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WHAT A WASTE

A Global Review of Solid Waste Management

THE WORLD BANK

URBAN DEVELOPMENT & LOCAL GOVERNMENT

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).

URBAN DEVELOPMENT SERIES KNOWLEDGE PAPERS

WHAT A WASTE

A Global Review of Solid Waste Management

Daniel Hoornweg and Perinaz Bhada-Tata

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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

ITC landfill and recycling center, Ankara, Turkey

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.

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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EXECUTIVE SUMMARY

Photo: Ron Perry/Oki Golf

Golf course: post closure use of landfill site

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.

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

Ghabawi landfill, Amman, Jordan

Photo: Perinaz Bhada-Tata

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. 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.

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

Photo: Alejandro Lipszyc/World Bank

Abbreviations and Acronyms

AFR	Africa region
C&D	Construction and demolition
CDM	Clean Development Mechanism
EAP	East Asia and Pacific region
ECA	Europe and Central Asia region
GDP	Gross Domestic Product
GHG	Greenhouse gas
HIC	High-income country
ICI	Industrial, commercial, and institutional
IPCC	Intergovernmental Panel on Climate Change
ISWM	Integrated solid waste management
Kg/capita/day	kilograms per capita per day
LCR	Latin America and the Caribbean region
LIC	Low-income country
LMIC	Lower middle-income country
MENA	Middle East and North Africa region
METAP	Mediterranean Environmental Technical Assistance Program
MRF	Materials recovery facility
MSW	Municipal solid waste
$mtCO_2e$	Million tonnes of carbon dioxide equivalent
OECD	Organisation for Economic Co-operation and Development
PAHO	Pan-American Health Organization
RDF	Refuse-derived fuel
SAR	South Asia region
SWM	Solid waste management
tCO_2e	Tons of carbon dioxide equivalent
UMIC	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


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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.[1] 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

[1] 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.

Photo: Scott Wallace

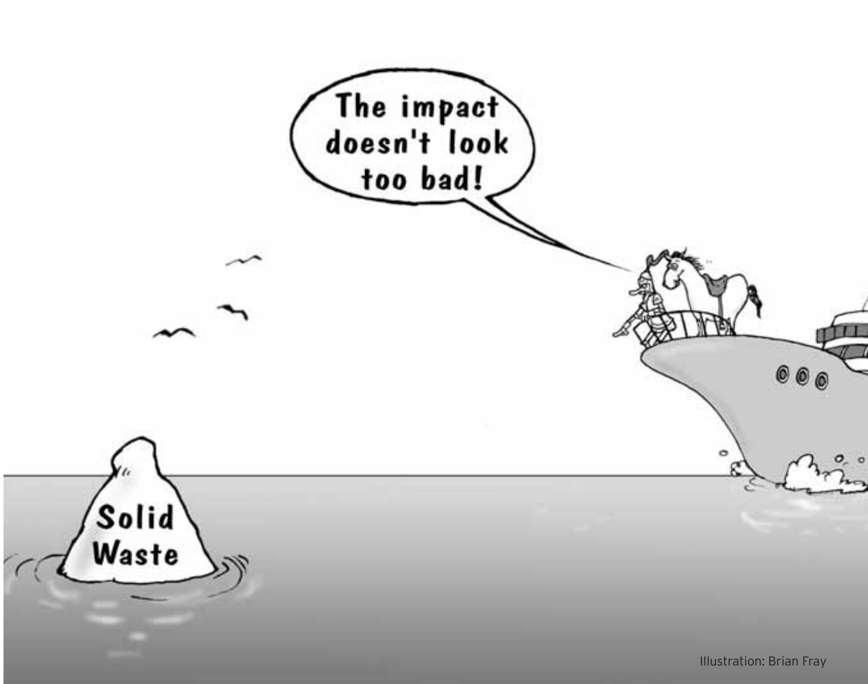


Illustration: Brian Fray

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

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.

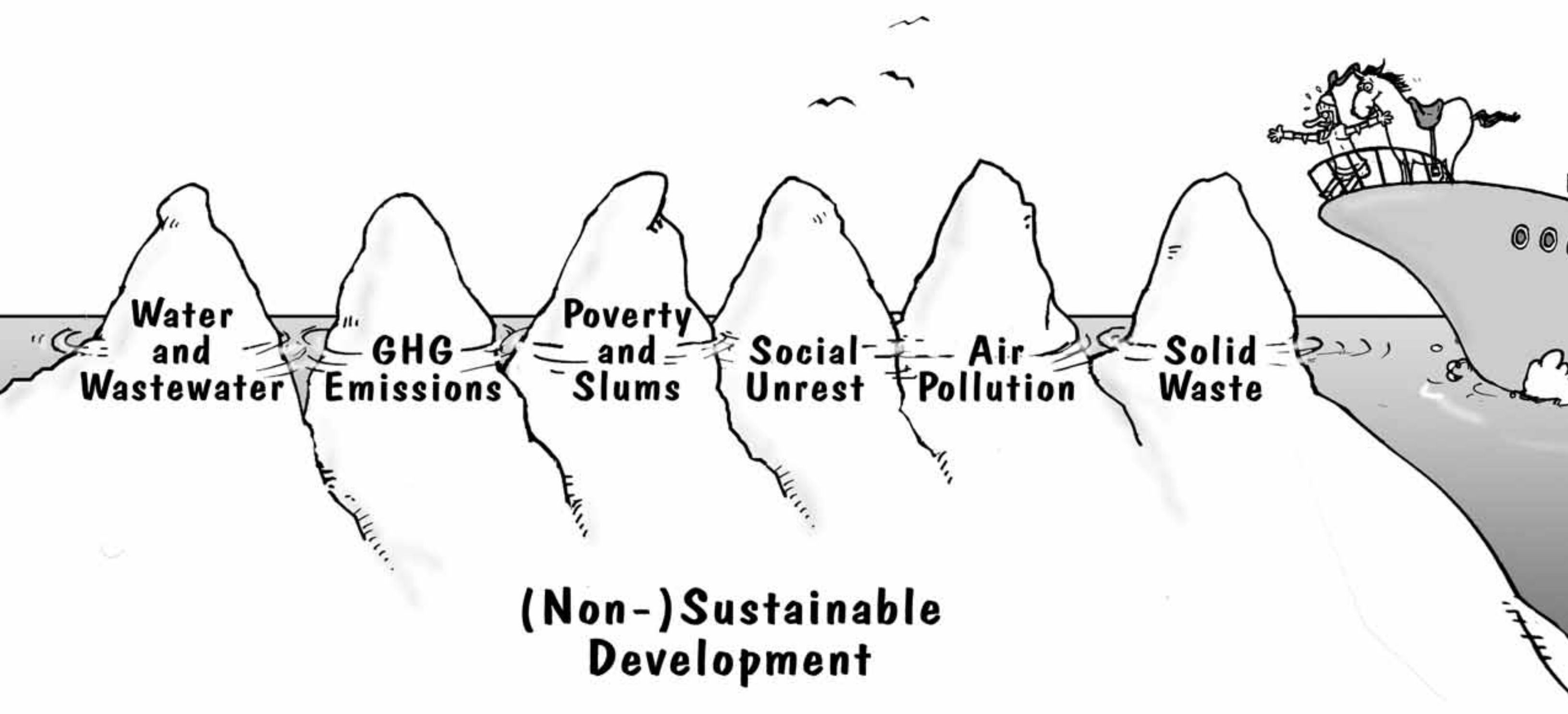


Illustration: Brian Fray

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. McCourtie/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. Overall recycling rates higher than low and middle income. Informal recycling still exists (e.g. aluminum can collection.) Extended product responsibility common.
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.

Collecting paper to be recycled, Mumbai, India

Photo: Jeroo Bhada

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

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	14[2]	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.[2]

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

[2] This table is not corrected for extraneous outliers, such as the 14.40 kg/capita/day upper bound in Latin America and the Caribbean [Trinidad and Tobago].

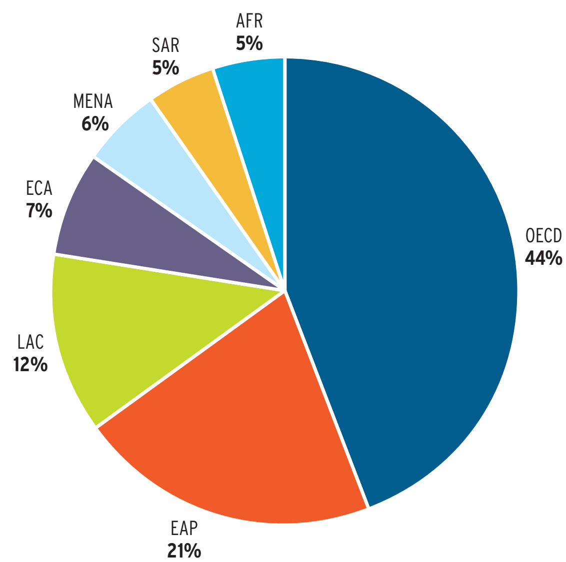


FIG. 1
Waste Generation by Region

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
Total	2,980	1.2	3,532,252	7,644	4,285	1.4	6,069,703

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 [3]

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.

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

[3] 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.

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.

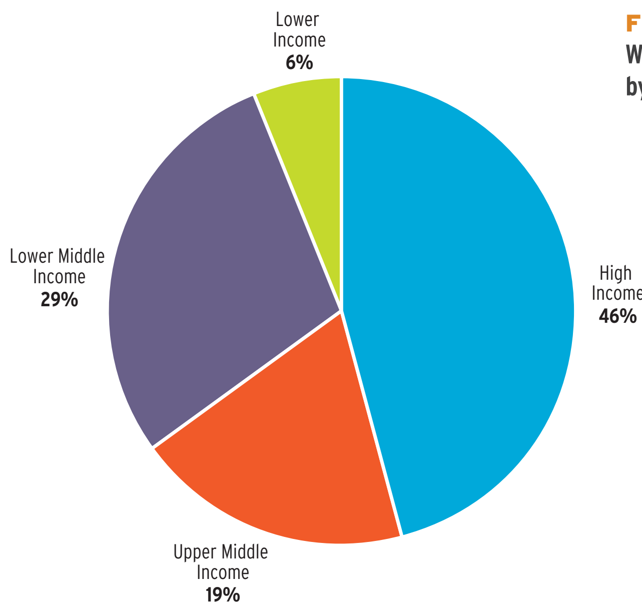


FIG. 2
Waste Generation by Income

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. 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

TABLE 6
Waste Generation Projections for 2025 by Income

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 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.

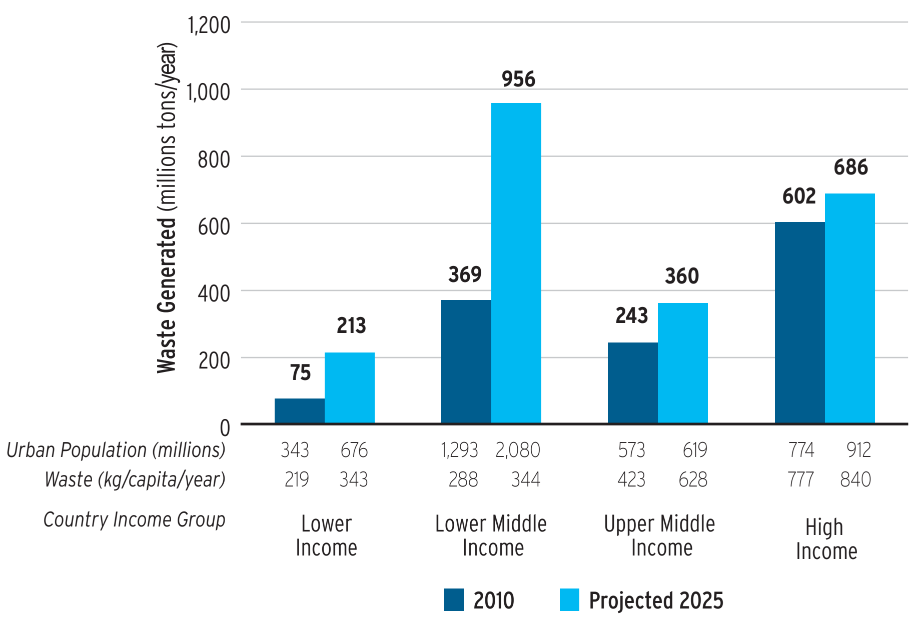
Methodology for calculating 2025 projections:

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

©iStockphoto.com/brytta

Separate garbage containers, Singapore

Photo: Cyrus Tata

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

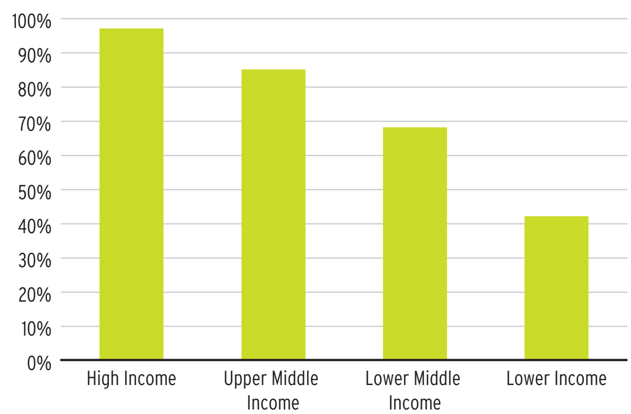
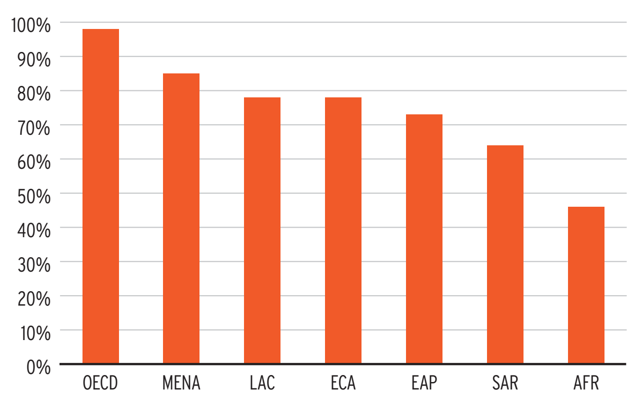


FIG. 5
Waste Collection Rates by Region



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 inerts 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

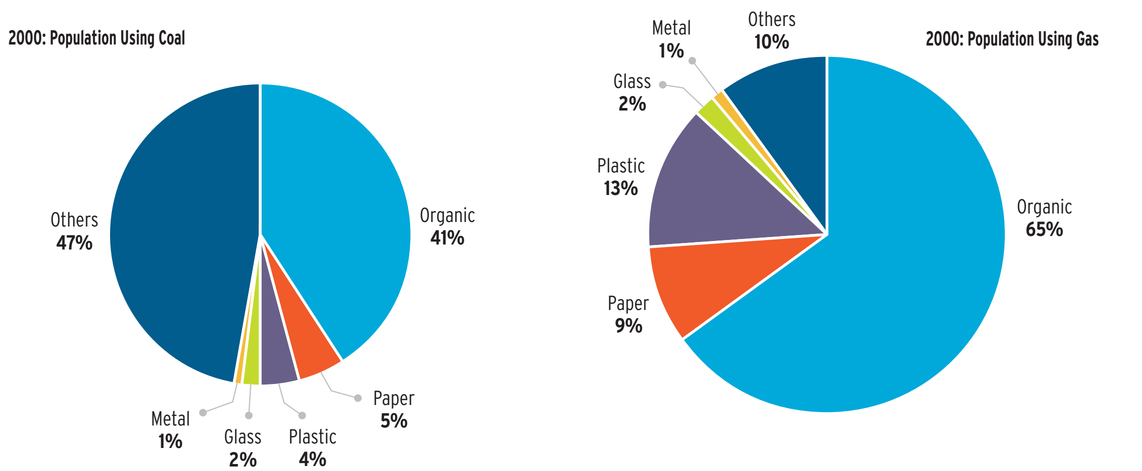


FIG. 6 Waste Composition in China

Source: Hoornweg 2005

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

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 classification 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

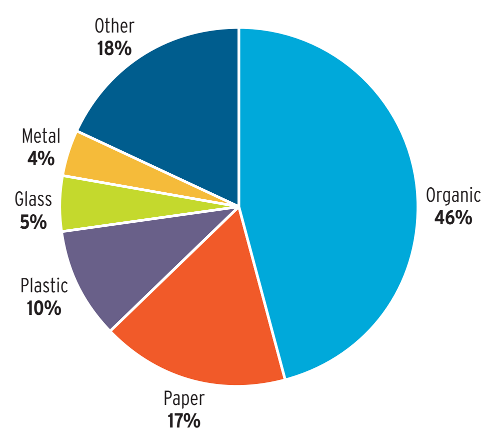


FIG. 7 Global Solid Waste Composition

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.

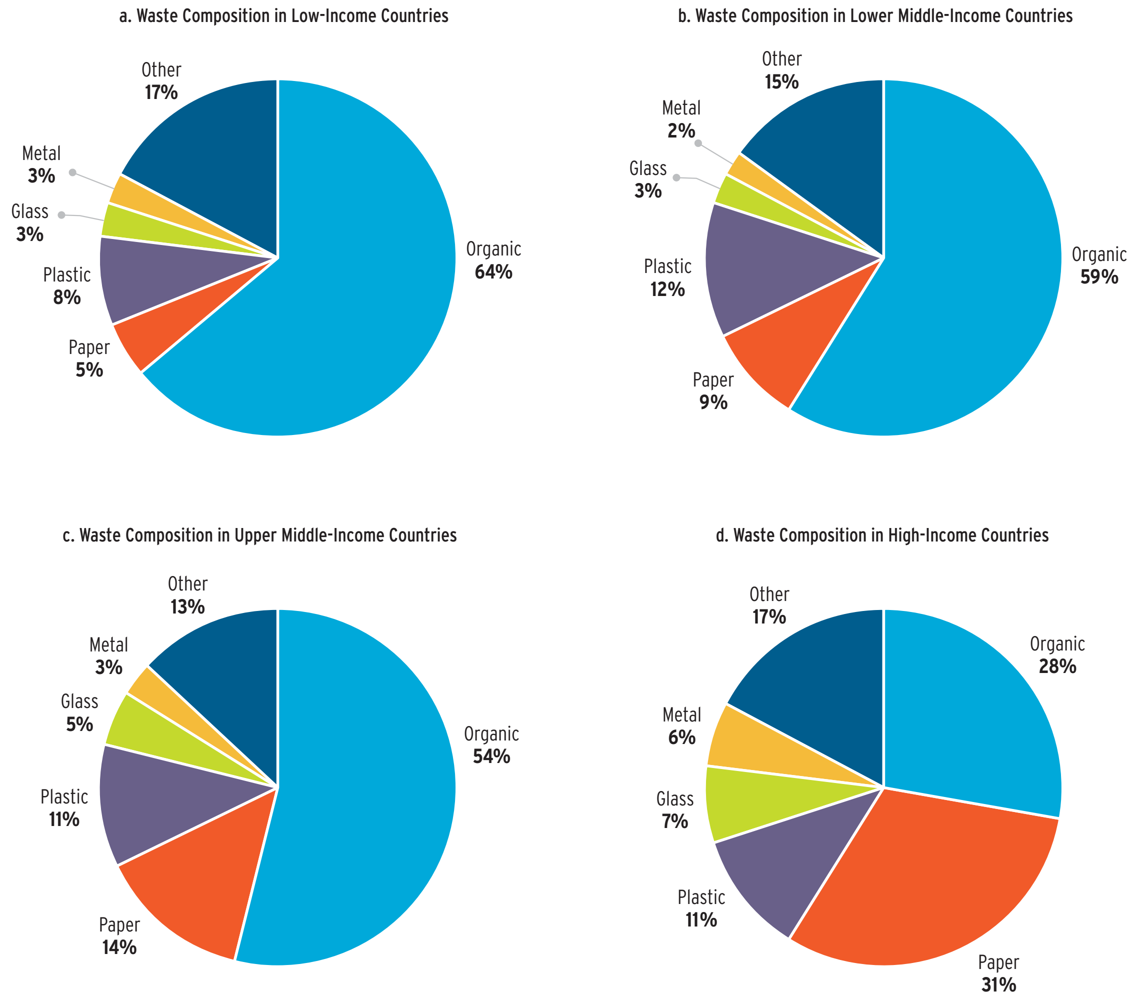


FIG. 8
Waste Composition by Income

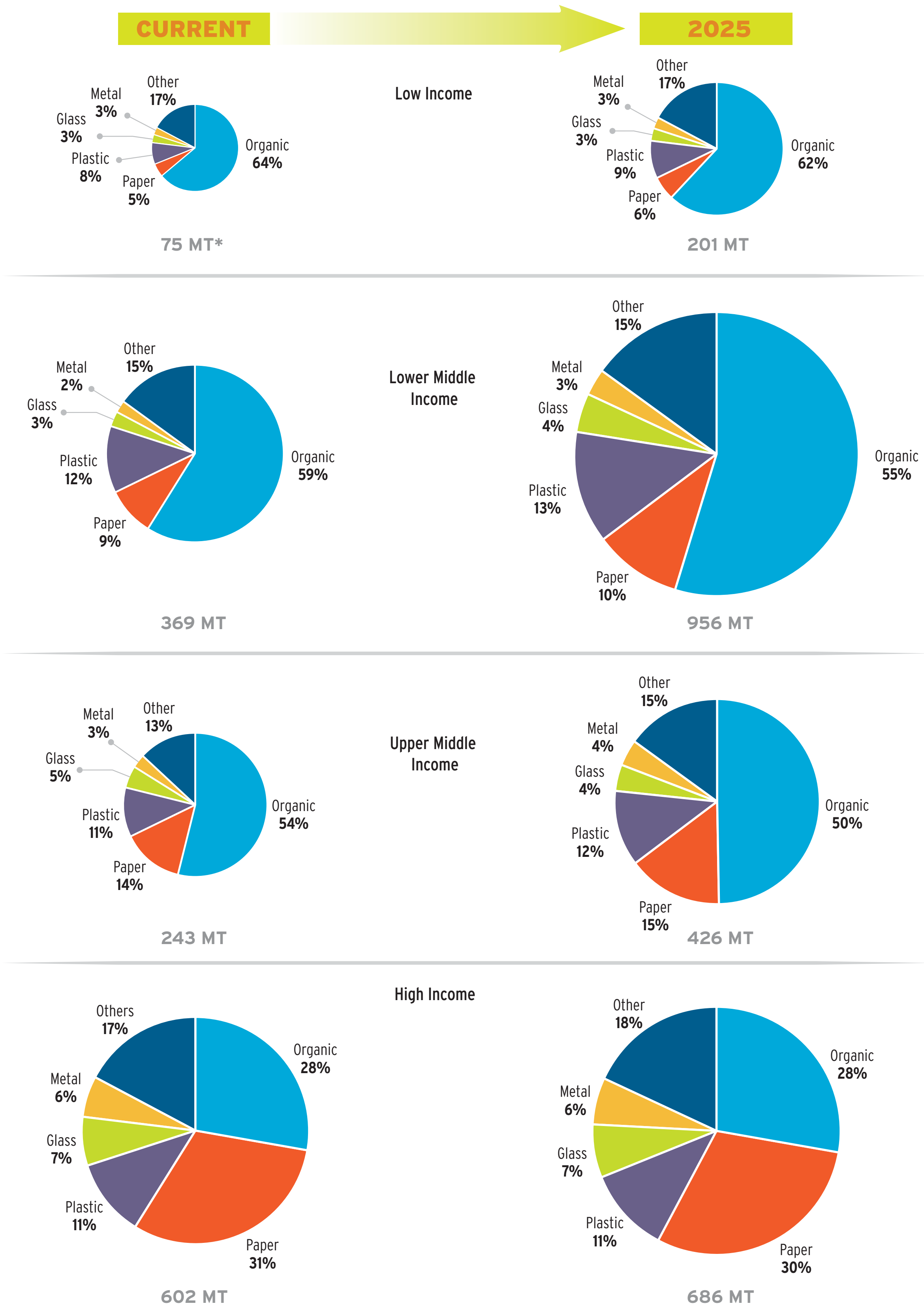
TABLE 10
Types of Waste Composition by Income Level

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

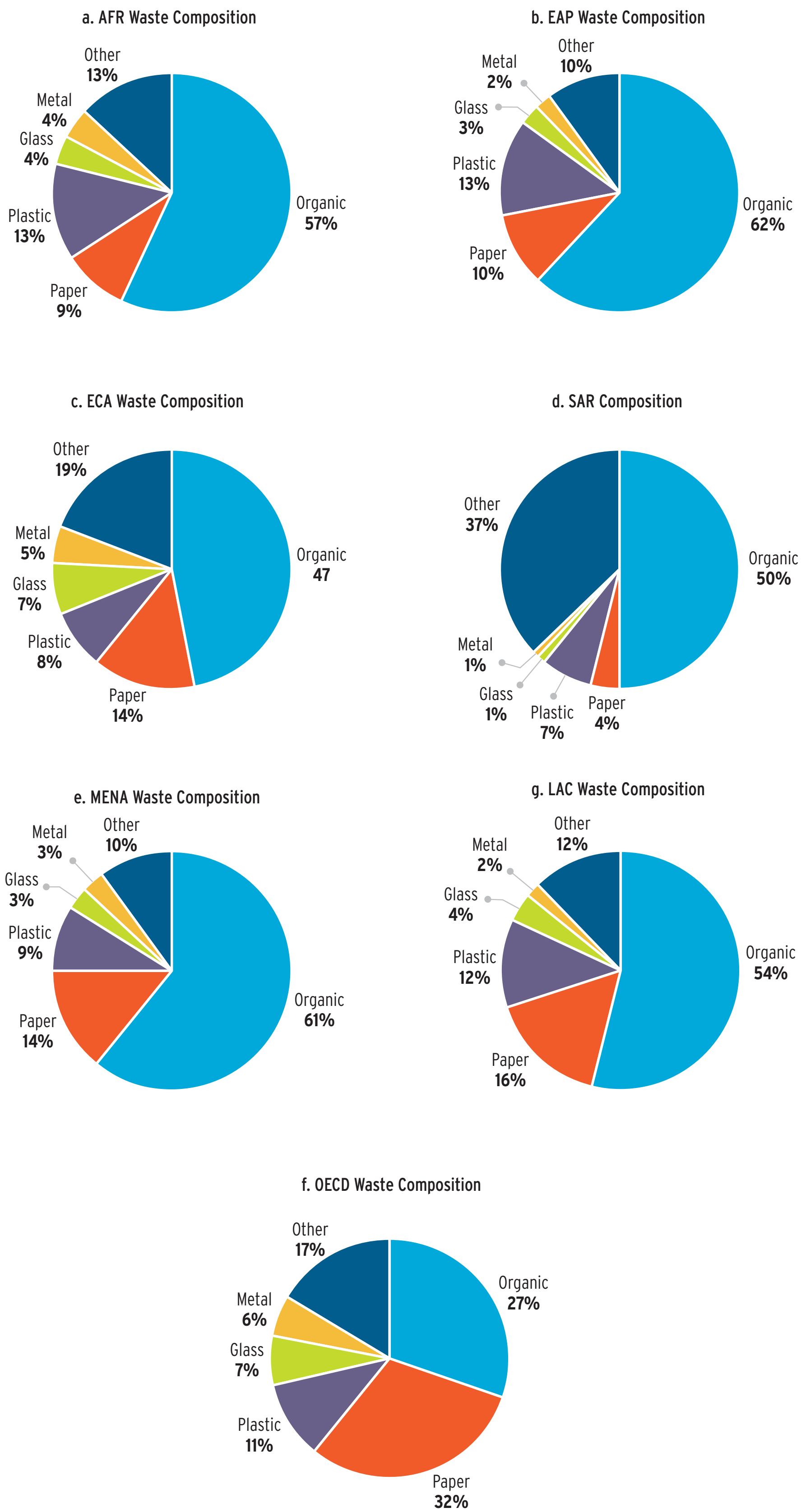
*Source year: varies, see Annex C on Data Availability.
**Source: By author from global trends, and Annex J.

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



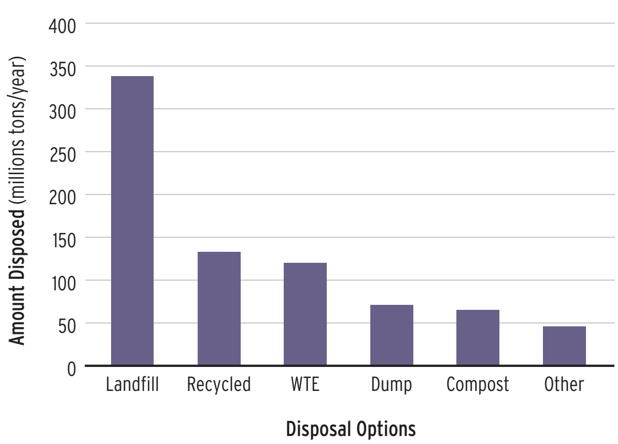
6 Waste Disposal

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.

Ghabawi landfill, Amman, Jordan ›

Photo: Perinaz Bhada-Tata

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 Mid dle 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 differences 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

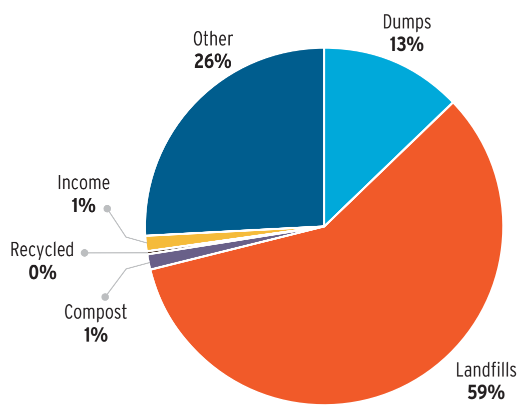


FIG. 13
Upper Middle-Income Countries Waste Disposal

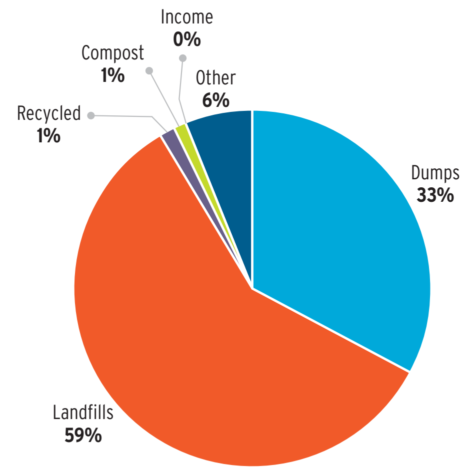


TABLE 12
MSW Disposal in two contrasting regions (million tonnes)

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.

BOX 3

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.

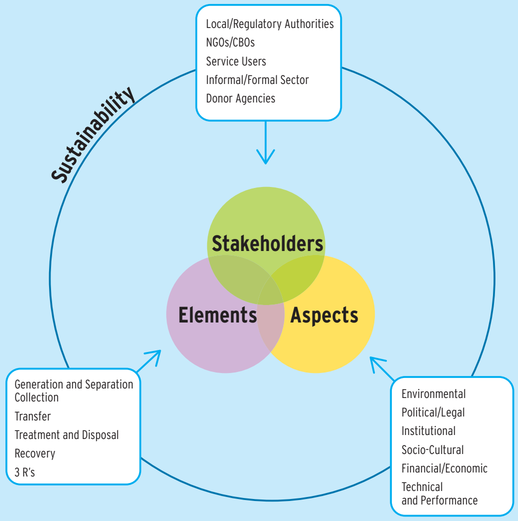
BOX 4

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).

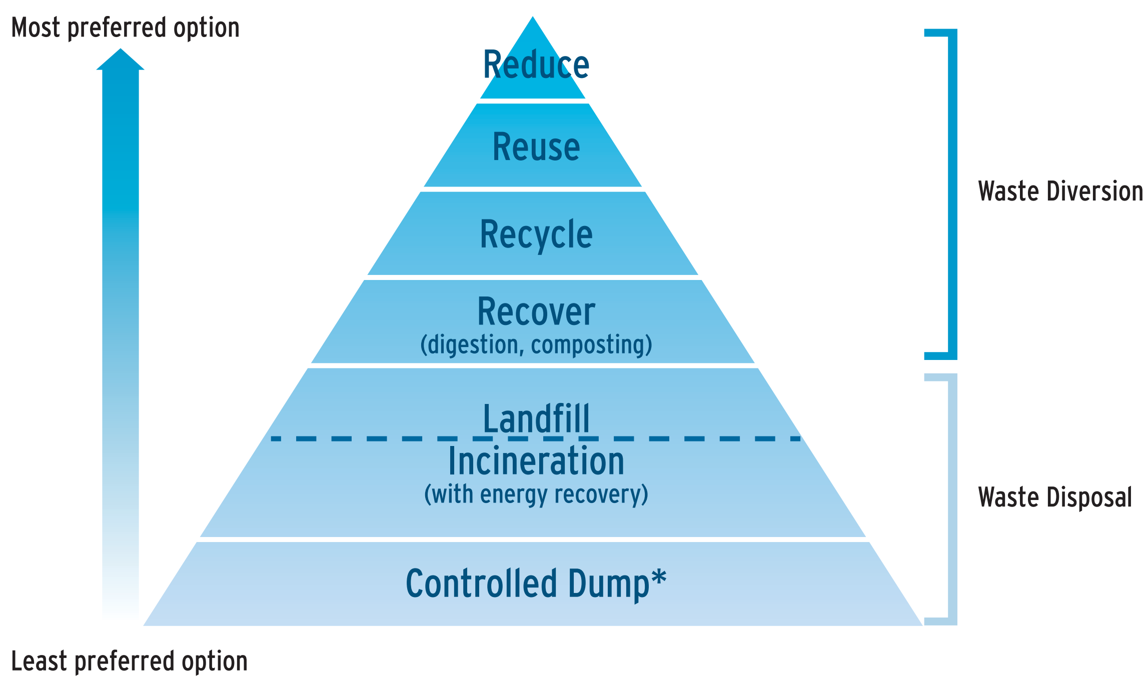
Environmental Protection: Poorly collected or improperly disposed of waste can have a detrimental impact on the environment. In low- and middle-income countries, MSW is often dumped in low-lying areas and land adjacent to slums. Lack of enforced regulations enables potentially infectious medical and 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.

FIG. 14
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 $mtCO_2e$) 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/ 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 Disposa* ($MtCO_2e$)	Greenhouse Gas Emissions** (CO_2, CH_4, N_2O) ($MtCO_2e$)	% 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).[4] 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[5] 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 $mtCO_2e$ per year to 32 million tCO_2e 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

[4] Wastewater management adds an equal amount of methane to the atmosphere.
[5] Organic biomass excludes organic waste such as plastics that are derived from fossil energy sources.

A transfer station in Amman, Jordan

Photo: Perinaz Bhada-Tata

TABLE 15
Technical GHG Mitigation Opportunities by Waste Management Component

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. 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/Anaerobic Digestion	Institute composting programs ideally with source separated organics. As with recyclables source separated materials reduce the contamination associated with recovery from mixed waste. 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/ 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.

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.

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

Photo: Cyrus Tata

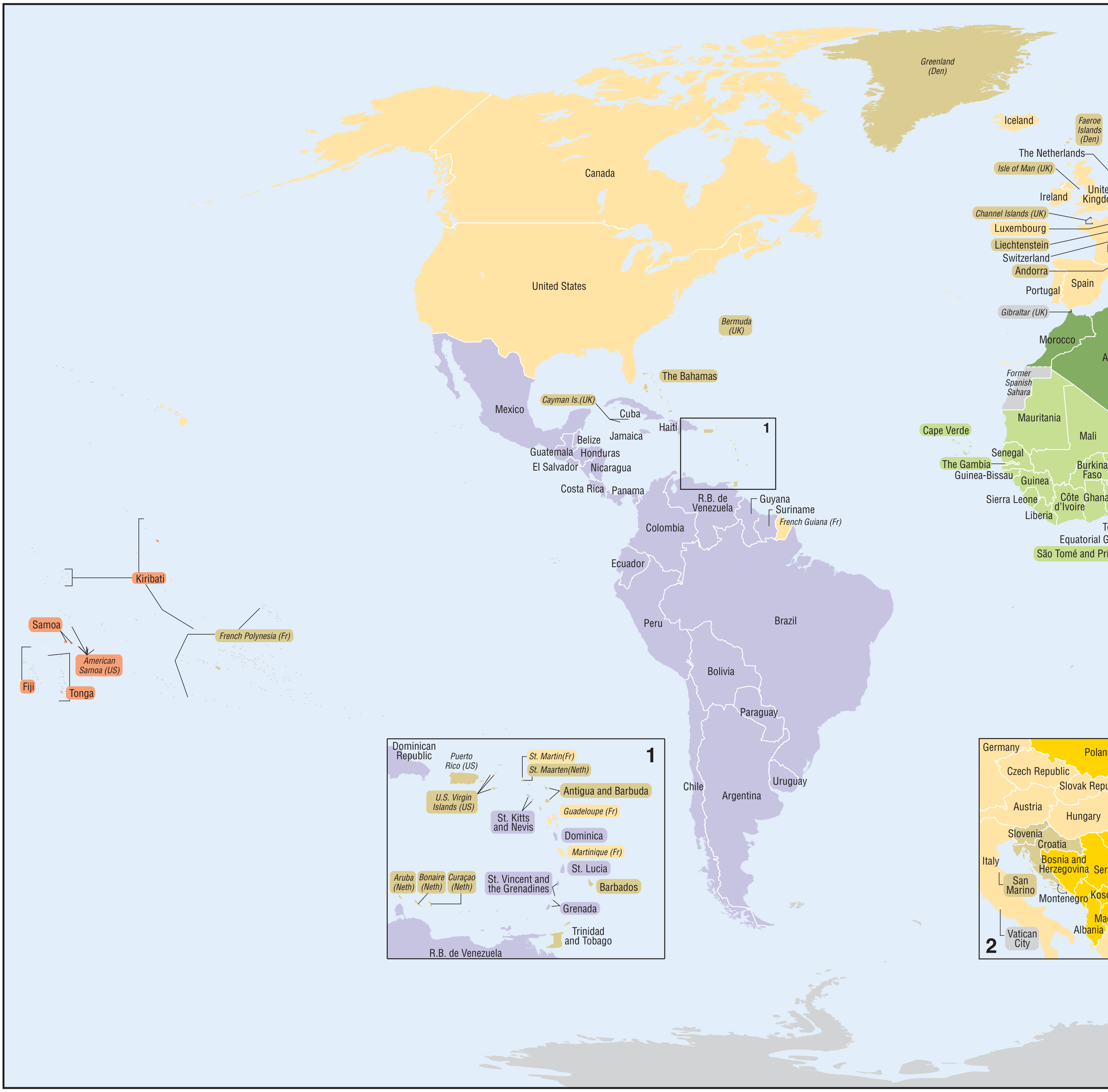
A couple salvage old bricks from an area demolished for renovation in Saigon

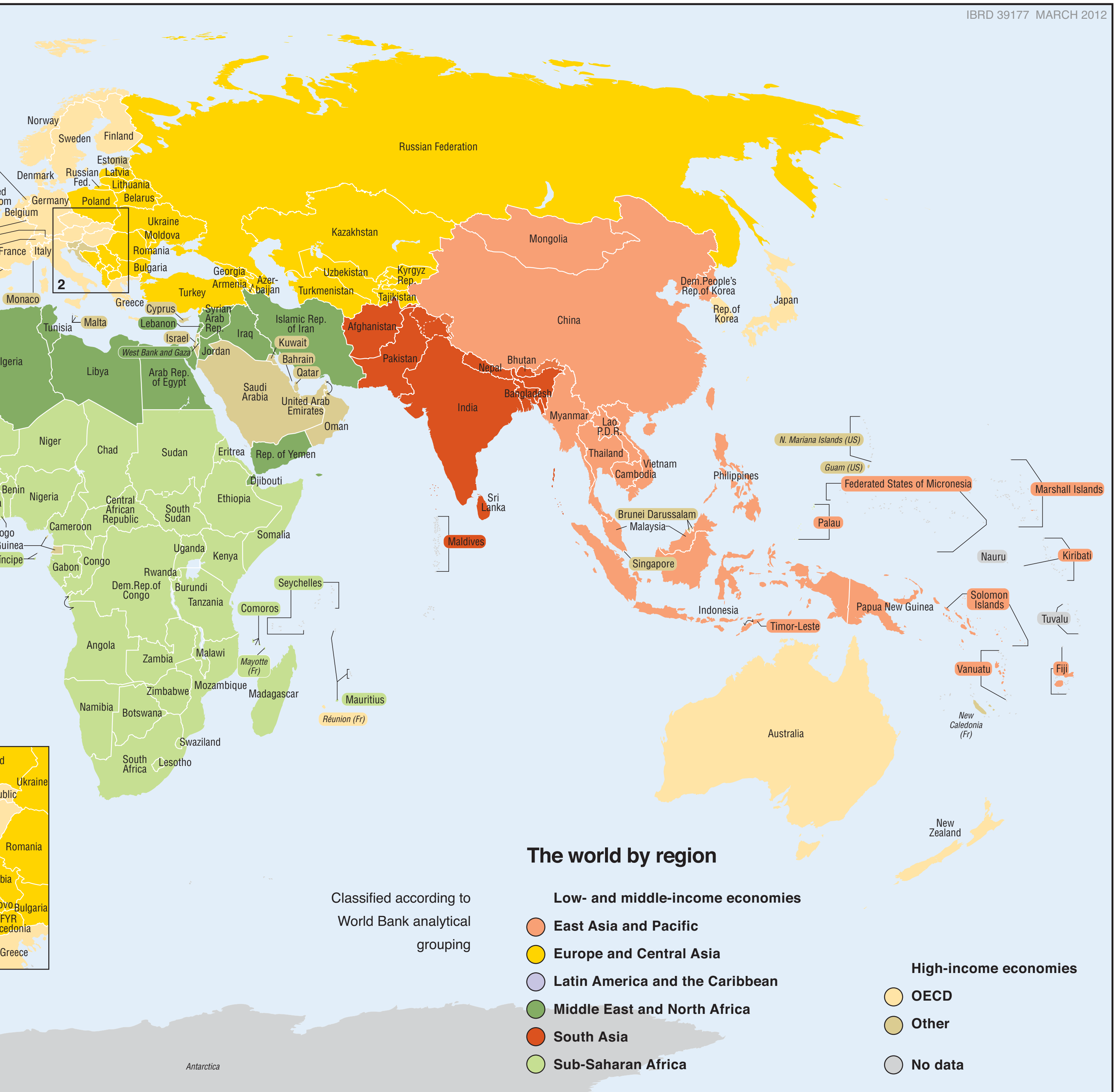
Photo: Tran Thi Hoa

ANNEXES

ANNEX A

Map of Regions

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Russian Federation
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Turkmenistan
Tajikistan
Mongolia
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Rep.of Korea
Japan
China
Cyprus
Lebanon
Syrian Arab Rep.
Iraq
Islamic Rep. of Iran
Afghanistan
Malta
Tunisia
Israel
Kuwait
West Bank and Gaza
Jordan
Bahrain
Qatar
Pakistan
Nepal
Bhutan
Algeria
Libya
Arab Rep. of Egypt
Saudi Arabia
United Arab Emirates
Bangladesh
India
Oman
Myanmar
Lao P.D.R.
Niger
Chad
Sudan
Eritrea
Rep. of Yemen
Thailand
Vietnam
Cambodia
Philippines
N. Mariana Islands (US)
Guam (US)
Federated States of Micronesia
Marshall Islands
Djibouti
Benin
Nigeria
Central African Republic
South Sudan
Ethiopia
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Brunei Darussalam
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Palau
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Gabon
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Burundi
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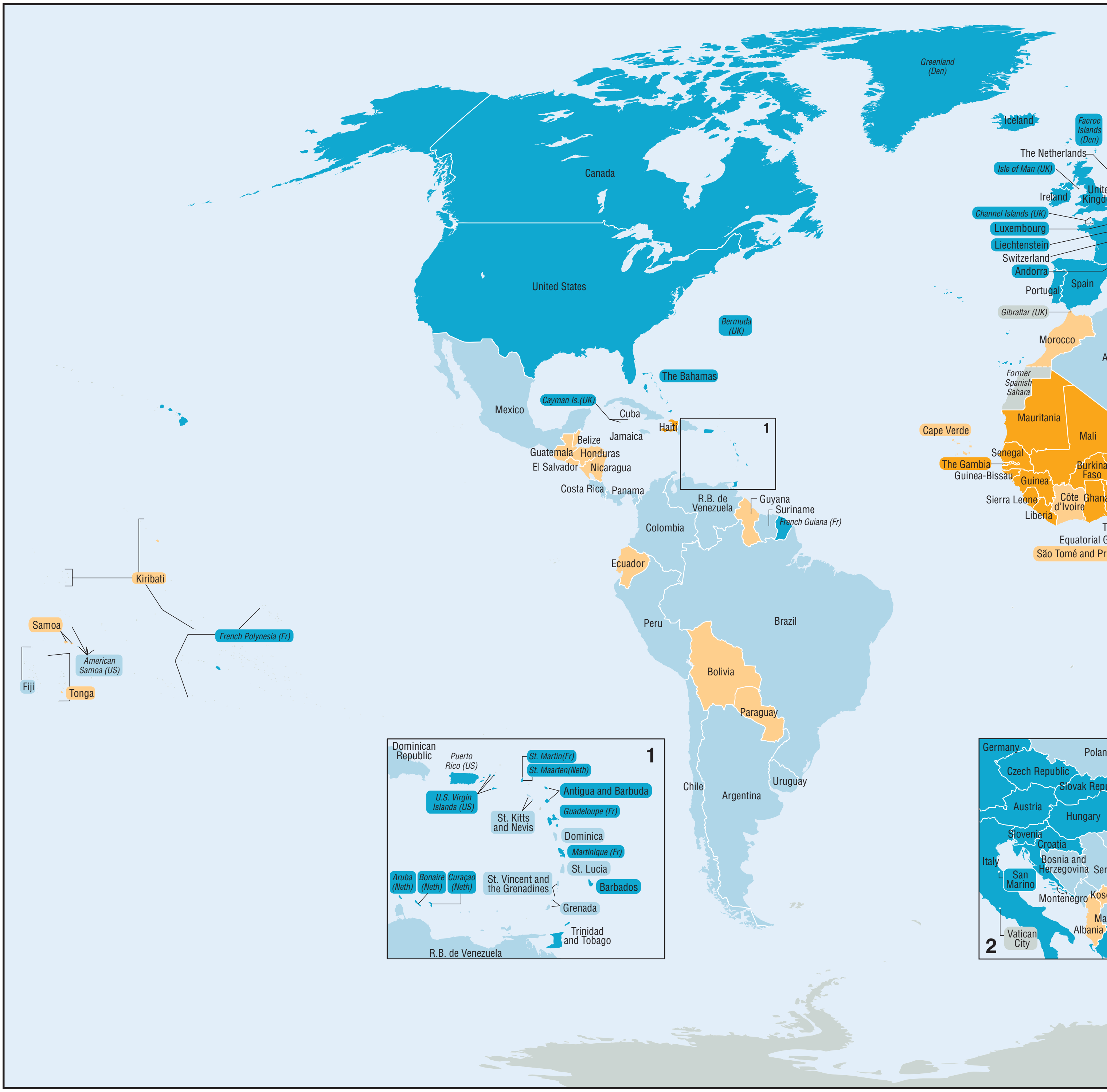
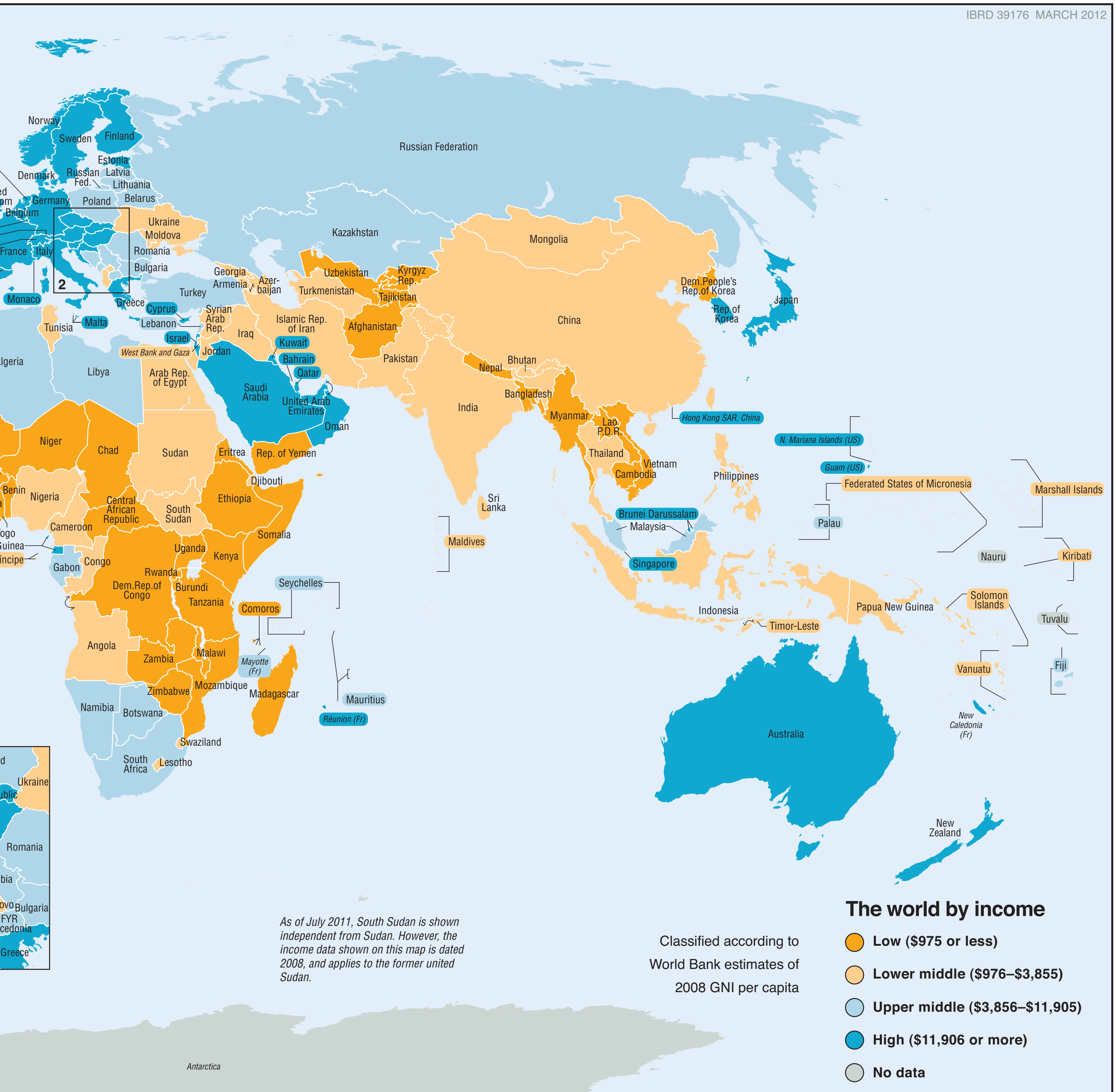
Indonesia
Papua New Guinea
Solomon Islands
Timor-Leste
Tuvalu
Angola
Zambia
Malawi
Mayotte (Fr)
Vanuatu
Fiji
Zimbabwe
Mozambique
Madagascar
Mauritius
Namibia
Botswana
Réunion (Fr)
New Caledonia (Fr)
Australia
Swaziland
South Africa
Lesotho
Ukraine
Romania
Bulgaria
FYR Macedonia
Greece
New Zealand
Antarctica
The world by region
Classified according to World Bank analytical grouping
Low- and middle-income economies
East Asia and Pacific
Europe and Central Asia
Latin America and the Caribbean
Middle East and North Africa
South Asia
Sub-Saharan Africa
High-income economies
OECD
Other
No data

ANNEX B

Map of Income Distribution

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Georgia
Armenia
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Kazakhstan
Uzbekistan
Kyrgyz Rep.
Turkmenistan
Tajikistan
Mongolia
Dem.People's Rep.of Korea
Rep.of Korea
Japan
China
Cyprus
Lebanon
Syrian Arab Rep.
Iraq
Islamic Rep. of Iran
Afghanistan
Pakistan
Tunisia
Malta
Israel
West Bank and Gaza
Jordan
Kuwait
Bahrain
Qatar
Libya
Arab Rep. of Egypt
Saudi Arabia
United Arab Emirates
Oman
Nepal
Bhutan
Bangladesh
India
Myanmar
Lao P.D.R.
Hong Kong SAR, China
N. Mariana Islands (US)
Guam (US)
Federated States of Micronesia
Marshall Islands
Niger
Chad
Sudan
Eritrea
Rep. of Yemen
Djibouti
Thailand
Vietnam
Cambodia
Philippines
Benin
Nigeria
Central African Republic
South Sudan
Ethiopia
Sri Lanka
Brunei Darussalam
Malaysia
Palau
Cameroon
Somalia
Maldives
Uganda
Kenya
Congo
Gabon
Rwanda
Dem.Rep.of Congo
Burundi
Tanzania
Seychelles
Comoros
Singapore
Nauru
Kiribati
Indonesia
Papua New Guinea
Solomon Islands
Timor-Leste
Tuvalu
Angola
Zambia
Malawi
Mayotte (Fr)
Madagascar
Zimbabwe
Mozambique
Vanuatu
Fiji
Mauritius
Namibia
Botswana
Réunion (Fr)
New Caledonia (Fr)
Australia
Swaziland
South Africa
Lesotho
Ukraine
Romania
Bulgaria
FYR Macedonia
Greece
New Zealand
Antarctica
As of July 2011, South Sudan is shown independent from Sudan. However, the income data shown on this map is dated 2008, and applies to the former united Sudan.
Classified according to World Bank estimates of 2008 GNI per capita
The world by income
Low ($975 or less)
Lower middle ($976–$3,855)
Upper middle ($3,856–$11,905)
High ($11,906 or more)
No data

ANNEX C

Availability of MSW Data by Country

Country	Income Level	Region	Generation	Year of Data	Source	Collection	Urban or Total	Year of Data	Source	Disposal	Year of Data	Source	Composition	Year of Data	Source
Albania[1]	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[2]	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[3]	HIC	MENA	x	2000	UNESCWA (2007)										
Bangladesh[4]	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[2]	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[2]	LI	AFR	x	2005	USAID (2009)										
Burundi[2]	LI	AFR	x	2005	USAID (2009)										
Cambodia[5]	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[2]	LMI	AFR	x	2005	USAID (2009)										
Central African Republic[2]	LI	AFR	x	2005	USAID (2009)										
Chad[2]	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.[2]	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)
Cote d'Ivoire[2]	LMI	AFR	x	2005	USAID (2009)										
Croatia[6]	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

Country	Income Level	Region	Generation	Year of Data	Source	Collection	Urban or Total	Year of Data	Source	Disposal	Year of Data	Source	Composition	Year of Data	Source
Cyprus	HIC	ECA	x	2007	European Environment Agency (2008)					x	2007	UNSD (2009)	x	2001	UNSD (2009)
Czech Republic	HIC	OECD	x	2006	OECD (2008)	x	T	2007	UNSD (2009)	x	2004	OECD (2008)	x	1996	UNSD (2009)
Denmark	HIC	OECD	x	2006	OECD (2008)	x	T	2007	UNSD (2009)	x	2003	OECD (2008)	x	2005	OECD (2008)
Dominica	UMI	LCR	x	2001	PAHO (2005)	x	T	2005	UNSD (2009)	x	2005	UNSD (2009)			
Dominican Republic	UMI	LCR	x	2001	PAHO (2005)	x	T	2001	PAHO (2005)	x	2001	PAHO (2005)	x	2000	UNSD (2009)
Ecuador[3]	LMI	LCR	x	2001	PAHO (2005)	x	T	2001	PAHO (2005)	x	2001	PAHO (2005)			
Egypt, Arab Rep.	LMI	MENA	x	2000	METAP (2004)	x	U	2000	METAP (2004)	x	2000	METAP (2004)	x	2000	METAP (2004)
El Salvador	LMI	LCR	x	2001	PAHO (2005)	x	T	2001	PAHO (2005)	x	2001	PAHO (2005)			
Eritrea[2]	LI	AFR	x	2005	USAID (2009)										
Estonia	HIC	ECA	x	2007	European Environment Agency (2008)	x	T	2001	UNSD (2009)	x	2007	UNSD (2009)			
Ethiopia[7]	LI	AFR	x	2006	Tadesse et al. (2008)								x	1995	
Fiji	UMI	EAP	x	1994	McIntyre (2005)								x	1994	McIntyre (2005)
Finland	HIC	OECD	x	2006	OECD (2008)	x	T	2007	UNSD (2009)	x	2004	OECD (2008)	x	2000	UNSD (2009)
France	HIC	OECD	x	2006	OECD (2008)	x	T	2007	UNSD (2009)	x	2005	OECD (2008)	x	2005	OECD (2008)
Gabon[2]	UMI	AFR	x	2005	USAID (2009)										
Gambia[2]	LI	AFR	x	2005	USAID (2009)								x	2001	UNSD (2009)
Georgia	UMI	ECA	x	2007	UNSD (2009)	x	T	2007	UNSD (2009)				x	2007	UNSD (2009)
Germany	HIC	OECD	x	2006	OECD (2008)	x	T	2007	UNSD (2009)	x	2004	OECD (2008)	x	2005	OECD (2008)
Ghana	LI	AFR	x	2008	Asase et al. (2009)	x	U	2008	Asase et al. (2009)	x	2008	Asase et al. (2009)	x	2008	Asase et al. (2009)
Greece	HIC	OECD	x	2006	OECD (2008)	x	T	2007	UNSD (2009)	x	2003	OECD (2008)	x	1997	UNSD (2009)
Grenada	UMI	LCR	x	2001	PAHO (2005)	x	T	2001	PAHO (2005)	x	2001	PAHO (2005)			
Guatemala	LMI	LCR	x	2001	PAHO (2005)	x	T	2001	PAHO (2005)	x	2001	PAHO (2005)	x	2006	UNSD (2009)
Guinea	LI	AFR											x	2007	UNSD (2009)
Guyana	LMI	LCR	x	2001	PAHO (2005)	x	T	2001	PAHO (2005)	x	2001	PAHO (2005)	x	2000	UNSD (2009)
Haiti	LI	LCR	x	2001	PAHO (2005)	x	T	2001	PAHO (2005)	x	2001	PAHO (2005)			
Honduras	LMI	LCR	x	2001	PAHO (2005)	x	T	2001	PAHO (2005)						
Hong Kong, China	HIC	EAP	x	2008	Shekdar (2009)	x	T	2007	UNSD (2009)	x	2007	UNSD (2009)	x	2008	Shekdar (2009)
Hungary	HIC	OECD	x	2006	OECD (2008)	x	T	2003	UNSD (2009)	x	2003	OECD (2008)	x	2005	OECD (2008)
Iceland	HIC	OECD	x	2006	OECD (2008)	x	T	2007	UNSD (2009)	x	2004	OECD (2008)	x	2003	OECD (2008)
India	LMI	SAR	x	2006	Hanrahan et al. (2006)								x	2004	UNSD (2009)
Indonesia[8]	LMI	EAP	x	2008	Shekdar (2009)	x	U	2006	Pasang et al. (2007)				x	2000	Ngoc and Schnitzer (2009)
Iran, Islamic Rep.[9]	LMI	MENA	x	2005	Damghani et al. (2008)								x	2005	Damghani et al. (2008)
Iraq[10]	LMI	MENA	x	2005	UNESCWA (2007)	x	T	2005	UNSD (2009)						
Ireland	HIC	OECD	x	2006	OECD (2008)	x	T	2005	UNSD (2009)	x	2005	OECD (2008)	x	2005	OECD (2008)
Israel	HIC	MENA	x	1996	Israel Ministry of the Environment (2000)					x	1996	Israel Ministry of the Environment (2000)	x	2005	UNSD (2009)
Italy	HIC	OECD	x	2006	OECD (2008)	x	T	2007	UNSD (2009)	x	2005	OECD (2008)	x	2005	OECD (2008)
Jamaica[3]	UMI	LCR	x	2001	PAHO (2005)	x	T	2001	PAHO (2005)	x	2001	PAHO (2005)	x	2007	UNSD (2009)
Japan	HIC	OECD	x	2005	OECD (2008)	x	T	2003	UNSD (2009)	x	2003	OECD (2008)	x	2008	Shekdar (2009)
Jordan	LMI	MENA	x	2001	METAP (2004)	x	U	2001	METAP (2004)	x	2001	METAP (2004)	x	2001	METAP (2004)
Kenya	LI	AFR	x	2002	Kenya Ministry of Environment (2002)										
Korea, South	HIC	OECD	x	2005	OECD (2008)	x	T	2002	UNSD (2009)	x	2004	OECD (2008)	x	2005	OECD (2008)
Kuwait	HIC	MENA	x	2009	Personal communication										

ANNEX C *(continued)*

Availability of MSW Data by Country

Country	Income Level	Region	Generation	Year of Data	Source	Collection	Urban or Total	Year of Data	Source	Disposal	Year of Data	Source	Composition	Year of Data	Source
Lao PDR	LI	EAP	x	2008	Shekdar (2009)								x	2000	Ngoc and Schnitzer (2009)
Latvia	UMI	ECA	x	2007	European Environment Agency (2008)	x	T	1999	UNSD (2009)	x	2003	Latvia Ministry of Environment (2006)	x	2003	Latvia Ministry of Environment (2006)
Lebanon	UMI	MENA	x	2000	METAP (2004)	x	U	2000	METAP (2004)	x	2000	METAP (2004)	x	2000	METAP (2004)
Lesotho[2]	LMI	AFR	x	2005	USAID (2009)										
Liberia[11]	LI	AFR											x	2004	UNEP (2007)
Lithuania	UMI	ECA	x	2007	European Environment Agency (2008)					x	2003	Lithuania Ministry of Environment (2005)			
Luxembourg	HIC	OECD	x	2006	OECD (2008)	x	T	2007	UNSD (2009)	x	2003	OECD (2008)	x	2005	OECD (2008)
Macao, China	HIC	EAP	x	2003	Jin et al. (2006)	x	T	2007	UNSD (2009)	x	2007	UNSD (2009)	x	2007	UNSD (2009)
Macedonia, FYR	LMI	ECA	x	2006	Hristovski et al. (2007)								x	1996	Macedonia (1996)
Madagascar	LI	AFR	x	2003	Payet (2003)	x	T	2007	UNSD (2009)	x	2007	UNSD (2009)	x	2007	UNSD (2009)
Malawi[2]	LI	AFR	x	2005	USAID (2009)										
Malaysia[12]	UMI	EAP	x	2002	Saeed et al. (2009)								x	2000	Ngoc and Schnitzer (2009)
Maldives	LMI	SAR	x	1998	UNEP (2002)										
Mali[13]	LI	AFR	x	2007	Samake et al. (2009)	x	T						x	1995	UNSD (2009)
Malta	HIC	MENA	x	2007	European Environment Agency (2008)	x	T	2007	UNSD (2009)	x	2007	UNSD (2009)			
Marshall Islands	LMI	EAP				x	T	2007	UNSD (2009)	x	2007	UNSD (2009)	x	2007	UNSD (2009)
Mauritania[2]	LI	AFR	x	2005	USAID (2009)										
Mauritius	UMI	AFR	x	2003	Payet (2003)	x	T	2007	UNSD (2009)	x	2007	UNSD (2009)	x	2007	UNSD (2009)
Mexico	UMI	LCR	x	2006	OECD (2008)	x	T			x	2006	OECD (2008)	x	2005	OECD (2008)
Monaco	HIC	OECD				x	T	2007	UNSD (2009)	x	2007	UNSD (2009)			
Mongolia	LI	EAP	x	2001	Mongolia Ministry of Nature (2001)										
Morocco	LMI	MENA	x	2002	METAP (2004)	x	T	2002	METAP (2004)	x	2002	METAP (2004)	x	2000	UNSD (2009)
Mozambique[14]	LI	AFR	x	2007	Grest (2008)								x	2007	Grest (2008)
Myanmar	UMI	EAP	x	2000	IPCC (2006)								x	2000	Ngoc and Schnitzer (2009)
Namibia[2]	UMI	AFR	x	2005	USAID (2009)										
Nepal	LI	SAR	x	2008	Shekdar (2009) per cap	x	U	2003	Alam et al. (2008)				x	2008	Shekdar (2009)
Netherlands	HIC	OECD	x	2006	OECD (2008)	x	T	2007	UNSD (2009)	x	2004	OECD (2008)	x	2004	OECD (2008)
New Zealand	HIC	OECD	x	2006	OECD (2008)					x	1999	OECD (2008)	x	1995	UNSD (2009)
Nicaragua[3]	LMI	LCR	x	2001	PAHO (2005)	x	T	2001	PAHO (2005)	x	2001	PAHO (2005)			
Niger[2]	LI	AFR	x	2005	USAID (2009)					x	2005	UNSD (2009)	x	2005	UNSD (2009)
Nigeria	LMI	AFR	x	2008	Solomon (2009)								x	2008	Imam et al. (2008)
Norway	HIC	OECD	x	2006	OECD (2008)	x	T	2004	UNSD (2009)	x	2004	OECD (2008)	x	2005	OECD (2008)
Oman	HIC	MENA	x	1997	Al-Yousfi										
Pakistan[15]	LMI	SAR	x	2009	Batool and Nawaz (2009)								x	2009	Batool and Nawaz (2009)
Panama	UMI	LCR	x	2001	PAHO (2005)	x	T	2001	PAHO (2005)	x	2001	PAHO (2005)	x	2000	UNSD (2009)
Paraguay	LMI	LCR	x	2001	PAHO (2005)	x	T	2001	PAHO (2005)	x	2001	PAHO (2005)			
Peru	UMI	LCR	x	2001	PAHO (2005)	x	T	2001	PAHO (2005)	x	2001	PAHO (2005)	x	2001	UNSD (2009)
Philippines	LMI	EAP	x	2008	Shekdar (2009)								x	2000	Ngoc and Schnitzer (2009)
Poland	UMI	ECA	x	2007	European Environment Agency (2008)					x	2005	OECD (2008)	x	1990	UNSD (2009)
Portugal	HIC	OECD	x	2006	OECD (2008)	x	T	2007	UNSD (2009)	x	2005	OECD (2008)	x	2001	OECD (2008)
Qatar	HIC	MENA	x	2004	UNESCWA (2007)										

ANNEX C *(continued)*

Availability of MSW Data by Country

Country	Income Level	Region	Generation	Year of Data	Source	Collection	Urban or Total	Year of Data	Source	Disposal	Year of Data	Source	Composition	Year of Data	Source
Romania	UMI	ECA	x	2007	European Environment Agency (2008)	x	T	2002	UNSD (2009)	x	2007	UNSD (2009)	x	2006	Atudorei
Russian Federation	UMI	ECA	x	2000	IPCC (2006)										
Rwanda[2]	LI	AFR	x	2005	USAID (2009)										
Sao Tome and Principe[2]	LMI	AFR	x	2005	USAID (2009)										
Saudi Arabia	HIC	MENA	x	1997	Al-Yousfi										
Senegal[2]	LI	AFR	x	2005	USAID (2009)	x	T	2005	UNSD (2009)				x	2007	UNSD (2009)
Serbia1	LI	ECA	x	2006	Denmark Ministry of Foreign Affairs	x	T	2006	Denmark Ministry of Foreign Affairs				x	1999	UNSD (2009)
Seychelles	UMI	AFR	x	2003	Payet (2003)	x	T	2003	Payet (2003)						
Sierra Leone[16]	LI	AFR	x	2007	Patriotic Vanguard (2007)	x	U	2007	Patriotic Vanguard (2007)				x	2007	Patriotic Vanguard (2007)
Singapore	HIC	EAP	x	2008	Singapore (2009)	x	T	2007	UNSD (2009)	x	2007	UNSD (2009)	x	2000	Ngoc and Schnitzer (2009)
Slovak Republic	HIC	OECD	x	2006	OECD (2008)	x	T	2007	UNSD (2009)	x	2005	OECD (2008)	x	2002	OECD (2008)
Slovenia	HIC	ECA	x	2007	European Environment Agency (2008)	x	T	2002	UNSD (2009)	x	2003	Slovenia Ministry of the Environment (2006)			
Solomon Islands	LMI	EAP	x	1994	McIntyre (2005)								x	1994	McIntyre (2005)
South Africa[17]	UMI	AFR	x	2003	City of Cape Town (2008)										
Spain	HIC	OECD	x	2006	OECD (2008)					x	2004	OECD (2008)	x	2002	OECD (2008)
Sri Lanka	LMI	SAR	x	2003	Perera (2003)								x	2008	Shekdar (2009)
St. Kitts and Nevis[3]	UMI	LCR	x	2001	PAHO (2005)	x	T	2001	PAHO (2005)	x	2001	PAHO (2005)			
St. Lucia	UMI	LCR	x	2001	PAHO (2005)	x	T	2001	PAHO (2005)	x	2001	PAHO (2005)			
St. Vincent and the Grenadines	UMI	LCR	x	2001	PAHO (2005)	x	T	2001	PAHO (2005)	x	2001	PAHO (2005)	x	2002	UNSD (2009)
Sudan	LMI	AFR	x	2000	IPCC (2006)										
Suriname	UMI	LCR	x	2001	PAHO (2005)	x	T	2001	PAHO (2005)	x	2001	PAHO (2005)			
Swaziland[2]	LMI	AFR	x	2005	USAID (2009)										
Sweden	HIC	OECD	x	2006	OECD (2008)	x	T	2007	UNSD (2009)	x	2005	OECD (2008)	x	2005	OECD (2008)
Switzerland	HIC	OECD	x	2006	OECD (2008)	x	T	2007	UNSD (2009)	x	2005	OECD (2008)	x	2005	OECD (2008)
Syrian Arab Republic	LMI	MENA	x	2002	METAP (2004)	x	U	2002	METAP (2004)	x	2002	METAP (2004)	x	2002	METAP (2004)
Tajikistan	UMI	ECA	x	2001	CEROI (2001)										
Tanzania	LI	AFR	x	2005	Kassim and Ali (2006)	x	U	2005	Kassim and Ali (2006)						
Thailand	LMI	EAP	x	2008	Shekdar (2009)					x	2000	UNSD (2009)	x	2000	Ngoc and Schnitzer (2009)
Togo[2]	LI	AFR	x	2005	USAID (2009)								x	2007	UNSD (2009)
Tonga	LMI	EAP	x	1994	McIntyre (2005)								x	1994	McIntyre (2005)
Trinidad and Tobago	HIC	LCR	x	2001	PAHO (2005)	x	T	2001	PAHO (2005)	x	2001	PAHO (2005)	x	2003	UNSD (2009)
Tunisia	LMI	MENA	x	2000	METAP (2004)	x	U	2000	METAP (2004)	x	2000	METAP (2004)	x	2000	METAP (2004)
Turkey	LMI	ECA	x	2006	OECD (2008)	x	T	2004	Turan et al. (2009)	x	2004	Turan et al. (2009)	x	2008	Turan et al. (2009)
Turkmenistan	LMI	ECA	x	2000	Turkmenistan Ministry of Nature Protection (2000)										
Uganda[18]	LI	AFR	x	2004	Bingh (2004)	x	U	2002	Bingh (2004)	x	2006	UNSD (2009)	x	2002	Bingh (2004)
United Arab Emirates[3]	HIC	MENA	x	2000	UNESCWA (2007)										

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

Country	Income Level	Region	Generation	Year of Data	Source	Collection	Urban or Total	Year of Data	Source	Disposal	Year of Data	Source	Composition	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[19]	LI	AFR	x		Environmental Council of Zambia (2004)	x	T	2005	UNSD (2009)						
Zimbabwe[2]	LI	AFR	x	2005	USAID (2009)								x	2007	UNSD (2009)

NOTES:

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

	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	>$10,725
Waste Generation (tonnes/capita/yr)	0.22	0.29	0.42	0.78
Collection Efficiency (percent collected)	43%	68%	85%	98%
Cost of Collection and Disposal (US$/tonne)				
Collection[2]	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[3]	5-30	10-40	20-75	35-90
Waste -to-Energy Incineration[4]	NA	40-100	60-150	70-200
Anaerobic Digestion[5]	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[6]	2025 Cost
Low Income Countries[7]	$1.5 billion	$7.7 billion
Lower Middle Income Countries[8]	$20.1 billion	$84.1 billion
Upper Middle Income Countries[9]	$24.5 billion	$63.5 billion
High Income Countries[10]	$159.3 billion	$220.2 billion
Total Global Cost (US$)	**$205.4 billion**	**$375 billion**

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.

[1] 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.

[2] Collection includes pick up, transfer, and transport to final disposal site for residential and non-residential waste.

[3] Composting excludes sale of finished compost (which ranges from $0 to $100/ton).

[4] Includes sale of any net energy; excludes disposal costs of bottom and fly ash (non hazardous and hazardous).

[5] Anaerobic digestion includes sale of energy from methane and excludes cost of residue sale and disposal.

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

[7] 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)

[8] 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)

[9] 2010: $24.5bil = 243,000,000 tonnes X 84% X (($0.9_{Landfill}$ ($65/ton + $50/ton)) + ($0.1_{Incinerate}$ ($65/ton + $100/ton))); 2025: $63.5bil = 426,000,000 X 92% X (($0.85_{Landfill}$ ($85/ton + $65/ton)) + ($0.15_{Incinerate}$($85/ton +$145/ton)))

[10] 2010: $159.3bil = 602,000,000 tonnes X 98% X (($0.8_{Landfill}$ ($180/ton + $75/ton)) + ($0.2_{Incinerate}$ ($180/ton + $150/ton))); 2025: $220.2bil = 686,000,000 tonnes X 98% X (($0.75_{Landfill}$ ($210/ton + $95/ton)) + $0.25_{Incinerate}$($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)
Africa					
Benin					
Parakou (UNSD 2009)	2002	148,450	0.59	87,671	88
Porto Novo (Achankeng 2003)	1993		0.50		–
Burkina Faso (UNSD 2009)					
Ouagadougou	2002	876,200	0.79	692,635	693
Burundi (Achankeng 2003)					
Bujumbura	1993		1.40		–
Cameroon (Achankeng 2003)					
Douala	1993		0.70		
Yaounde	1993		0.80		
Congo, Rep. (Achankeng 2003)					
Brazzaville	1993		0.60		
Cote d'Ivoire (Achankeng 2003)					
Abidjan	1993		1.00		
Egypt (Achankeng 2003)					
Cairo	1993		0.50		
Gambia, The (Achankeng 2003)					
Banjul	1993		0.30		
Ghana					
Accra (Achankeng 2003)	1993		0.40		
Kumasi (Asase 2009)	2006	1,610,867	0.60	966,520	967
Guinea (UNSD 2009)					
Conakry	2007	3,000,000	0.24	725,274	725
Madagascar (Achankeng 2003)					
Antananarivo	1993		0.30		
Mauritania (Achankeng 2003)					
Nouakchott	1993		0.90		
Morocco (Achankeng 2003)					
Rabat	1993		0.60		
Namibia (Achankeng 2003)					
Windhoek	1993		0.70		
Niger					
Niamey (Achankeng 2003)	1993		1.00		
Zinder (UNSD 2009)	2006	242,800a	0.29	69,430	69
Nigeria (Achankeng 2003)					
Ibadan	1993		1.10		
Lagos	1993		0.30		
Rwanda (Achankeng 2003)					
Kigali	1993		0.60		
Senegal (Achankeng 2003)					
Dakar	1993		0.70		
Tanzania (Achankeng 2003)					
Dar es Salaam	1993		1.00		
Togo (Achankeng 2003)					
Lome	1993		1.90		
Tunisia (Achankeng 2003)					
Tunis	1993		0.50		
Uganda (Achankeng 2003)					
Kampala	1993		6.00		
Zambia (UNSD 2009)					
Lusaka	2005	1,300,000	0.90	1,171,994	1,172
Zimbabwe (UNSD 2009)					
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)
East Asia & Pacific					
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
Huaibei, Anhui	2000	814,000	0.90	732,600	733
Huainan, Anhui	2000	1,354,000	0.90	1,218,600	1,219
Huhehaote, 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
Shijianzhuang, 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
Eastern Europe & Central Asia (UNSD 2009)					
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
Latin America and the Caribbean (PAHO 2005)					
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
Sucre	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
Guaratingueta	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
Jacarei	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 For a	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 Algre	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
Uruguaiana	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
Chile					
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
Colombia					
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
Costa Rica					
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
Cuba					
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
Ecuador*					
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
El Salvador					
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
Grenada					
Grenada	2001	95,551	0.85	81,218	81
Guatemala					
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
Guyana					
Georgetown	2001	180,000	1.53	275,400	275
Haiti					
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
Honduras					
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
Jamaica*					
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
Mexico					
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
Cuauhtemoc, 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 Cristobal 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 Potosi, San Luis Potosi	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 Nicolas 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 Potosi	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
Tecoman, 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 Potosi	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
Nicaragua					
Chinandega	2001	124,107	0.61	75,085	75
Leon	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
Panama					

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
Venezuela					
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 Bolivar	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
Middle East & North Africa					
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
South Asia					
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
Tiruvanantapuram	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
Nepal (Alam 2008)					
Kathmandu	2003	738,173	0.31	226,800	227
Sri Lanka (UNSD 2009)					
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 (%)
Africa			
Benin (UNSD 2009)			
Parakou	2002	148,450	10
Burkina Faso (UNSD 2009)			
Ouagadougou	1995	876,200	51
Cameroon (Parrot et al. 2009)			
Yaounde	2005	1,720,000	43
Chad (Parrot et al. 2009)			
Ndjamena	2003	800,000	15 - 20
Côte d'Ivoire (Parrot et al. 2009)			
Abidjan	2002	2,777,000	30 - 40
Guinea (UNSD 2009)			
Conakry	2007	3,000,000	76
Kenya (Parrot et al. 2009)			
Nairobi	2006	2,312,000	30 - 45
Mauritania (Parrot et al. 2009)			
Nouakchott	N/A	611,883	20 - 30
Niger (UNSD 2009)			
Zinder**	2007	242,800	77
Senegal (Parrot et al. 2009)			
Dakar	2003	1,708,000	30 - 40
Tanzania (Parrot et al. 2009)			
Dar es Salaam	N/A	2,500,000	48
Togo (Parrot et al. 2009)			
Lome	2002	1,000,000	42
Zambia (UNSD 2009)			
Lusaka	2005	1,300,000	18
Zimbabwe (UNSD 2009)			
Harare	2007	2,500,000	99
East Asia & Pacific (UNSD 2009)			
China, Hong Kong SAR			
Hong Kong	2007	6,926,000	100
China, Macao SAR			
Macao	2007	525,760	100
Indonesia			
Jakarta	2004	8,962,000	83
Philippines			
Manila	2007	1,660,714	95
Eastern Europe & Central Asia (UNSD 2009)			
Albania			
Tirana	2007	1,532,000	90
Belarus			
Minsk	2007	1,806,200	100
Croatia			
Zagreb	2006	784,900	100
Georgia			
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 (%)
Latin America and the Caribbean (PAHO, 2005)			
Argentina			
Area Metropolitana Buenos Aires	2001	12,544,018	100
Bahia 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
Bahamas			
Nassau, Bahamas	2001	200,000	100
Barbados*			
Barbados	2001	268,792	100
Bolivia*			
Cochabamba	2001	717,026	90
El Alto	2001	629,955	76
La Paz	2001	790,353	87
Oruro	2001	201,230	92
Potosi	2001	135,783	88
Santa Cruz de la Sierra	2001	1,113,000	88
Sucre	2001	193,876	85
Tarija	2001	135,783	93
Chile			
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

City	Year	Urban Population	MSW Collection Coverage (%)
Colombia			
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
Costa Rica			
Alajuela	2001	234,737	82
Desamparados	2001	203,770	40
San José	2001	326,384	100
Cuba			
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
Dominican Republic			
La Romana	2001	201,700	100
Quito	2001	2,774,926	60
Santo Domingo de los Colorados	2001	244,039	90
Ecuador*			
Quito	2001	1,841,200	80
Santo Domingo de los Colorados	2001	200,421	83
El Salvador			
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
Grenada			
Grenada	2001	95,551	100
Guatemala			
Antigua Guatemala	2001	248,019	80
Guatemala	2001	2,541,581	70
Quetzaltenango	2001	122,157	90
San Benito	2001	366,735	80
Guyana			
Georgetown	2001	180,000	100
Haiti			
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
Honduras			
San Pedro Sula	2001	483,384	85
Jamaica*			
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
Mexico			
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

City	Year	Urban Population	MSW Collection Coverage (%)
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
Cuauhtemoc, 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 Cristobal 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 Potosi, San Luis Potosi	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 Nicolas 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 Potosi	2001	185,063	85
Tampico, Tamaulipas	2001	298,063	85
Tapachula, Chiapas	2001	276,743	85
Taxco, Guerrero	2001	100,889	85
Tecoman, 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

City	Year	Urban Population	MSW Collection Coverage (%)
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 Potosi	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
Nicaragua			
Chinandega	2001	124,107	80
Leon	2001	147,845	70
Managua	2001	952,068	80
Panama			
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
Paraguay			
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
Lambare	2001	119,984	42
Luque	2001	170,433	54
San Lorenzo	2001	202,745	26
Peru			
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
Saint Lucia			
St. Lucia	2001	162,157	100
Saint Vincent and the Grenadines*			
St. Vincent	2001	106,916	90
Suriname			
Greater Paramaribo	2001	287,131	82
Trinidad and Tobago			
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
Uruguay			
Canelones	2001	539,130	75
Maldonado	2001	137,390	95
Montevideo	2001	1,303,182	90
Venezuela			
Distrito Capital	2001	1,836,286	80
Municipio Barinas Edo Barinas	2001	283,273	100
Municipio Caroni Edo Bolivar	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 Simon Bolivar Edo Anzoategui	2001	344,593	80
Municipio Simon Rodriguez Edo Anzoategui	2001	147,800	100
Middle East & North Africa (UNSD 2009)			
Egypt			
Cairo	2007	7,765,000	77
Iraq			
Baghdad	2005	6,784,000	86
South Asia			
Nepal (Alam 2008)			
Kathmandu	2003	738,173	94
Sri Lanka (UNSD 2009)			
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 a 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 (%)
Latin America & Caribbean (PAHO 2005)						
Argentina						
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
Bolivia						
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
Barbados						
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
Cuba						
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
Colombia						
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
Costa Rica						
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
Dominican Republic						
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 (%)
Ecuador						
Quito	1,841,200	84	0	0	0	16
Santo Domingo de los Colrados	200,421	0	91	0	0	9
El Salvador						
San Salvador, San Salvador	479,605	81	0	0	0	19
San Salvador - Soyapango	285,286	95	0	0	0	5
Grenada						
Grenada	95,551	90	0	0	0	10
Guatemala						
Guatemala	2,541,581	0	40	0	0	60
Guyana						
Georgetown	180,000	0	90	0	10	0
Haiti						
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
Honduras						
Distrito Central	819,867	0	100	0	0	0
Jamaica						
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
Mexico						
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
Atlixco, 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
Chilpancingo, Guerrero	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
Cuauhtemoc, 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 Cristobal 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 Potosi, San Luis Potosi	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 Nicolas 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 Potosi	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
Tecoman, 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 Potosi	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
Zitacuaro, Michoacán	139,514	0	0	94	0	6
Nicaragua						
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
Panama						
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
Paraguay						
Asunción	513,399	37	61	0	0	2
Luque	170,433	0	100	0	0	0
Peru						
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 (%)
St. Lucia						
St. Lucia	162,157	70	18	0	0	13
St. Vincent and the Grenadines						
St. Vincent	106,916	80	0	0	0	20
Suriname						
Greater Paramaribo	287,131	0	0	100	0	0
Trinidad and Tobago						
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
Uruguay						
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
Venezuela						
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/ City	Year	Urban Population	Organic (%)	Total Recyclables (%)	Paper (%)	Plastic (%)	Glass (%)	Metal (%)	Other (%)
Africa									
Ghana (Asase 2009)									
Kumasi	2008	1,610,867	64	–	3	4	–	1	28
East Asia & Pacific									
Cambodia (Kum et al. 2005)									
Phnom Penh	2002		65	–	4	13	5	1	12
Middle East & North Africa (Al-Yousfi)									
Egypt									
Cairo	2002		67	–	18	3	3	2	7
Jordan									
Amman	2002		55	–	14	13	3	2	13
Saudi Arabia									
Riyadh	2002		34	–	31	2	3	16	14
Syria									
Aleppo	2002		59	–	13	12	8	1	8
Tunisia									
Tunis	2002		68	–	10	11	3	2	6
Yemen									
Aden	2002		57	–	11	11	3	5	14
South Asia									
India (CPCB 2005)									
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/ City	Year	Urban Population	Organic (%)	Total Recyclables (%)	Paper (%)	Plastic (%)	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
Nepal (calculated from Alam 2008)									
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	102,258,000	1.75	179,000
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	14.40	2,082	1,401,000	291000	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: Total Urban Population	Current Available Data: MSW Generation Per Capita (kg/capita/day)	Current Available Data: Total MSW Generation (tonnes/day)	2025: Total Population	2025: Urban Population	2025: MSW Generation Per Capita (kg/capita/day)	2025: 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: Total Urban Population (millions)	Current: Urban MSW Generation Per Capita (kg/capita/day)	Current: Urban MSW Generation Total (tonnes/day)	Projections for 2025: Projected Population Total Population (millions)	Projected Population Urban Population (millions)	Projected Urban MSW Generation Per Capita (kg/capita/day)	Projected Urban MSW Generation 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: Total Urban Population (millions)	Current: Urban MSW Generation Per Capita (kg/capita/day)	Current: Urban MSW Generation Total (tonnes/day)	Projections for 2025: Projected Population Total (millions)	Projected Population Urban (millions)	Projected Urban MSW Generation Per Capita (kg/capita/day)	Projected Urban MSW Generation 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

Country	Income	Region	Collection (%)	Urban/Total
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[2]	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[3]	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[2]	HIC	EAP	–	21	–	–	–	100
Madagascar[2]	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[4]	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[5]	HIC	OECD	–	64	6	9	21	–
Romania	UMI	ECA	–	75	–	–	–	25
Singapore[6]	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 classfied 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													
Income Level	Number of Countries Included	Organic (%)		Paper (%)		Plastic (%)		Glass (%)		Metal (%)		Other (%)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit	Lower Limit	Upper Limit	Lower Limit	Upper Limit	Lower Limit	Upper Limit	Lower Limit	Upper Limit
Lower Income	22	18	88	2	21	1	20	1	8	1	12	1	57
Lower Middle Income	27	20	76	3	34	2	18	1	9	1	20	2	59
Upper Middle Income	25	5	70	7	37	3	36	1	13	1	8	3	43
High Income	35	4	56	4	68	1	24	1	13	1	16	5	63
Total	109												

Summary by Region													
Region	Number of Countries Included	Organic (%)		Paper (%)		Plastic (%)		Glass (%)		Metal (%)		Other (%)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit	Lower Limit	Upper Limit	Lower Limit	Upper Limit	Lower Limit	Upper Limit	Lower Limit	Upper Limit
AFR	19	18	88	2	21	1	20	1	5	1	5	1	57
EAP	17	4	71	2	31	2	24	3	9	1	20	2	63
ECA	12	5	65	10	37	3	12	1	13	3	9	11	43
LCR	18	14	69	6	32	4	36	1	8	1	16	3	59
MENA	10	40	70	9	25	4	16	1	5	2	9	2	16
OECD	6	14	56	8	68	1	22	2	13	2	13	5	63
SAR	27	35	80	3	17	2	18	1	4	1	1	5	59
Total	109												

ANNEX N
IPCC Classification of MSW Composition

Region	Food Waste	Paper/ Card-board	Wood	Textiles	Rubber/ Leather	Plastic	Metal	Glass	Other
Asia									
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
Africa									
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		
Europe									
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						
Oceania									
Australia & New Zealand	36	30	24						
Rest of Oceania	67.5	6	2.5						
America									
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) 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.

For more information, please contact the Global City Indicators Facility at:

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