      | 137                               | 750,000          | 526,000          | 0.7                                       | 368                               |
| Central African Republic | LI           | AFR    | 1,596,934              | 0.50                                      | 795                               | 5,831,000        | 2,634,000        | 0.7                                       | 1,844                             |
| Chad                     | LI           | AFR    | 2,566,839              | 0.50                                      | 1,288                             | 17,504,000       | 6,566,000        | 0.7                                       | 4,596                             |
| Chile                    | UMI          | LCR    | 13,450,282             | 1.08                                      | 14,493                            | 19,266,000       | 17,662,000       | 1.5                                       | 26,493                            |
| China                    | LMI          | EAP    | 511,722,970            | 1.02                                      | 520,548                           | 1,445,782,000    | 822,209,000      | 1.7                                       | 1,397,755                         |
| Colombia                 | LMI          | LCR    | 29,283,628             | 0.95                                      | 27,918                            | 55,563,000       | 44,179,000       | 1.5                                       | 66,269                            |
| Comoros                  | LI           | AFR    | 161,070                | 2.23                                      | 359                               | 1,217,000        | 405,000          | 2.1                                       | 851                               |
| Congo, Dem. Rep.         | LI           | AFR    | 18,855,716             | 0.50                                      | 9,425                             | 107,481,000      | 48,980,000       | 0.75                                      | 36,735                            |
| Congo, Rep.              | LMI          | AFR    | 2,056,826              | 0.53                                      | 1,096                             | 5,362,000        | 3,678,000        | 0.75                                      | 2,759                             |
| Costa Rica               | UMI          | LCR    | 2,390,195              | 1.36                                      | 3,260                             | 5,549,000        | 3,973,000        | 1.8                                       | 7,151                             |
| Cote d'Ivoire            | LI           | AFR    | 9,006,597              | 0.48                                      | 4,356                             | 26,233,000       | 15,677,000       | 0.7                                       | 10,974                            |
| Croatia                  | UMI          | ECA    | 2,539,903              | 0.29                                      | 740                               | 4,274,000        | 2,735,000        | 0.8                                       | 2,188                             |
| Cuba                     | UMI          | LCR    | 8,447,447              | 0.81                                      | 6,822                             | 11,231,000       | 8,763,000        | 1.3                                       | 11,392                            |
| Cyprus                   | HIC          | ECA    | 595,707                | 2.07                                      | 1,230                             | 1,018,000        | 760,000          | 2.1                                       | 1,596                             |
| Czech Republic           | HIC          | OECD   | 7,547,813              | 1.10                                      | 8,326                             | 9,910,000        | 7,575,000        | 1.65                                      | 12,499                            |
| Denmark                  | HIC          | OECD   | 4,684,754              | 2.34                                      | 10,959                            | 5,578,000        | 5,027,000        | 2.15                                      | 10,808                            |
| Dominica                 | UMI          | LCR    | 50,793                 | 1.24                                      | 63                                | 69,000           | 55,000           | 1.6                                       | 88                                |
| Dominican Republic       | LMI          | LCR    | 5,625,356              | 1.18                                      | 6,658                             | 12,172,000       | 9,523,000        | 1.5                                       | 14,285                            |
| Ecuador                  | LMI          | LCR    | 7,599,288              | 1.13                                      | 8,603                             | 16,074,000       | 12,027,000       | 1.5                                       | 18,041                            |
| Egypt, Arab Rep.         | LMI          | MENA   | 29,894,036             | 1.37                                      | 40,822                            | 98,513,000       | 46,435,000       | 1.8                                       | 83,583                            |
| El Salvador              | LMI          | LCR    | 3,504,687              | 1.13                                      | 3,945                             | 8,525,000        | 5,726,000        | 1.6                                       | 9,162                             |
| Eritrea                  | LI           | AFR    | 878,184                | 0.50                                      | 438                               | 7,684,000        | 2,368,000        | 0.7                                       | 1,658                             |
| Estonia                  | HIC          | ECA    | 931,657                | 1.47                                      | 1,367                             | 1,252,000        | 903,000          | 1.7                                       | 1,535                             |
| Ethiopia                 | LI           | AFR    | 12,566,942             | 0.30                                      | 3,781                             | 124,996,000      | 30,293,000       | 0.65                                      | 19,690                            |
| Fiji                     | UMI          | EAP    | 339,328                | 2.10                                      | 712                               | 905,000          | 557,000          | 2.1                                       | 1,170                             |

**ANNEX J (continued)****MSW Generation by Country – Current Data and Projections for 2025**

| Country            | Income Level | Region | Current Available Data |   |                                   | 2025             |                  |   |                                   |
|--------------------|--------------|--------|------------------------|---|-----------------------------------|------------------|------------------|---|-----------------------------------|
|                    |              |        | Total Urban Population | MSW Generation Per Capita (kg/capita/day) | Total MSW Generation (tonnes/day) | Total Population | Urban Population | MSW Generation Per Capita (kg/capita/day) | Total MSW Generation (tonnes/day) |
| Finland            | HIC          | OECD   | 3,301,950              | 2.13                                      | 7,030                             | 5,464,000        | 3,805,000        | 2.1                                       | 7,991                             |
| France             | HIC          | OECD   | 47,192,398             | 1.92                                      | 90,493                            | 65,769,000       | 53,659,000       | 2   | 107,318                           |
| Gabon              | UMI          | AFR    | 1,144,675              | 0.45                                      | 521                               | 1,698,000        | 1,524,000        | 0.7                                       | 1,067                             |
| Gambia             | LI           | AFR    | 822,588                | 0.53                                      | 438                               | 2,534,000        | 1,726,000        | 0.75                                      | 1,295                             |
| Georgia            | LMI          | ECA    | 2,316,296              | 1.69                                      | 3,904                             | 3,945,000        | 2,272,000        | 1.85                                      | 4,203                             |
| Germany            | HIC          | OECD   | 60,530,216             | 2.11                                      | 127,816                           | 80,341,000       | 61,772,000       | 2.05                                      | 126,633                           |
| Ghana              | LI           | AFR    | 11,680,134             | 0.09                                      | 1,000                             | 31,993,000       | 19,713,000       | 0.5                                       | 9,857                             |
| Greece             | HIC          | OECD   | 6,755,967              | 2.00                                      | 13,499                            | 11,236,000       | 7,527,000        | 2   | 15,054                            |
| Grenada            | UMI          | LCR    | 31,324                 | 2.71                                      | 85                                | 108,000          | 40,000           | 2.3                                       | 92                                |
| Guatemala          | LMI          | LCR    | 5,237,139              | 2.00                                      | 10,466                            | 19,926,000       | 11,478,000       | 2   | 22,956                            |
| Guyana             | LMI          | LCR    | 215,946                | 5.33                                      | 1,151                             | 683,000          | 230,000          | 3.5                                       | 805                               |
| Haiti              | LI           | LCR    | 3,227,249              | 1.00                                      | 3,233                             | 12,305,000       | 7,966,000        | 1.4                                       | 11,152                            |
| Honduras           | LMI          | LCR    | 2,832,769              | 1.45                                      | 4,110                             | 9,682,000        | 5,544,000        | 1.8                                       | 9,979                             |
| Hong Kong, China   | HIC          | EAP    | 6,977,700              | 1.99                                      | 13,890                            | 8,305,000        | 8,305,000        | 2   | 16,610                            |
| Hungary            | HIC          | OECD   | 6,717,604              | 1.92                                      | 12,904                            | 9,448,000        | 7,011,000        | 2   | 14,022                            |
| Iceland            | HIC          | OECD   | 280,148                | 1.56                                      | 438                               | 337,000          | 314,000          | 1.7                                       | 534                               |
| India              | LMI          | SAR    | 321,623,271            | 0.34                                      | 109,589                           | 1,447,499,000    | 538,055,000      | 0.7                                       | 376,639                           |
| Indonesia          | LMI          | EAP    | 117,456,698            | 0.52                                      | 61,644                            | 271,227,000      | 178,731,000      | 0.85                                      | 151,921                           |
| Iran, Islamic Rep. | LMI          | MENA   | 46,219,250             | 0.16                                      | 7,197                             | 88,027,000       | 66,930,000       | 0.6                                       | 40,158                            |
| Ireland            | HIC          | OECD   | 2,589,698              | 3.58                                      | 9,260                             | 5,275,000        | 3,564,000        | 3   | 10,692                            |
| Israel             | HIC          | MENA   | 5,179,120              | 2.12                                      | 10,959                            | 8,722,000        | 8,077,000        | 2.1                                       | 16,962                            |
| Italy              | HIC          | OECD   | 39,938,760             | 2.23                                      | 89,096                            | 58,079,000       | 42,205,000       | 2.05                                      | 86,520                            |
| Jamaica            | UMI          | LCR    | 1,353,969              | 0.18                                      | 247                               | 2,908,000        | 1,733,000        | 0.9                                       | 1,560                             |
| Japan              | HIC          | OECD   | 84,330,180             | 1.71                                      | 144,466                           | 121,614,000      | 86,460,000       | 1.7                                       | 146,982                           |
| Jordan             | LMI          | MENA   | 3,850,403              | 1.04                                      | 4,000                             | 8,029,000        | 6,486,000        | 1.3                                       | 8,432                             |
| Kenya              | LI           | AFR    | 6,615,510              | 0.30                                      | 2,000                             | 57,176,000       | 16,952,000       | 0.6                                       | 10,171                            |
| Korea, South       | HIC          | OECD   | 38,895,504             | 1.24                                      | 48,397                            | 49,019,000       | 41,783,000       | 1.4                                       | 58,496                            |
| Kuwait             | HIC          | MENA   | 2,683,301              | 5.72                                      | 15,342                            | 3,988,000        | 3,934,000        | 4   | 15,736                            |
| Lao PDR            | LI           | EAP    | 1,916,209              | 0.70                                      | 1,342                             | 7,713,000        | 3,776,000        | 1.1                                       | 4,154                             |
| Latvia             | UMI          | ECA    | 1,549,569              | 1.03                                      | 1,600                             | 2,072,000        | 1,476,000        | 1.45                                      | 2,140                             |
| Lebanon            | UMI          | MENA   | 3,244,163              | 1.18                                      | 3,836                             | 4,784,000        | 4,275,000        | 1.7                                       | 7,268                             |
| Lesotho            | LMI          | AFR    | 461,534                | 0.50                                      | 230                               | 2,211,000        | 850,000          | 0.8                                       | 680                               |
| Lithuania          | UMI          | ECA    | 2,256,263              | 1.10                                      | 2,474                             | 3,102,000        | 2,193,000        | 1.5                                       | 3,290                             |
| Luxembourg         | HIC          | OECD   | 390,776                | 2.31                                      | 904                               | 569,000          | 473,000          | 2.2                                       | 1,041                             |
| Macao, China       | HIC          | EAP    | 466,162                | 1.47                                      | 685                               | 535,000          | 535,000          | 1.75                                      | 936                               |
| Macedonia, FYR     | LMI          | ECA    | 1,341,972              | 1.06                                      | 1,425                             | 2,001,000        | 1,493,000        | 1.6                                       | 2,389                             |
| Madagascar         | LI           | AFR    | 4,653,890              | 0.80                                      | 3,734                             | 29,954,000       | 11,350,000       | 1.1                                       | 12,485                            |
| Malawi             | LI           | AFR    | 2,288,114              | 0.50                                      | 1,151                             | 21,353,000       | 6,158,000        | 0.8                                       | 4,926                             |
| Malaysia           | UMI          | EAP    | 14,429,641             | 1.52                                      | 21,918                            | 33,769,000       | 27,187,000       | 1.9                                       | 51,655                            |
| Maldives           | LMI          | SAR    | 70,816                 | 2.48                                      | 175                               | 411,000          | 233,000          | 2.2                                       | 513                               |
| Mali               | LI           | AFR    | 3,900,064              | 0.65                                      | 2,534                             | 20,589,000       | 8,987,000        | 0.95                                      | 8,538                             |
| Malta              | HIC          | MENA   | 384,809                | 1.78                                      | 685                               | 431,000          | 416,000          | 2   | 832                               |
| Mauritania         | LI           | AFR    | 1,197,094              | 0.50                                      | 603                               | 4,548,000        | 2,203,000        | 0.8                                       | 1,762                             |
| Mauritius          | UMI          | AFR    | 519,206                | 2.30                                      | 1,195                             | 1,406,000        | 674,000          | 2.2                                       | 1,483                             |
| Mexico             | UMI          | LCR    | 79,833,562             | 1.24                                      | 99,014                            | 124,695,000      | 102,258          | 1.75                                      | 179                               |
| Mongolia           | LMI          | EAP    | 1,370,974              | 0.66                                      | 904                               | 3,112,000        | 1,965,000        | 0.95                                      | 1,867                             |
| Morocco            | LMI          | MENA   | 15,753,989             | 1.46                                      | 23,014                            | 37,865,000       | 23,994,000       | 1.85                                      | 44,389                            |
| Mozambique         | LI           | AFR    | 7,706,816              | 0.14                                      | 1,052                             | 28,954,000       | 14,493,000       | 0.5                                       | 7,247                             |
| Myanmar            | LI           | EAP    | 12,847,522             | 0.44                                      | 5,616                             | 55,374,000       | 24,720,000       | 0.85                                      | 21,012                            |
| Namibia            | LMI          | AFR    | 708,907                | 0.50                                      | 356                               | 2,560,000        | 1,226,000        | 0.9                                       | 1,103                             |
| Nepal              | LI           | SAR    | 3,464,234              | 0.12                                      | 427                               | 38,855,000       | 10,550,000       | 0.7                                       | 7,385                             |

**ANNEX J (continued)****MSW Generation by Country – Current Data and Projections for 2025**

| Country                        | Income Level | Region | Current Available Data |   |                                   | 2025             |                  |   |                                   |
|--------------------------------|--------------|--------|------------------------|---|-----------------------------------|------------------|------------------|---|-----------------------------------|
|                                |              |        | Total Urban Population | MSW Generation Per Capita (kg/capita/day) | Total MSW Generation (tonnes/day) | Total Population | Urban Population | MSW Generation Per Capita (kg/capita/day) | Total MSW Generation (tonnes/day) |
| Netherlands                    | HIC          | OECD   | 13,197,842             | 2.12                                      | 27,945                            | 16,960,000       | 14,860,000       | 2.1                                       | 31,206                            |
| New Zealand                    | HIC          | OECD   | 3,612,147              | 3.68                                      | 13,293                            | 4,764,000        | 4,229,000        | 3   | 12,687                            |
| Nicaragua                      | LMI          | LCR    | 2,848,165              | 1.10                                      | 3,123                             | 7,075,000        | 4,478,000        | 1.5                                       | 6,717                             |
| Niger                          | LI           | AFR    | 2,162,063              | 0.49                                      | 1,068                             | 26,250,000       | 5,503,000        | 0.75                                      | 4,127                             |
| Nigeria                        | LI           | AFR    | 73,178,110             | 0.56                                      | 40,959                            | 210,129,000      | 126,634,000      | 0.8                                       | 101,307                           |
| Norway                         | HIC          | OECD   | 3,605,500              | 2.80                                      | 10,082                            | 5,228,000        | 4,187,000        | 2.3                                       | 9,630                             |
| Oman                           | HIC          | MENA   | 1,629,404              | 0.70                                      | 1,142                             | 3,614,000        | 2,700,000        | 1.15                                      | 3,105                             |
| Pakistan                       | LI           | SAR    | 60,038,941             | 0.84                                      | 50,438                            | 224,956,000      | 104,042,000      | 1.05                                      | 109,244                           |
| Panama                         | UMI          | LCR    | 2,008,299              | 1.21                                      | 2,438                             | 4,267,000        | 3,501,000        | 1.65                                      | 5,777                             |
| Paraguay                       | LMI          | LCR    | 3,052,320              | 0.21                                      | 630                               | 8,026,000        | 5,584,000        | 0.6                                       | 3,350                             |
| Peru                           | LMI          | LCR    | 18,678,510             | 1.00                                      | 18,740                            | 34,148,000       | 25,593,000       | 1.4                                       | 35,830                            |
| Philippines                    | LMI          | EAP    | 58,654,205             | 0.50                                      | 29,315                            | 115,878,000      | 86,418,000       | 0.9                                       | 77,776                            |
| Poland                         | UMI          | ECA    | 23,398,400             | 0.88                                      | 20,630                            | 36,337,000       | 23,236,000       | 1.2                                       | 27,883                            |
| Portugal                       | HIC          | OECD   | 6,162,205              | 2.21                                      | 13,616                            | 10,712,000       | 7,389,000        | 2.15                                      | 15,886                            |
| Qatar                          | HIC          | MENA   | 759,577                | 1.33                                      | 1,014                             | 1,102,000        | 1,066,000        | 1.7                                       | 1,812                             |
| Romania                        | UMI          | ECA    | 11,648,240             | 1.04                                      | 12,082                            | 19,494,000       | 11,783,000       | 1.45                                      | 17,085                            |
| Russian Federation             | UMI          | ECA    | 107,386,402            | 0.93                                      | 100,027                           | 128,193,000      | 96,061,000       | 1.25                                      | 120,076                           |
| Rwanda                         | LI           | AFR    | 1,573,625              | 0.52                                      | 822                               | 15,220,000       | 3,831,000        | 0.85                                      | 3,256                             |
| Sao Tome and Principe          | LI           | AFR    | 88,673                 | 0.49                                      | 44                                | 216,000          | 155,000          | 0.9                                       | 140                               |
| Saudi Arabia                   | HIC          | MENA   | 15,388,239             | 1.30                                      | 20,000                            | 34,797,000       | 29,661,000       | 1.7                                       | 50,424                            |
| Senegal                        | LI           | AFR    | 4,693,019              | 0.52                                      | 2,438                             | 17,999,000       | 8,992,000        | 0.85                                      | 7,643                             |
| Serbia                         | UMI          | ECA    | 3,830,299              | 0.79                                      | 3,041                             | 9,959,000        | 5,814,000        | 1.05                                      | 6,105                             |
| Seychelles                     | UMI          | AFR    | 43,172                 | 2.98                                      | 129                               | 94,000           | 60,000           | 2.5                                       | 150                               |
| Sierra Leone                   | LI           | AFR    | 2,029,398              | 0.45                                      | 904                               | 8,639,000        | 3,949,000        | 0.85                                      | 3,357                             |
| Singapore                      | HIC          | EAP    | 4,839,400              | 1.49                                      | 7,205                             | 5,104,000        | 5,104,000        | 1.8                                       | 9,187                             |
| Slovak Republic                | HIC          | OECD   | 3,036,442              | 1.37                                      | 4,164                             | 5,308,000        | 3,300,000        | 1.6                                       | 5,280                             |
| Slovenia                       | HIC          | ECA    | 986,862                | 1.21                                      | 1,192                             | 1,941,000        | 958,000          | 1.7                                       | 1,629                             |
| Solomon Islands                | LI           | EAP    | 50,992                 | 4.30                                      | 219                               | 705,000          | 183,000          | 4   | 732                               |
| South Africa                   | UMI          | AFR    | 26,720,493             | 2.00                                      | 53,425                            | 52,300,000       | 36,073,000       | 2   | 72,146                            |
| Spain                          | HIC          | OECD   | 33,899,073             | 2.13                                      | 72,137                            | 46,623,000       | 37,584,000       | 2.1                                       | 78,926                            |
| Sri Lanka                      | LMI          | SAR    | 2,953,410              | 5.10                                      | 15,068                            | 20,328,000       | 3,830,000        | 4   | 15,320                            |
| St. Kitts and Nevis            | UMI          | LCR    | 15,069                 | 5.45                                      | 82                                | 61,000           | 23,000           | 4   | 92                                |
| St. Lucia                      | UMI          | LCR    | 44,119                 | 4.35                                      | 192                               | 195,000          | 64,000           | 4   | 256                               |
| St. Vincent and the Grenadines | UMI          | LCR    | 48,255                 | 1.70                                      | 82                                | 125,000          | 69,000           | 1.85                                      | 128                               |
| Sudan                          | LMI          | AFR    | 12,600,333             | 0.79                                      | 10,000                            | 54,267,000       | 30,921,000       | 1.05                                      | 32,467                            |
| Suriname                       | UMI          | LCR    | 343,331                | 1.36                                      | 466                               | 482,000          | 389,000          | 1.6                                       | 622                               |
| Swaziland                      | LMI          | AFR    | 270,983                | 0.51                                      | 137                               | 1,242,000        | 417,000          | 0.85                                      | 354                               |
| Sweden                         | HIC          | OECD   | 7,662,130              | 1.61                                      | 12,329                            | 9,854,000        | 8,525,000        | 1.85                                      | 15,771                            |
| Switzerland                    | HIC          | OECD   | 5,490,214              | 2.61                                      | 14,329                            | 7,978,000        | 6,096,000        | 2.3                                       | 14,021                            |
| Syrian Arab Republic           | LMI          | MENA   | 9,109,737              | 1.37                                      | 12,493                            | 27,519,000       | 16,890,000       | 1.7                                       | 28,713                            |
| Tajikistan                     | LI           | ECA    | 1,653,091              | 0.89                                      | 1,479                             | 8,929,000        | 2,774,000        | 1.2                                       | 3,329                             |
| Tanzania                       | LI           | AFR    | 9,439,781              | 0.26                                      | 2,425                             | 59,989,000       | 21,029,000       | 0.55                                      | 11,566                            |
| Thailand                       | LMI          | EAP    | 22,453,143             | 1.76                                      | 39,452                            | 68,803,000       | 29,063,000       | 1.95                                      | 56,673                            |
| Togo                           | LI           | AFR    | 2,390,840              | 0.52                                      | 1,233                             | 9,925,000        | 5,352,000        | 0.85                                      | 4,549                             |
| Tonga                          | LMI          | EAP    | 22,162                 | 3.71                                      | 82                                | 112,000          | 37,000           | 3.5                                       | 130                               |
| Trinidad and Tobago            | HIC          | LCR    | 144,645                | 1.59                                      | 2,082                             | 1,401,000        | 291,000          | 10  | 2,910                             |
| Tunisia                        | LMI          | MENA   | 6,063,259              | 0.81                                      | 4,932                             | 12,170,000       | 8,909,000        | 1.15                                      | 10,245                            |
| Turkey                         | UMI          | ECA    | 48,846,780             | 1.77                                      | 86,301                            | 89,557,000       | 67,981,000       | 2   | 135,962                           |
| Turkmenistan                   | LMI          | ECA    | 2,061,980              | 0.98                                      | 2,027                             | 6,068,000        | 3,485,000        | 1.25                                      | 4,356                             |

**ANNEX J (continued)****MSW Generation by Country – Current Data and Projections for 2025**

| Country              | Income Level | Region | Current Available Data |   |                                   | 2025             |                  |   |                                   |
|----------------------|--------------|--------|------------------------|---|-----------------------------------|------------------|------------------|---|-----------------------------------|
|                      |              |        | Total Urban Population | MSW Generation Per Capita (kg/capita/day) | Total MSW Generation (tonnes/day) | Total Population | Urban Population | MSW Generation Per Capita (kg/capita/day) | Total MSW Generation (tonnes/day) |
| Uganda               | LI           | AFR    | 3,450,140              | 0.34                                      | 1,179                             | 54,011,000       | 9,713,000        | 0.65                                      | 6,313                             |
| United Arab Emirates | HIC          | MENA   | 2,526,336              | 1.66                                      | 4,192                             | 6,268,000        | 5,092,000        | 2   | 10,184                            |
| United Kingdom       | HIC          | OECD   | 54,411,080             | 1.79                                      | 97,342                            | 65,190,000       | 59,738,000       | 1.85                                      | 110,515                           |
| United States        | HIC          | OECD   | 241,972,393            | 2.58                                      | 624,700                           | 354,930,000      | 305,091,000      | 2.3                                       | 701,709                           |
| Uruguay              | UMI          | LCR    | 3,025,161              | 0.11                                      | 329                               | 3,548,000        | 3,333,000        | 0.6                                       | 2,000                             |
| Vanuatu              | LMI          | EAP    | 33,430                 | 3.28                                      | 110                               | 328,000          | 113,000          | 3   | 339                               |
| Venezuela, RB        | UMI          | LCR    | 22,342,983             | 1.14                                      | 25,507                            | 35,373,000       | 34,059,000       | 1.5                                       | 51,089                            |
| Vietnam              | LI           | EAP    | 24,001,081             | 1.46                                      | 35,068                            | 106,357,000      | 40,505,000       | 1.8                                       | 72,909                            |
| Zambia               | LI           | AFR    | 4,010,708              | 0.21                                      | 842                               | 16,539,000       | 6,862,000        | 0.55                                      | 3,774                             |
| Zimbabwe             | LI           | AFR    | 4,478,555              | 0.53                                      | 2,356                             | 15,969,000       | 7,539,000        | 0.7                                       | 5,277                             |

| Summary by Income Level    |                              |                                   |                             |                            |                      |       |                                |           |
|----------------------------|------------------------------|-----------------------------------|-----------------------------|----------------------------|----------------------|-------|--------------------------------|-----------|
| Income Level               | Number of Countries Included | Current Available Data            |                             |                            | Projections for 2025 |       |                                |           |
|                            |                              | Total Urban Population (millions) | Urban MSW Generation        |                            | Projected Population |       | Projected Urban MSW Generation |           |
| Per Capita (kg/capita/day) | Total (tonnes/day)           | Total Population (millions)       | Urban Population (millions) | Per Capita (kg/capita/day) | Total (tonnes/day)   |       |                                |           |
| Lower Income               | 38                           | 343                               | 0.60                        | 204,802                    | 1,637                | 676   | 0.86                           | 584,272   |
| Lower Middle Income        | 42                           | 1,293                             | 0.78                        | 1,012,321                  | 4,011                | 2,080 | 1.26                           | 2,618,804 |
| Upper Middle Income        | 35                           | 572                               | 1.16                        | 665,586                    | 888                  | 619   | 1.59                           | 987,039   |
| High Income                | 46                           | 774                               | 2.13                        | 1,649,546                  | 1,112                | 912   | 2.06                           | 1,879,590 |
| Total                      | 161                          | 2,982                             | 1.19                        | 3,532,255                  | 7,648                | 4,287 | 1.42                           | 6,069,705 |

| Summary by Region          |                              |                                   |                      |                            |                      |                  |                                |                    |
|----------------------------|------------------------------|-----------------------------------|----------------------|----------------------------|----------------------|------------------|--------------------------------|--------------------|
| Region                     | Number of Countries Included | Current Available Data            |                      |                            | Projections for 2025 |                  |                                |                    |
|                            |                              | Total Urban Population (millions) | Urban MSW Generation |                            | Projected Population |                  | Projected Urban MSW Generation |                    |
| Per Capita (kg/capita/day) | Total (tonnes/day)           | Total (millions)                  | Urban (millions)     | Per Capita (kg/capita/day) | Total (tonnes/day)   | Urban (millions) | Per Capita (kg/capita/day)     | Total (tonnes/day) |
| AFR                        | 42                           | 261                               | 0.65                 | 169,120                    | 1,153                | 518              | 0.85                           | 441,840            |
| EAP                        | 17                           | 777                               | 0.95                 | 738,959                    | 2,124                | 1,230            | 1.52                           | 1,865,380          |
| ECA                        | 19                           | 227                               | 1.12                 | 254,389                    | 339                  | 240              | 1.48                           | 354,811            |
| LCR                        | 33                           | 400                               | 1.09                 | 437,545                    | 682                  | 466              | 1.56                           | 728,392            |
| MENA                       | 16                           | 162                               | 1.07                 | 173,545                    | 379                  | 257              | 1.43                           | 369,320            |
| OECD                       | 27                           | 729                               | 2.15                 | 1,566,286                  | 1,032                | 842              | 2.07                           | 1,742,417          |
| SAR                        | 7                            | 426                               | 0.45                 | 192,411                    | 1,939                | 734              | 0.77                           | 567,545            |
| Total                      | 161                          | 2,982                             | 1.19                 | 3,532,255                  | 7,648                | 4,287            | 1.42                           | 6,069,705          |

**ANNEX K**  
**MSW Collection Rates by Country**

| Country             | Income | Region | Collection (%) | Urban/Total |
|---------------------|--------|--------|----------------|-------------|
| Albania             | LMI    | ECA    | 77             | T           |
| Algeria             | UMI    | MENA   | 92             | U           |
| Andorra             | HIC    | OECD   | 100            | T           |
| Antigua and Barbuda | HIC    | LCR    | 95             | T           |
| Armenia             | LMI    | ECA    | 80             | T           |
| Austria             | HIC    | OECD   | 100            | T           |
| Belarus             | UMI    | ECA    | 100            | T           |
| Belgium             | HIC    | OECD   | 100            | T           |
| Belize              | LMI    | LCR    | 50             | T           |
| Benin               | LI     | AFR    | 23             | T           |
| Brazil              | UMI    | LCR    | 83             | T           |
| Bulgaria            | UMI    | ECA    | 81             | T           |
| Cambodia            | LI     | EAP    | 75             | U           |
| Canada              | HIC    | OECD   | 99             | T           |
| Colombia            | UMI    | LCR    | 98             | T           |
| Comoros             | LI     | AFR    | 20             | T           |
| Costa Rica          | UMI    | LCR    | 74             | T           |
| Croatia             | HIC    | ECA    | 92             | T           |
| Cuba                | UMI    | LCR    | 76             | T           |
| Czech Republic      | HIC    | OECD   | 100            | T           |
| Denmark             | HIC    | OECD   | 100            | T           |
| Dominica            | UMI    | LCR    | 94             | T           |
| Dominican Republic  | UMI    | LCR    | 69             | T           |
| Ecuador             | LMI    | LCR    | 81             | T           |
| Egypt, Arab Rep.    | LMI    | MENA   | 30-95          | U           |
| El Salvador         | LMI    | LCR    | 71             | T           |
| Estonia             | HIC    | ECA    | 79             | T           |
| Finland             | HIC    | OECD   | 100            | T           |
| France              | HIC    | OECD   | 100            | T           |
| Georgia             | LMI    | ECA    | 60             | T           |
| Germany             | HIC    | OECD   | 100            | T           |
| Ghana               | LI     | AFR    | 85             | U           |
| Greece              | HIC    | OECD   | 100            | T           |
| Grenada             | UMI    | LCR    | 100            | T           |
| Guatemala           | LMI    | LCR    | 72             | T           |
| Guyana              | LMI    | LCR    | 89             | T           |
| Haiti               | LI     | LCR    | 11             | T           |
| Honduras            | LMI    | LCR    | 68             | T           |
| Hong Kong, China    | HIC    | EAP    | 100            | T           |
| Hungary             | HIC    | OECD   | 90             | T           |
| Iceland             | HIC    | OECD   | 100            | T           |
| Indonesia           | LMI    | EAP    | 80             | U           |
| Iraq                | LMI    | MENA   | 56             | T           |
| Ireland             | HIC    | OECD   | 76             | T           |
| Italy               | HIC    | OECD   | 100            | T           |
| Jamaica             | UMI    | LCR    | 62             | T           |
| Japan               | HIC    | OECD   | 100            | T           |
| Jordan              | LMI    | MENA   | 95+            | U           |
| Korea, South        | HIC    | OECD   | 99             | T           |
| Latvia              | UMI    | ECA    | 50             | T           |
| Lebanon             | UMI    | MENA   | 100            | U           |
| Luxembourg          | HIC    | OECD   | 100            | T           |

**ANNEX K (continued)****MSW Collection Rates by Country**

| <b>Country</b>                 | <b>Income</b> | <b>Region</b> | <b>Collection (%)</b> | <b>Urban/Total</b> |
|--------------------------------|---------------|---------------|-----------------------|--------------------|
| Macao, China                   | HIC           | EAP           | 100                   | T                  |
| Madagascar                     | LI            | AFR           | 18                    | T                  |
| Mali                           | LI            | AFR           | 40                    | T                  |
| Malta                          | HIC           | MENA          | 100                   | T                  |
| Marshall Islands               | LMI           | EAP           | 60                    | T                  |
| Mauritius                      | UMI           | AFR           | 98                    | T                  |
| Mexico                         | UMI           | LCR           | 91                    | T                  |
| Monaco                         | HIC           | OECD          | 100                   | T                  |
| Morocco                        | LMI           | MENA          | 72-100                | T                  |
| Nepal                          | LI            | SAR           | 94                    | U                  |
| Netherlands                    | HIC           | OECD          | 100                   | T                  |
| Nicaragua                      | LMI           | LCR           | 73                    | T                  |
| Norway                         | HIC           | OECD          | 99                    | T                  |
| Panama                         | UMI           | LCR           | 77                    | T                  |
| Paraguay                       | LMI           | LCR           | 51                    | T                  |
| Peru                           | UMI           | LCR           | 74                    | T                  |
| Portugal                       | HIC           | OECD          | 100                   | T                  |
| Romania                        | UMI           | ECA           | 90                    | T                  |
| Senegal                        | LI            | AFR           | 21                    | T                  |
| Serbia                         | UMI           | ECA           | 65                    | T                  |
| Seychelles                     | UMI           | AFR           | 95                    | T                  |
| Sierra Leone                   | LI            | AFR           | 33-55                 | U                  |
| Singapore                      | HIC           | EAP           | 100                   | T                  |
| Slovak Republic                | HIC           | OECD          | 100                   | T                  |
| Slovenia                       | HIC           | ECA           | 93                    | T                  |
| St. Kitts and Nevis            | UMI           | LCR           | 98                    | T                  |
| St. Lucia                      | UMI           | LCR           | 100                   | T                  |
| St. Vincent and the Grenadines | UMI           | LCR           | 91                    | T                  |
| Suriname                       | UMI           | LCR           | 80                    | T                  |
| Sweden                         | HIC           | OECD          | 100                   | T                  |
| Switzerland                    | HIC           | OECD          | 99                    | T                  |
| Syrian Arab Republic           | LMI           | MENA          | 80                    | U                  |
| Tanzania                       | LI            | AFR           | 48                    | U                  |
| Trinidad and Tobago            | HIC           | LCR           | 100                   | T                  |
| Tunisia                        | LMI           | MENA          | 95                    | U                  |
| Turkey                         | UMI           | ECA           | 77                    | T                  |
| Uganda                         | LI            | AFR           | 39                    | U                  |
| United Kingdom                 | HIC           | OECD          | 100                   | T                  |
| United States                  | HIC           | OECD          | 100                   | T                  |
| Uruguay                        | UMI           | LCR           | 86                    | T                  |
| Venezuela, RB                  | UMI           | LCR           | 86                    | T                  |
| West Bank and Gaza             | LMI           | MENA          | 85                    | U                  |
| Zambia                         | LI            | AFR           | 20                    | T                  |

**ANNEX K (continued)**  
**MSW Collection Rates by Country**

| Summary by Income Level |                              |                    |             |
|-------------------------|------------------------------|--------------------|-------------|
| Income Level            | Number of Countries Included | MSW Collection (%) |             |
|                         |                              | Lower Limit        | Upper Limit |
| Lower Income            | 13                           | 10.62              | 55.00       |
| Lower Middle Income     | 20                           | 50.20              | 95+         |
| Upper Middle Income     | 27                           | 50.00              | 100.00      |
| High Income             | 35                           | 76.00              | 100.00      |
| Total                   | 95                           |                    |             |

| Summary by Region |                              |                    |             |
|-------------------|------------------------------|--------------------|-------------|
| Region            | Number of Countries Included | MSW Collection (%) |             |
|                   |                              | Lower Limit        | Upper Limit |
| AFR               | 12                           | 17.70              | 55.00       |
| EAP               | 6                            | 60.00              | 100.00      |
| ECA               | 12                           | 50.00              | 100.00      |
| LCR               | 28                           | 10.62              | 100.00      |
| MENA              | 10                           | 55.60              | 95+         |
| OECD              | 26                           | 76.00              | 100.00      |
| SAR               | 1                            | 94.00              |             |
| Total             | 95                           |                    |             |

**ANNEX L****MSW Disposal Methods by Country**

| Country                   | Income | Region | Dumps (%) | Landfills (%) | Compost (%) | Recycled (%) | WTE (%) | Other (%) |
|---------------------------|--------|--------|-----------|---------------|-------------|--------------|---------|-----------|
| Algeria                   | UMI    | MNA    | 96.80     | 0.20          | 1.00        | 2.00         | —       | —         |
| Antigua and Barbuda       | HIC    | LCR    |           | 99.00         |             | 1.00         | —       | —         |
| Armenia                   | LMI    | ECA    | —         | 100.00        | —           | —            | —       | —         |
| Australia                 | HIC    | OECD   | —         | 69.66         | —           | 30.34        | —       | —         |
| Austria                   | HIC    | OECD   | —         | 6.75          | 44.72       | 26.54        | 21.10   | 0.90      |
| Belarus                   | UMI    | ECA    | —         | 96.00         | 4.00        | —            | —       | —         |
| Belgium                   | HIC    | OECD   | —         | 11.57         | 22.77       | 31.10        | 34.32   | —         |
| Belize                    | LMI    | LCR    | —         | 100.00        | —           | —            | —       | —         |
| Bulgaria                  | UMI    | ECA    | —         | 82.90         | —           | —            | —       | 17.10     |
| Cambodia                  | LI     | EAP    | 100.00    | —             | —           | —            | —       | —         |
| Cameroon                  | LMI    | AFR    | 95.00     | —             | —           | 5.00         | —       | —         |
| Canada                    | HIC    | OECD   | —         | —             | 12.48       | 26.78        | —       | 60.74     |
| Chile                     | UMI    | LCR    | —         | 100.00        | —           | —            | —       | —         |
| Colombia                  | UMI    | LCR    | 54.00     | 46.00         | —           | —            | —       | —         |
| Costa Rica                | UMI    | LCR    | 22.37     | 71.95         | —           | 0.29         | —       | 5.39      |
| Croatia                   | HIC    | ECA    | —         | 69.50         | 0.90        | 2.40         | —       | 27.20     |
| Cuba                      | UMI    | LCR    | —         | 100.00        | 11.10       | 4.80         | —       | —         |
| Cyprus                    | HIC    | ECA    | —         | 87.20         | —           | —            | —       | 12.80     |
| Czech Republic            | HIC    | OECD   | —         | 79.78         | 3.24        | 1.27         | 13.97   | 1.74      |
| Denmark                   | HIC    | OECD   | —         | 5.09          | 15.28       | 25.57        | 54.04   | 0.03      |
| Dominica                  | UMI    | LCR    | —         | 100.00        | —           | —            | —       | —         |
| Greece                    | HIC    | OECD   | —         | 92            | —           | 8            | —       | —         |
| Grenada                   | UMI    | LCR    | —         | 90            | —           | —            | —       | 10        |
| Guatemala                 | LMI    | LCR    | —         | 22            | —           | —            | —       | 78        |
| Guyana                    | LMI    | LCR    | 37        | 59            | —           | —            | —       | 4         |
| Haiti                     | LI     | LCR    | 24        | —             | —           | —            | —       | 76        |
| Hong Kong, China          | HIC    | EAP    | —         | 55            | —           | 45           | —       | —         |
| Hungary                   | HIC    | OECD   | —         | 90            | 1           | 3            | 6       | 0         |
| Iceland <sup>2</sup>      | HIC    | OECD   | —         | 72            | 9           | 16           | 9       | —         |
| Ireland                   | HIC    | OECD   | —         | 66            | —           | 34           | —       | —         |
| Israel                    | HIC    | MENA   | —         | 90            | —           | 10           | —       | —         |
| Italy                     | HIC    | OECD   | —         | 54            | 33          | —            | 12      | —         |
| Jamaica                   | UMI    | LCR    | —         | 100           | —           | —            | —       | —         |
| Japan                     | HIC    | OECD   | —         | 3             | —           | 17           | 74      | 6         |
| Jordan <sup>3</sup>       | LMI    | MENA   | —         | 85            | —           | —            | —       | 15        |
| Korea, South              | HIC    | OECD   | —         | 36            | —           | 49           | 14      | —         |
| Kyrgyz Republic           | LI     | ECA    | —         | 100           | —           | —            | —       | —         |
| Latvia                    | UMI    | ECA    | 60        | 40            | —           | —            | —       | —         |
| Lebanon                   | UMI    | MENA   | 37        | 46            | 8           | 8            | —       | 1         |
| Lithuania                 | UMI    | ECA    | —         | 44            | —           | 4            | 2       | 50        |
| Luxembourg                | HIC    | OECD   | —         | 19            | 19          | 23           | 39      | —         |
| Macao, China <sup>2</sup> | HIC    | EAP    | —         | 21            | —           | —            | —       | 100       |
| Madagascar <sup>2</sup>   | LI     | AFR    | —         | 97            | 4           | —            | —       | —         |
| Malta                     | HIC    | MENA   | —         | 88            | —           | —            | —       | 13        |
| Marshall Islands          | LMI    | EAP    | —         | —             | 6           | 31           | —       | 63        |
| Mauritius                 | UMI    | AFR    | —         | 91            | —           | 2            | —       | —         |
| Mexico                    | UMI    | LCR    | —         | 97            | —           | 3            | —       | —         |
| Monaco <sup>4</sup>       | HIC    | OECD   | —         | 27            | —           | 4            | —       | 132       |
| Morocco                   | LMI    | MENA   | 95        | 1             | —           | 4            | —       | —         |
| Netherlands               | HIC    | OECD   | —         | 2             | 23          | 25           | 32      | 17        |
| New Zealand               | HIC    | OECD   | —         | 85            | —           | 15           | —       | —         |
| Nicaragua                 | LMI    | LCR    | 34        | 28            | —           | —            | —       | 38        |

**ANNEX L (continued)**  
**MSW Disposal Methods by Country**

| Country                        | Income | Region | Dumps (%) | Landfills (%) | Compost (%) | Recycled (%) | WTE (%) | Other (%) |
|--------------------------------|--------|--------|-----------|---------------|-------------|--------------|---------|-----------|
| Niger                          | LI     | AFR    | —         | 64            | —           | 4            | —       | 32        |
| Norway                         | HIC    | OECD   | —         | 26            | 15          | 34           | 25      | 0         |
| Panama                         | UMI    | LCR    | 20        | 56            | —           | —            | —       | 24        |
| Paraguay                       | LMI    | LCR    | 42        | 44            | —           | —            | —       | 14        |
| Peru                           | UMI    | LCR    | 19        | 66            | —           | —            | —       | 15        |
| Poland                         | UMI    | ECA    | —         | 92            | 3           | 4            | 0       | —         |
| Portugal <sup>5</sup>          | HIC    | OECD   | —         | 64            | 6           | 9            | 21      | —         |
| Romania                        | UMI    | ECA    | —         | 75            | —           | —            | —       | 25        |
| Singapore <sup>6</sup>         | HIC    | EAP    | —         | 15            | —           | 47           | —       | 49        |
| Slovak Republic                | HIC    | OECD   | —         | 78            | 1           | 1            | 12      | 7         |
| Slovenia                       | HIC    | ECA    | —         | 86            | —           | —            | —       | 14        |
| Spain                          | HIC    | OECD   | —         | 52            | 33          | 9            | 7       | —         |
| St. Kitts and Nevis            | UMI    | LCR    | —         | 100           | —           | —            | —       | —         |
| St. Lucia                      | UMI    | LCR    | —         | 70            | —           | —            | —       | 30        |
| St. Vincent and the Grenadines | UMI    | LCR    | —         | 78            | —           | —            | —       | 22        |
| Suriname                       | UMI    | LCR    | 100       | —             | —           | —            | —       | 0         |
| Sweden                         | HIC    | OECD   | —         | 5             | 10          | 34           | 50      | 1         |
| Switzerland                    | HIC    | OECD   | —         | 1             | 16          | 34           | 50      | —         |
| Syrian Arab Republic           | LMI    | MENA   | >60       | <25           | <5          | <15          | —       | —         |
| Thailand                       | LMI    | EAP    | —         | —             | —           | 14           | —       | 85        |
| Trinidad and Tobago            | HIC    | LCR    | 6         | —             | —           | —            | —       | 94        |
| Tunisia                        | LMI    | MENA   | 45        | 50            | 0           | 5            | —       | —         |
| Turkey                         | UMI    | ECA    | 66        | 30            | 1           | —            | 0       | 3         |
| Uganda                         | LI     | AFR    | —         | 100           | —           | —            | —       | —         |
| United Kingdom                 | HIC    | OECD   | —         | 64            | 9           | 17           | 8       | 1         |
| United States                  | HIC    | OECD   | —         | 54            | 8           | 24           | 14      | —         |
| Uruguay                        | UMI    | LCR    | 32        | 3             | —           | —            | —       | 66        |
| Venezuela, RB                  | UMI    | LCR    | 59        | —             | —           | —            | —       | 41        |
| West Bank and Gaza             | LMI    | MENA   | 69        | 30            | —           | 1            | —       | —         |

**NOTES:**

For sources and year of data, see Annex C.

1. All waste is taken to landfills, where the waste is classified and then sent to different destinations, such as recycling and composting plants.

2. Percentages may not add up to 100 because residues of some treatments, such as incineration and composting, are landfilled.

3. Landfilling refers to all waste disposed on land.

4. Recycled amount refers to both recycled and composted waste; other includes wastes imported from France for incineration with energy recovery.

5. Landfill includes non-controlled dumping sites.

6. MSW includes industrial waste from manufacturing industries; landfill includes ash from incineration.

**ANNEX L (continued)****MSW Disposal Methods by Country**

| Summary by Income Level |                              |
|-------------------------|------------------------------|
| Income Level            | Number of Countries Included |
| Lower Income            | 7                            |
| Lower Middle Income     | 17                           |
| Upper Middle Income     | 27                           |
| High Income             | 39                           |
| Total                   | 90                           |

| Summary by Region |                              |
|-------------------|------------------------------|
| Region            | Number of Countries Included |
| AFR               | 6                            |
| EAP               | 6                            |
| ECA               | 13                           |
| LCR               | 27                           |
| MENA              | 10                           |
| OECD              | 0                            |
| SAR               | 28                           |
| Total             | 90                           |

**ANNEX M****MSW Composition by Country**

| Country            | Income Level | Region | Organic (%) | Paper (%) | Plastic (%) | Glass (%) | Metal (%) | Other (%) |
|--------------------|--------------|--------|-------------|-----------|-------------|-----------|-----------|-----------|
| Albania            | LMI          | ECA    | 38          | 10        | 8           | 5         | 5         | 34        |
| Algeria            | UMI          | MENA   | 70          | 10        | 5           | 1         | 2         | 12        |
| Andorra            | HIC          | OECD   | 19          | 26        | 14          | 11        | 3         | 27        |
| Argentina          | UMI          | LCR    | 40          | 24        | 14          | 5         | 2         | 15        |
| Armenia            | LMI          | ECA    | 51          | 12        | 10          | 9         | 5         | 14        |
| Australia          | HIC          | OECD   | 47          | 23        | 4           | 7         | 5         | 13        |
| Austria            | HIC          | OECD   | 35          | 22        | 11          | 8         | 5         | 19        |
| Bangladesh         | LI           | SAR    | 71          | 5         | 7           | –         | –         | 16        |
| Belarus            | UMI          | ECA    | 29          | 28        | 10          | 13        | 7         | 13        |
| Belgium            | HIC          | OECD   | 39          | 17        | 5           | 7         | 3         | 29        |
| Belize             | LMI          | LCR    | 60          | 20        | 5           | 5         | 5         | 5         |
| Benin              | LI           | AFR    | 52          | 3         | 7           | 2         | 2         | 1         |
| Bhutan             | LMI          | SAR    | 58          | 17        | 13          | 4         | 1         | 7         |
| Bolivia            | LMI          | LCR    | 24          | 6         | 8           | 2         | 1         | 59        |
| Brazil             | UMI          | LCR    | 61          | 15        | 15          | 3         | 2         | 5         |
| Brunei Darussalam  | HIC          | EAP    | 44          | 22        | 2           | 4         | 5         | 13        |
| Cambodia           | LI           | EAP    | 55          | 3         | 10          | 8         | 7         | 17        |
| Cameroon           | LMI          | AFR    | 48          | 4         | 5           | 4         | 5         | 35        |
| Canada             | HIC          | OECD   | 24          | 47        | 3           | 6         | 13        | 8         |
| Chile              | UMI          | LCR    | 50          | 19        | 10          | 2         | 2         | 4         |
| Colombia           | UMI          | LCR    | 54          | 11        | 10          | 5         | 2         | 18        |
| Costa Rica         | UMI          | LCR    | 50          | 21        | 18          | 2         | 2         | 7         |
| Croatia            | HIC          | ECA    | 46          | 20        | 12          | 7         | 4         | 11        |
| Cuba               | UMI          | LCR    | 69          | 12        | 10          | 5         | 2         | 3         |
| Cyprus             | HIC          | ECA    | 38          | 27        | 11          | 1         | 9         | 13        |
| Czech Republic     | HIC          | OECD   | 18          | 8         | 4           | 4         | 2         | 63        |
| Denmark            | HIC          | OECD   | 29          | 27        | 1           | 5         | 6         | 32        |
| Dominican Republic | UMI          | LCR    | 39          | 14        | 36          | 1         | 1         | 10        |
| Egypt, Arab Rep.   | LMI          | MENA   | 60          | 10        | 12          | 3         | 2         | 13        |
| Ethiopia           | LI           | AFR    | 88          | 4         | 2           | 1         | 1         | 4         |
| Fiji               | UMI          | EAP    | 68          | 15        | 8           | 3         | 3         | 4         |
| Finland            | HIC          | OECD   | 33          | 40        | 10          | 5         | 5         | 7         |
| France             | HIC          | OECD   | 32          | 20        | 9           | 10        | 3         | 26        |
| Gambia             | LI           | AFR    | 35          | 10        | –           | 2         | 2         | 51        |
| Georgia            | LMI          | ECA    | 39          | 34        | 3           | 3         | 5         | 16        |
| Germany            | HIC          | OECD   | 14          | 34        | 22          | 12        | 5         | 12        |
| Ghana              | LI           | AFR    | 64          | 3         | 4           | –         | 1         | 28        |
| Greece             | HIC          | OECD   | 47          | 20        | 9           | 5         | 5         | 16        |
| Guatemala          | LMI          | LCR    | 44          | 18        | 13          | 5         | 4         | 16        |
| Guinea             | LI           | AFR    | 58          | 9         | 4           | 1         | 1         | 27        |
| Guyana             | LMI          | LCR    | 49          | 24        | 10          | 2         | 2         | 12        |
| Hong Kong, China   | HIC          | EAP    | 38          | 26        | 19          | 3         | 2         | 12        |
| Hungary            | HIC          | OECD   | 29          | 15        | 17          | 2         | 2         | 35        |
| Iceland            | HIC          | OECD   | 26          | 26        | 17          | 4         | 3         | 24        |
| India              | LMI          | SAR    | 35          | 3         | 2           | 1         | –         | 59        |
| Indonesia          | LMI          | EAP    | 62          | 6         | 10          | 9         | 8         | 4         |
| Iran, Islamic Rep. | LMI          | MENA   | 43          | 22        | 11          | 2         | 9         | 13        |
| Ireland            | HIC          | OECD   | 25          | 31        | 11          | 5         | 4         | 23        |
| Israel             | HIC          | MENA   | 40          | 25        | 13          | 3         | 3         | 16        |
| Italy              | HIC          | OECD   | 29          | 28        | 5           | 13        | 2         | 22        |
| Jamaica            | UMI          | LCR    | 57          | 13        | 18          | 5         | 4         | 3         |
| Japan              | HIC          | OECD   | 26          | 46        | 9           | 7         | 8         | 12        |

**ANNEX M (continued)****MSW Composition by Country**

| Country                        | Income Level | Region | Organic (%) | Paper (%) | Plastic (%) | Glass (%) | Metal (%) | Other (%) |
|--------------------------------|--------------|--------|-------------|-----------|-------------|-----------|-----------|-----------|
| Jordan                         | LMI          | MENA   | 62          | 11        | 16          | 2         | 2         | 6         |
| Korea, South                   | HIC          | OECD   | 28          | 24        | 8           | 5         | 7         | 28        |
| Lao PDR                        | LI           | EAP    | 46          | 6         | 10          | 8         | 12        | 21        |
| Latvia                         | UMI          | ECA    | 57          | —         | —           | —         | —         | 43        |
| Lebanon                        | UMI          | MENA   | 63          | 18        | 7           | 5         | 3         | 4         |
| Liberia                        | LI           | AFR    | 43          | 10        | 13          | 1         | 2         | 31        |
| Luxembourg                     | HIC          | OECD   | 45          | 22        | 1           | 12        | 4         | 16        |
| Macao, China                   | HIC          | EAP    | 4           | 4         | 24          | 4         | 1         | 63        |
| Macedonia, FYR                 | UMI          | ECA    | 20          | 24        | 11          | 5         | 3         | 37        |
| Madagascar                     | LI           | AFR    | 52          | 4         | 1           | 1         | 1         | 41        |
| Malaysia                       | UMI          | EAP    | 62          | 7         | 12          | 3         | 6         | 10        |
| Mali                           | LI           | AFR    | 18          | 4         | 2           | 1         | 4         | 1         |
| Marshall Islands               | LMI          | EAP    | 20          | 15        | 15          | 5         | 20        | 22        |
| Mauritius                      | UMI          | AFR    | 70          | 12        | 9           | 2         | 3         | 4         |
| Mexico                         | UMI          | LCR    | 51          | 15        | 6           | 6         | 3         | 18        |
| Morocco                        | LMI          | MENA   | 69          | 19        | 4           | 4         | 3         | 2         |
| Mozambique                     | LI           | AFR    | 69          | 12        | 10          | 3         | 2         | 4         |
| Myanmar                        | LI           | EAP    | 54          | 8         | 16          | 7         | 8         | 7         |
| Nepal                          | LI           | SAR    | 80          | 7         | 3           | 3         | 1         | 7         |
| Netherlands                    | HIC          | OECD   | 35          | 26        | 19          | 4         | 4         | 12        |
| New Zealand                    | HIC          | OECD   | 56          | 21        | 8           | 3         | 7         | 5         |
| Niger                          | LI           | AFR    | 38          | 2         | 2           | —         | 1         | 57        |
| Nigeria                        | LMI          | AFR    | 57          | 11        | 18          | 5         | 5         | 4         |
| Norway                         | HIC          | OECD   | 30          | 33        | 9           | 4         | 4         | 20        |
| Pakistan                       | LMI          | SAR    | 67          | 5         | 18          | 2         | —         | 7         |
| Panama                         | UMI          | LCR    | 44          | 25        | 11          | 8         | 5         | 7         |
| Peru                           | UMI          | LCR    | 55          | 7         | 4           | 3         | 2         | 28        |
| Philippines                    | LMI          | EAP    | 41          | 19        | 14          | 3         | 5         | 18        |
| Poland                         | UMI          | ECA    | 38          | 10        | 10          | 12        | 8         | 23        |
| Portugal                       | HIC          | OECD   | 34          | 21        | 11          | 7         | 4         | 23        |
| Romania                        | UMI          | ECA    | 46          | 11        | 3           | 11        | 5         | 24        |
| Senegal                        | LI           | AFR    | 44          | 10        | 3           | 1         | 3         | 39        |
| Serbia                         | UMI          | ECA    | 5           | 37        | 12          | 10        | 5         | 31        |
| Sierra Leone                   | LI           | AFR    | 85          | —         | —           | —         | —         | 15        |
| Singapore                      | HIC          | EAP    | 44          | 28        | 12          | 4         | 5         | 7         |
| Slovak Republic                | HIC          | OECD   | 38          | 13        | 7           | 8         | 3         | 31        |
| Solomon Islands                | LMI          | EAP    | 65          | 6         | 17          | 5         | 6         | 2         |
| Spain                          | HIC          | OECD   | 49          | 21        | 12          | 8         | 4         | 7         |
| Sri Lanka                      | LMI          | SAR    | 76          | 11        | 6           | 1         | 1         | 5         |
| St. Vincent and the Grenadines | UMI          | LCR    | 34          | 32        | 12          | 8         | 6         | 8         |
| Sweden                         | HIC          | OECD   | —           | 68        | 2           | 11        | 2         | 17        |
| Switzerland                    | HIC          | OECD   | 29          | 20        | 15          | 4         | 3         | 29        |
| Syrian Arab Republic           | LMI          | MENA   | 65          | 10        | 12          | 4         | 2         | 7         |
| Thailand                       | LMI          | EAP    | 48          | 15        | 14          | 5         | 4         | 14        |
| Togo                           | LI           | AFR    | 46          | 4         | 10          | 2         | 2         | 35        |
| Tonga                          | LMI          | EAP    | 47          | 31        | 5           | 3         | 8         | 5         |
| Trinidad and Tobago            | HIC          | LCR    | 14          | 32        | 24          | 3         | 16        | 12        |
| Tunisia                        | LMI          | MENA   | 68          | 9         | 11          | 2         | 4         | 6         |
| Turkey                         | UMI          | ECA    | 40-65       | 7-18      | 5-14        | 2-6       | 1-6       | 7-24      |
| Uganda                         | LI           | AFR    | 78          | 3         | 1           | 1         | 2         | 16        |
| United States                  | HIC          | OECD   | 25          | 34        | 12          | 5         | 8         | 16        |
| Uruguay                        | UMI          | LCR    | 54          | 20        | 11          | 3         | 5         | 8         |

## **ANNEX M (continued)**

## **MSW Composition by Country**

| Country            | Income Level | Region | Organic (%) | Paper (%) | Plastic (%) | Glass (%) | Metal (%) | Other (%) |
|--------------------|--------------|--------|-------------|-----------|-------------|-----------|-----------|-----------|
| Vanuatu            | LMI          | EAP    | 71          | 11        | 8           | 3         | 4         | 3         |
| Vietnam            | LI           | EAP    | 60          | 2         | 16          | 7         | 6         | 9         |
| West Bank and Gaza | LMI          | MENA   | 61          | 14        | 7           | 3         | 2         | 13        |
| Zambia             | LI           | AFR    | 50          | 5         | 5           | 2         | 2         | 37        |
| Zimbabwe           | LI           | AFR    | 40          | 21        | 20          | 4         | 4         | 11        |

**NOTE:**

For sources and year of data, see Annex C.

## Summary by Income Level

## Summary by Region

**ANNEX N****IPCC Classification of MSW Composition**

| Region                     | Food Waste | Paper/ Card-board | Wood | Textiles | Rubber/ Leather | Plastic | Metal | Glass | Other |
|----------------------------|------------|-------------------|------|----------|-----------------|---------|-------|-------|-------|
| <b>Asia</b>                |            |                   |      |          |                 |         |       |       |       |
| Eastern Asia               | 26.2       | 18.8              | 3.5  | 3.5      | 1               | 14.3    | 2.7   | 3.1   | 7.4   |
| South-Central Asia         | 40.3       | 11.3              | 7.9  | 2.5      | 0.8             | 6.4     | 3.8   | 3.5   | 21.9  |
| South-Eastern Asia         | 43.5       | 12.9              | 9.9  | 2.7      | 0.9             | 7.2     | 3.3   | 4     | 16.3  |
| Western Asia & Middle East | 41.1       | 18                | 9.8  | 2.9      | 0.6             | 6.3     | 1.3   | 2.2   | 5.4   |
| <b>Africa</b>              |            |                   |      |          |                 |         |       |       |       |
| Eastern Africa             | 53.9       | 7.7               | 7    | 1.7      | 1.1             | 5.5     | 1.8   | 2.3   | 11.6  |
| Middle Africa              | 43.4       | 16.8              | 6.5  | 2.5      |                 | 4.5     | 3.5   | 2     | 1.5   |
| Northern Africa            | 51.1       | 16.5              | 2    | 2.5      |                 | 4.5     | 3.5   | 2     | 1.5   |
| Southern Africa            | 23         | 25                | 15   |          |                 |         |       |       |       |
| Western Africa             | 40.4       | 9.8               | 4.4  | 1        |                 | 3       | 1     |       |       |
| <b>Europe</b>              |            |                   |      |          |                 |         |       |       |       |
| Eastern Europe             | 30.1       | 21.8              | 7.5  | 4.7      | 1.4             | 6.2     | 3.6   | 10    | 14.6  |
| Northern Europe            | 23.8       | 30.6              | 10   | 2        |                 | 13      | 7     | 8     |       |
| Southern Europe            | 36.9       | 17                | 10.6 |          |                 |         |       |       |       |
| Western Europe             | 24.2       | 27.5              | 11   |          |                 |         |       |       |       |
| <b>Oceania</b>             |            |                   |      |          |                 |         |       |       |       |
| Australia & New Zealand    | 36         | 30                | 24   |          |                 |         |       |       |       |
| Rest of Oceania            | 67.5       | 6                 | 2.5  |          |                 |         |       |       |       |
| <b>America</b>             |            |                   |      |          |                 |         |       |       |       |
| North America              | 33.9       | 23.2              | 6.2  | 3.9      | 1.4             | 8.5     | 4.6   | 6.5   | 9.8   |
| Central America            | 43.8       | 13.7              | 13.5 | 2.6      | 1.8             | 6.7     | 2.6   | 3.7   | 12.3  |
| South America              | 44.9       | 17.1              | 4.7  | 2.6      | 0.7             | 10.8    | 2.9   | 3.3   | 13    |
| Caribbean                  | 46.9       | 17                | 2.4  | 5.1      | 1.9             | 9.9     | 5     | 5.7   | 3.5   |

**NOTES:**

1. Data are based on weight of wet waste of MSW without industrial waste at generation around year 2000.
2. The region-specific values are calculated from national, partly incomplete composition data. The percentages given may therefore not add up to 100%. Some regions may not have data for some waste types - blanks in the table represent missing data.

**ANNEX O****The Global City Indicators Program**

No single standard or comprehensive system to measure and monitor city performance and urban quality of life exists today. The Global City Indicators Program, driven by cities themselves, fills this important gap. Through the collection and analysis of city data in a comparative format and data domain, elected officials, city managers and the public will be able to monitor the performance of their cities over time based on a core set of indicators.

The Global City Indicators Program (GCIP) is a decentralized, city-led initiative that enables cities to measure, report, and improve their performance and quality of life, facilitate capacity building, and share best practices through an easy-to-use web portal. GCIP assists cities in providing support to decision makers in making informed policy decisions, in addition to enhancing government accountability to the public.

Managing cities effectively and efficiently is critical and becoming more complex as population growth and economic development are taking place in urban areas. Today's big challenges, such as poverty reduction, economic development, climate change, and the creation and maintenance of an inclusive and peaceful society, will all need to be met through the responses of cities. So too will the day-to-day challenges of garbage collection, responding to the house on fire and larger disasters, and facilitating the provision of water, electricity, education, health care, and the myriad of other services that make life more productive and enjoyable.

The pace of change within and among cities is increasing. Indicators need to be anchored on baseline data and need to be sufficiently broad to capture social and economic aspects of urban development. Standardized indicators are essential in order to measure the performance of cities, capture trends and developments, and support cities in becoming global partners.

The Global City Indicators Program is organized into two broad categories: city services (which includes services typically provided by city governments and other entities) and quality of life (which includes critical contributors to overall quality of life, though the city government may have little direct control on these activities). The two categories are structured around 18 themes.

The Global City Indicators Program process encompasses monitoring, reporting, verifying, and amending the indicators. Similar to a Wikipedia approach, the Global City Indicators Program is a dynamic web-based resource ([www.cityindicators.org](http://www.cityindicators.org)) that allows participating cities across the world to standardize the collection of their indicators and analyze and share the results and best practices on service delivery and quality of life.

The Global City Indicators Program is run by the Global City Indicators Facility based at the University of Toronto, which manages the development of indicators and assists cities in joining the Program. A Board of Directors and an Advisory Board oversee the Global City Indicators Facility and provide technical and advisory support to the Facility. The Boards are made up of representatives from cities, international organizations, and academia. The Global City Indicators Program was initiated by the World Bank through funding from the Government of Japan.

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