

**Solid Waste Management**  
***(Volume II: Regional Overviews***  
***and Information Sources)***

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# Solid Waste Management

## (Volume II)



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## SECTION A. AFRICA

### A. Topic a: Waste Reduction

There are few formal systems of materials recovery through the public or private sectors in Africa. Instead, materials recovery, including source separation and recycling, is largely the domain of the informal sector. The activity is focused on components of economic and/or social value and occurs at several levels. At the household level in low-income, peri-urban areas, materials recovery includes the reuse of plastic bags, bottles, paper, cardboard, and cans for domestic purposes. The rate of reuse of these types of materials is high, and these materials enter the formal waste collection system only when they are no longer fit for domestic use. In high-income areas, recovery is carried out by domestic servants and/or wardens. Rather than reusing the materials directly, they sell bottles, plastics, cardboard, and paper to intermediaries or commercial centres that pay for these materials. The extent to which these transactions occur depends on the availability of local marketable end uses for the materials.

*In most parts of Africa, materials recovery takes place only in the informal sector.*

Scavengers provide informal collection services (see below, Collection and Transfer) recovering additional material set out at the kerb by domestic generators and at dumps and landfills. At landfill sites, scavengers may be organised into specialised groups with a permit to operate at the landfill. In other cases, they may be individuals seeking to recover items for personal or commercial use.

Glass bottles are largely returned to their point of sale for direct reuse by the beverage industry. A deposit system has maintained a high return rate continent-wide. In the majority of cities, the glass content of the MSW stream would not be sufficient to support a glass recycling industry. Instead, the bottles not reused for bottling of beverages are diverted from the waste stream and used as containers in the home. Other glass items are discarded with the rest of the MSW stream.

Plastics are recycled by scavengers where markets exist. Some plastic recovery operations have modular pelletizers to process the material prior to sale. The processed material is then sold to local plastic product manufacturers. These plants use granulated or pelletized virgin plastics for the manufacture of packaging material and utensils and furniture that can be extruded.

In some locations, rags are recovered, processed, and recycled by scavengers using rag-pulling equipment and other equipment to shred, clean, and re-knit the fibres into all-purpose utility cloths for resale.

In South Africa, a deposit system is used to encourage the return of bottles and tin and aluminium cans. In addition, specially marked receptacles are placed at green depots for dropoff of bottles and cans. The country has a large tin mining and processing industry, with a demand for tin-bearing scrap. Recovered aluminium cans are processed for reuse in manufacturing of aluminium beverage containers.

In summary, the informal recovery and reuse of materials from the waste stream occurs at several levels in Africa. At the household level items are reused before entering the waste stream, thereby extending their useful life. Scavengers also recover materials for personal and commercial purposes. The extent of commercial recycling of paper, metals, glass, and plastic depends on the

presence of industrial or other end uses for these materials. While such industries may be found in some of the major cities, they are largely absent in secondary cities and in the rural areas. Even in those cases where they are found, they do not consistently stimulate recycling in their host cities. With few official statistics on MSW generation and recycling to point to continent-wide, it is difficult to generalise about an overall rate of waste reduction or materials recovery in Africa. As African cities move to upgrade their municipal solid waste management systems, obtaining these data will be vital to the design of well integrated systems.

#### A1. INFORMATION Sources in Africa on Topic a, Waste Reduction:

- Accra Metropolitan Assembly (AMA) - Ghana
- Alexandria University, Dept. Civil/Environmental Engineering-Egypt
- ALPHALOG - Mali
- Associated Environmental NGOs, Cape Recycling Network - South Africa
- Cairo University, Dept. Civil Eng. - Egypt
- Centre Recherche Technologie Appliquée (INFOCITA) - Guinea Bissau
- EarthLife Africa (ELA) - South Africa
- École Mohammadia des Ingenieurs, Section Génie de l'Environnement - Morocco
- École Nationale Supérieure Universitaire de Technologie (ENSUT) - Senegal
- École Nationale Polytechnique - Civil/Environmental Engineering - Algeria
- ENDA/TM - RUPA Participatory Urban Management Program - Senegal
- Environmental Council of Zambia (ECA) - Zambia
- Federal Environmental Protection Agency (FEPA) - Nigeria
- Industrial Environmental Forum of Southern Africa (IEFSA) - South Africa
- Institut Africain de Gestion Urbain (IAGU) - Senegal
- Institute of Waste Management (South Africa)
- International Association on Water Quality (IAWQ) - Regional
- Makerere University, Dept. of Women's Studies (DWS) - Uganda
- Ministère de l'Environnement et de l'Aménagement du Territoire - Tunisia
- Ministry for Coordination of Environmental Affairs (MICOA) - Mozambique
- Ministry of Natural Resources & Environmental Affairs - Malawi
- National Environmental Management Council, Environmental Information Centre - Tanzania
- National Research Center - Egypt
- Nigerian Society of Engineers (NSE) - Nigeria
- Projet Assainissement et Protection de l'Environnement (PrAPE) - Benin
- UN Centre for Human Settlements (HABITAT) - Kenya
- UN Centre for Human Settlements (HABITAT) - Kenya
- UNEP-INFOTERRA - Regional
- Universidade Agostinho Neto - Faculty of Engineering - Angola
- Université des Sciences/Technologie Houari Boumedienne - Civil Engineering - Algeria
- University of Botswana, Dept. of Environmental Sciences - Botswana
- University of Liberia Library - Liberia
- University of Malawi, Chancellor College - Malawi

#### **B. Topic b: Collection and Transfer**

Most major cities in Africa have an organised municipal waste collection system. Collection is carried out by a variety of means including: human- and animal-drawn carts (wheelbarrows,

pushcarts), open-back trucks, compactor trucks, and trailers. Collection coverage across the continent ranges from 20% to 80% with a median range of 40% to 50%.

In cities across West Africa, vehicle immobilization rates reach as high as 70%, reducing the rate of collection. Where collection is performed by non-mechanical means, the volume of material to be collected often exceeds the capacity of the collection system. Pre-collection is carried out by community groups in some areas not served directly by municipal vehicles. For example, in Cotonou, Benin, such a group is authorised to pre-collect the waste and deposit it in communal bins for later removal by the municipality.

In most municipalities, collection is provided by the municipality. Private operators also provide service on a fee basis to households and commercial establishments. In Cairo, the Zabbaleen is a group that traditionally has specialised in MSW collection (and recycling) and now operates as a cooperative to perform this service with authorization from the municipal authority. However, though such cooperatives might do much to improve municipal sanitation, they are not common in other African cities. Since the mid-1970s, international aid has promoted initiatives to improve the coverage of MSW collection services in Africa. These efforts have focused primarily on vehicular collection in the central city. In some West African cities, such as Dakar and Cotonou, local initiatives have focused on providing service to formerly neglected peri-urban areas.

*In most African cities, MSW is disposed of near the perimeter of the city, within easy reach of vehicles and collection crews.*

Street sweeping is also performed by municipal public works staff. Sweeping is most commonly performed manually. In some cities, the streets are swept at dawn prior to the opening of the market place and commercial centre and prior to the first pass of the MSW collection service. In other cities, sweeping occurs at dusk, with the closing of the market place and commercial centre. The debris is deposited into public waste receptacles along the street and outside the market place. This waste is then removed later for disposal. Waste collection generally occurs at dawn before the commercial centres open and at dusk after these centres have closed for the day. Waste collection from market places and commercial centres tend to be made in the evening while waste collection from residential areas and of street sweepings is made at dawn.

In the case of markets with stalls assigned to individual vendors, the vendor generally is assigned the responsibility for sweeping his/her stall and placing the debris at the kerb. Municipal street sweepers then clean these common areas and set out the waste for pick up by the collection vehicle.

Transfer stations are not common in MSWM in African cities. One such facility, operated by the City of Abidjan, Côte d'Ivoire, is no longer functional. In almost all cases, the point of disposal of the MSW is located on the perimeter of the city, within easy reach of vehicles and collection crews. The collection vehicles generally have a capacity between 6 and 7 m<sup>3</sup> and go directly from their point of last pickup to the disposal site.

The lack of reliable collection service undoubtedly takes a toll on the public health and aesthetics of African cities. As the urban share of the population grows on the continent this problem is likely to increase. Collection is a key link in the chain of MSWM from the point of generation to ultimate disposal. In any initiative to upgrade waste management service, sustainable, contextually appropriate collection should be a major focus of attention.

## B1. INFORMATION Sources in Africa on Topic b, Collection and Transfer:

- Accra Metropolitan Assembly (AMA) - Ghana
- AFSHP - Mauritania
- Alexandria University, Dept. Civil/Environmental Engineering-Egypt
- ALPHALOG - Mali
- Associated Environmental NGOs, Cape Recycling Network - South Africa
- Blantyre City Council - Malawi
- Bulawayo City Council - Zimbabwe
- Cairo University, Dept. Civil Eng. - Egypt
- Center for Refuse Treatment (CRT) - Benin
- Centre Régional pour l'Eau Potable et l'Assainissement (CREPA) - Burkina Faso
- Council for Human Ecology-Kenya (CHEK) - Kenya
- EarthLife Africa (ELA) - South Africa
- École Mohammadia des Ingenieurs, Section Génie de l'Environnement - Morocco
- École Nationale Polytechnique - Civil/Environmental Engineering - Algeria
- ENDA/TM - RUPA Participatory Urban Management Program - Senegal
- Environmental Council of Zambia (ECZ) - Zambia
- Environmental Justice Networking Forum (EJNF) - South Africa
- Federal Environmental Protection Agency (FEPA) - Nigeria
- FOCARFE - Cameroon
- Industrial Environmental Forum of Southern Africa (IEFSA) - South Africa
- Institut Africain de Gestion Urbain (IAGU) - Senegal
- Institute of Waste Management (South Africa)
- International Association on Water Quality (IAWQ) - Regional
- Kenyatta University, Dept. Environmental Sciences - Kenya
- Lilongwe City Council - Malawi
- Maseru City Council - Health & Environment Division - Lesotho
- Ministère de l'Envi Maseru City Council - Health & Environment Division - Lesotho
- l'Environnement et de l'Amenagement du Territoire - Tunisia
- Ministry of Natural Resources & Environmental Affairs - Malawi
- Moi University, School of Environmental Sciences - Kenya
- National Environmental Management Council, Environmental Information Centre - Tanzania
- Nigerian Environmental Study Group (NEST) - Nigeria
- Nigerian Society of Engineers (NSE) - Nigeria
- Projet Assainissement et Protection de l'Environnement (PrAPE) - Benin
- South Africa Municipal Workers Union (SAMWU) - South Africa
- UNEP-INFOTERRA - Regional
- Universidade Agostinho Neto - Faculty of Engineering - Angola
- Université des Sciences/Technologie Houari Boumediene - Civil Engineering - Algeria
- Université Nationale du Benin, Faculty of Health Sciences - Benin
- University of Botswana, Dept. of Environmental Sciences - Botswana
- University of Khartoum, School of Public Health & Environmental Hygiene - Sudan
- University of Liberia Library - Liberia
- University of Nairobi, Housing Research & Development Centre - Kenya

## C. Topic c: Composting

Two industrial composting plants operated in Dakar, Senegal and Abidjan, Côte d'Ivoire during the 1970s. These were financially unsuccessful, plagued by mechanical problems, and ultimately closed. Urban demand for compost has not been established. Additionally, the technology works better with a well segregated MSW stream. Yard waste may provide a suitable candidate for composting. However, this is likely to be a labour-intensive venture with unproven commercial viability.

In the suburbs of larger South African cities such as Durban, Johannesburg, and Pretoria, there are community composting centres. Residents drop off their garden waste and it is composted and resold for household-sized gardens. In peri-urban areas throughout Africa, NGOs, community based organizations, and economic interest enterprises also promote composting of MSW. These projects are generally highly labour-intensive with a low capital investment. The compost produced is largely for self-consumption or for sale to households or businesses such as hotels in the city. In Brazzaville (Congo), peri-urban farmers practice small-scale composting, applying the compost to their fields. There are operating composting systems in Benin and Cameroon.

Anaerobic digestion and the recovery of methane are also promoted by several NGOs such as the Biomass Users Network (BUN) in Zimbabwe. However, these systems primarily target rural, agricultural areas and focus on the use of animal wastes rather than MSW.

Overall, even though the organic content of the MSW in the typical African city may exceed 70% (wet basis), centralised composting, anaerobic digestion, and gas recovery are not significant components of African MSWM practice. Further investigation of their market potential may prove this to be an overlooked opportunity.

Backyard composting is limited. Some NGOs promote the practice in Benin, Cameroon, Egypt, Ghana, Kenya, Nigeria, South Africa, and Zimbabwe but the practice does not have a significant impact on MSWM at the city level. This may be a large forgone opportunity if the typical African waste stream is high in organic material with potentially high yields of compost.

### C1. INFORMATION Sources in Africa on Topic c, Composting:

- Accra Metropolitan Assembly (AMA) - Ghana
- Alexandria University, Dept. Civil/Environmental Engineering-Egypt
- ALPHALOG - Mali
- Associated Environmental NGOs, Cape Recycling Network - South Africa
- Cairo University, Dept. Civil Eng. - Egypt
- Center for Refuse Treatment (CRT) - Benin
- Centre Recherche Technologie Appliquée (INFOCITA) - Guinea Bissau
- Centre Régional pour l'Eau Potable et l'Assainissement (CREPA) - Burkina Faso
- Department of Energy (DoE) - Lesotho
- École Mohammadia des Ingenieurs, Section Génie de l'Environnement - Morocco
- École Nationale Supérieure Universitaire de Technologie (ENSUT) - Senegal
- École Nationale Polytechnique - Civil/Environmental Engineering - Algeria
- Environmental Council of Zambia (ECZ) - Zambia
- Federal Environmental Protection Agency (FEPA) - Nigeria
- FOCARFE - Cameroon
- Industrial Environmental Forum of Southern Africa (IEFSA) - South Africa
- Institut Africain de Gestion Urbain (IAGU) - Senegal

- Institute of Waste Management (South Africa)
- International Association on Water Quality (IAWQ) - Regional
- Makerere University, Dept. of Women's Studies (DWS) - Uganda
- Ministry of Natural Resources & Environmental Affairs - Malawi
- National Environmental Management Council, Environmental Information Centre - Tanzania
- National Research Center - Egypt
- UN Centre for Human Settlements (HABITAT) - Kenya
- UNEP-INFOTERRA - Regional
- Universidade Agostinho Neto - Faculty of Engineering - Angola
- University of Botswana, Dept. of Environmental Sciences - Botswana
- University of Liberia Library - Liberia
- University of Malawi, Chancellor College - Malawi
- University of Mauritius- Regional Compost Network (includes Botswana, Kenya, Mauritius, Reunion, South Africa and Zimbabwe)

#### **D. Topic d: Incineration**

Incineration and waste-to-energy (WTE) remain little used options for MSWM in Africa. One energy recovery plant was constructed in Tanzania with foreign assistance. Local capacity to sustain safe and efficient operations at such facilities is a key consideration in weighing the appropriateness of this technology for African cities. These considerations include local technical capacity to maintain and service the facility, the availability of basic spare parts, the scheduled replacement of pollution control equipment, and the effective implementation of a monitoring program to protect public health from plant emissions. The Senegalese have conducted research into the production of refuse-derived fuel (RDF). However, implementation of this system faces the same considerations listed above for incinerator technology in general. The high cost of pre-processing RDF poses an additional obstacle to its safe and cost-effective implementation in Africa.

*High costs, limited infrastructure, and the composition of the waste stream suggest that incineration is an inappropriate technology for most African cities.*

There are medical waste incinerators in some countries in the Region. These are present, for example, in the major hospitals of cities in South Africa. Some relatively simple, low-cost, and low-technology combustion units have been installed in some rural areas in Africa. Unfortunately, these units lack the basic equipment for the control of air emissions. However, across most of Africa, many such facilities have no environmental controls and often comprise nothing more than combustion of medical and chemical wastes in an oven or open pit.

High capital and operating costs make incineration and WTE inaccessible technologies for most African cities. Another limiting factor is the lack of infrastructure to support this technology. This includes human and mechanical resources as well as institutional controls. Furthermore, incineration in Africa would be very difficult to put into practice if the waste stream is indeed 70% (wet basis) putrescible organic content. Under these conditions, incineration is likely to be an energy-consuming rather than energy-producing option. Characterization of the MSW stream would first be necessary to establish the feasibility of incineration and WTE from MSW in Africa. To date, such city-specific information is largely unavailable for African cities.

In summary, incineration and WTE presently do not play significant roles in MSWM in Africa. High costs relative to other MSWM options, a limited infrastructure of human, mechanical, and



institutional resources, and the composition of the waste stream, suggest that incineration is an inappropriate technology for Africa now and for the foreseeable future.

D1. INFORMATION Sources in Africa on Topic d, Incineration:

- Alexandria University, Dept. Civil/Environmental Engineering-Egypt
- ALPHALOG - Mali
- Associated Environmental NGOs, Cape Recycling Network - South Africa
- Cairo University, Dept. Civil Eng. - Egypt
- Centre Recherche Technologie Appliquée (INFOCITA) - Guinea Bissau
- Council for Human Ecology-Kenya (CHEK) - Kenya
- École Mohammadia des Ingenieurs, Section Génie de l'Environnement - Morocco
- École Nationale Polytechnique - Civil/Environmental Engineering - Algeria
- Ècole Polytechnique de Thies (EPT) - Senegal
- Environmental Justice Networking Forum (EJNF) - South Africa
- Federal Environmental Protection Agency (FEPA) - Nigeria
- Industrial Environmental Forum of Southern Africa (IEFSA) - South Africa
- International Association on Water Quality (IAWQ) - Regional
- Ministry of Natural Resources & Environmental Affairs - Malawi
- National Environmental Management Council, Environmental Information Centre - Tanzania
- UNEP-INFOTERRA - Regional
- Université Nationale du Benin, Faculty of Health Sciences - Benin
- University of Botswana, Dept. of Environmental Sciences - Botswana
- University of Liberia Library - Liberia

### **E. Topic e: Landfills**

The overwhelming majority of landfills in Africa are open dumps. These facilities are generally located at the perimeter of major urban centres in open lots, wetland areas, or next to surface water sources. Though many municipalities have statutory requirements for the construction and maintenance of landfills these are generally not enforced. In most instances, the landfills are owned and operated by the same public agency that is charged with enforcing the standards. Often a lack of financial and human resources, coupled with absent enabling policies, limit the extent to which landfills can be built, operated, and maintained at minimum standards for sanitary practice.

Thus, landfills are generally sited based on considerations of access to collection vehicles rather than hydrological, geological, or public health considerations. This practice ranges from cities in the more arid regions of the North such as Algeria, Libya, and Sudan to those in higher rainfall central countries such as Cameroon and Zaire. The environmental and health consequences for water sources at risk are more significant for the latter cities than for the former.

At existing landfills, management operations are minimal. Most of these facilities are unlined and unfenced. Operating practice generally does not include compaction or the application of daily cover. This may reflect the absence of appropriate equipment or other resources to carry out these practices. Additionally, large numbers of scavengers may scour the disposal sites for materials of economic or personal value. The returns from the sale of these materials go to the scavengers, and not to the agency operating the facility.

During the last few years, some countries, including Egypt and South Africa, have considered and developed policy changes to promote upgraded landfills for their major cities. These facilities would be classified according to the type of waste they receive, their manner of construction, and their operating procedure. Tunisia has shown leadership in developing a nationwide sanitary landfill program. New guidelines for the construction and operation of landfills were issued in South Africa in 1995. The Environmental Council of Zambia also considers linking improved landfilling to upgraded MSW collection services in its 1995 solid waste plan.

*Most disposal sites in Africa simply are open dumps, some of which are situated in ecologically sensitive areas. Recently, however, some countries have moved toward improved landfill practice.*

Ocean dumping of MSW is banned or restricted by law in most of Africa. This is largely a consequence of restrictions on ocean dumping initially related to hazardous waste under the Lomé (iv) and Bamako Conventions, as well as the London Dumping Convention of 1972. Even though the practice is largely prohibited across Africa, it still occurs to a significant extent in larger coastal cities. Ocean dumping of sewage sludge beyond the 12-mile limit is still practiced. However, in most of coastal West Africa as well as in South Africa, policy changes are under way to phase out this practice.

In summary, landfills in Africa are primarily open dumps without leachate or gas management systems. Several disposal sites are located in ecologically or hydrologically sensitive areas. The landfills are generally operated below the standards of sanitary practice. Scavengers remove materials of economic value for recycling without a fee to the facility owner and operator. Operation and maintenance costs are provided from municipal budget allocations and often do not cover the full amount needed. The result is substandard and unsafe facilities that pose public health risks and aesthetic burdens to the citizens they are meant to serve. Though the standards of modern sanitary landfills with leachate and gas recovery may be too expensive for most African cities today (they are even too expensive for many municipalities in Organization for Economic Co-operation and Development (OECD) countries), sound practice in current operations and in the design and siting of new facilities can reduce the risks posed by existing facilities.

#### E1. INFORMATION Sources in Africa on Topic e, Landfills:

- Accra Metropolitan Assembly (AMA) - Ghana
- Alexandria University, Dept. Civil/Environmental Engineering-Egypt
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- Blantyre City Council - Malawi
- Bulawayo City Council - Zimbabwe
- Cairo University, Dept. Civil Eng. - Egypt
- Centre Recherche Technologie Appliquée (INFOCITA) - Guinea Bissau
- Direction de l'Hygiène du Milieu et de la Protection de l'Environnement - Tunisia
- EarthLife Africa (ELA) - South Africa
- École Mohammadia des Ingenieurs, Section Génie de l'Environnement - Morocco
- École Nationale Polytechnique - Civil/Environmental Engineering - Algeria
- Environmental Council of Zambia (ECZ) - Zambia
- Environmental Justice Networking Forum (EJNF) - South Africa
- Federal Environmental Protection Agency (FEPA) - Nigeria
- Industrial Environmental Forum of Southern Africa (IEFSA) - South Africa
- Institut Africain de Gestion Urbain (IAGU) - Senegal
- Institute of Waste Management (South Africa)

- International Association on Water Quality (IAWQ) - Regional
- Kenyatta University, Dept. Environmental Sciences - Kenya
- Lilongwe City Council - Malawi
- Makerere University, Dept. of Women's Studies (DWS) - Uganda
- Maseru City Council - Health & Environment Division - Lesotho
- Mauritius University, Division of Environmental Sciences - Mauritius
- Ministère de l'Environnement et de l'Aménagement du Territoire - Tunisia
- Ministry de la Santé Projet Onchochercose, Kankan - Guinea
- Ministry of Natural Resources & Environmental Affairs - Malawi
- Moi University, School of Environmental Sciences - Kenya
- National Environmental Secretariat (NES) - Lesotho
- National Environmental Management Council, Environmental Information Centre - Tanzania
- National Research Center - Egypt
- Nigerian Environmental Study Group (NEST) - Nigeria
- Nigerian Society of Engineers (NSE) - Nigeria
- South Africa Municipal Workers Union (SAMWU) - South Africa
- UNEP-INFOTERRA - Regional
- Université des Sciences/Technologie Houari Boumedienne - Civil Engineering - Algeria
- Université Nationale du Benin, Faculty of Health Sciences - Benin
- University Cape Coast, Dept. Chemistry - Ghana
- University Cape Town, Dept. Environmental & Geographical Sciences - South Africa
- University of Botswana, Dept. of Environmental Sciences - Botswana
- University of Khartoum, School of Public Health & Environmental Hygiene - Sudan
- University of Liberia Library - Liberia
- University of Nairobi, Housing Research & Development Centre - Kenya
- University of Zimbabwe, Dept. of Geography - Zimbabwe

## **F. Topic f: Special Wastes**

For the most part in Africa, services are not available for the separate handling of special wastes such as household hazardous waste (HHW paints, solvents, consumer batteries, etc.), construction and demolition debris (C&D), medical and infectious waste (MIW), tires, sewage sludge, or chemical and pharmaceutical wastes. The predominant practice is to collect these items along with the rest of the waste stream and co-dispose of them at the same open dumps used for regular MSW.

For other special wastes, some items are recycled. Automobile lead-acid batteries are recycled at a rate approaching 100% where there are available battery refurbishers and lead-smelting plants. Their continent-wide rate of recycling is not known. Tires are recycled as retreads, for use on carts, or to make shoes and other domestic articles. The significance of recycling for these purposes on the overall tire recycling rate is unknown. Used oil is recycled as an industrial lubricant or fuel in many countries. In South Africa, a deposit system has been proposed to increase the rate of oil recycling. In addition, the privately funded Rose Foundation promotes the recycling of used oil across the country. A factory for the regeneration of used oil operated in Dakar, Senegal during the 1980s but proved to be an uneconomical venture. C&D is recycled as backfill at new construction sites, for the reclamation of wetlands, and for the filling of low-lying areas subject to regular flooding. Wood, nails, bricks, and other materials of direct use are also reclaimed from C&D for use in other construction projects. The rate of recycling of C&D has not been established continent-wide.

*Most special wastes are disposed of in open dumps along with regular MSW. In some cases, however, particular types of special wastes are recycled.*

Many cities use septic tank or soak-away systems for municipal sewage, particularly in residential areas. Commodes are linked directly to the septic tank. Soak-aways drain all other wastewater from the buildings. In low-density residential areas, these drains are used to irrigate garden plots. In commercial centres or in high-density residential areas, they are connected to the municipal drainage system. This either leads to the municipal water treatment works, if available, or discharge into a nearby body of surface water.

In some cities, such as Dakar and the major cities of South Africa, wastewater treatment plants provide secondary treatment of industrial and municipal wastewaters. The sludge from these facilities is generally disposed of in open lots, which often serve as dumps for MSW. As with many equipment-intensive MSWM services in Africa, enabling policy, human resources, costs, and hardware are the main operational constraints to effective sludge management.

Accra had a co-composting system using treated human waste sludge and solid waste. The sale price of the compost covered the system cost. Initial equipment and technical assistance were provided by the German agency, GTZ-GATE. With the help of a World Bank urban project covering integrated human waste treatment and sanitary landfills, Accra's co-composting system may be adopted by other Ghanaian cities over the next few years.

As mentioned earlier, some medical and infectious waste is disposed of by combustion. It is difficult to say what proportion of this waste stream is treated in this manner. In some cities, portions of the MIW stream are buried in facilities that are separate from the MSW dump. Where MIW is neither buried nor burnt, it is generally disposed of in the city dump, next to the rest of the undifferentiated MSW stream.

In summary, separate arrangements are generally not available for special wastes. They are largely co-disposed in open dumps with regular MSW. Those materials with economic value are recycled both before and after entering the waste stream. These include car batteries and tires as respective examples. Some MIW is destroyed by combustion and some is buried. The exact proportions are unknown. C&D is used in land reclamation for new construction. Though official development aid has financed the construction of some wastewater treatment facilities, the sludge from these, as with most other sewage sludge, is disposed in open dumps along with the regular MSW. Accra provides an example of a successful human waste and MSW co-composting system.

#### F1. INFORMATION Sources in Africa on Topic f, Special Wastes:

- Accra Metropolitan Assembly (AMA) - Ghana
- Alexandria University, Dept. Civil/Environmental Engineering-Egypt
- Associated Environmental NGOs, Cape Recycling Network - South Africa
- Cairo University, Dept. Civil Eng. - Egypt
- Centre Recherche Technologie Appliquée (INFOCITA) - Guinea Bissau
- Council for Human Ecology-Kenya (CHEK) - Kenya
- EarthLife Africa (ELA) - South Africa
- École Mohammadia des Ingenieurs, Section Génie de l'Environnement - Morocco
- École Nationale Polytechnique - Civil/Environmental Engineering - Algeria
- Environmental Council of Zambia (ECZ) - Zambia
- Environmental Justice Networking Forum (EJNF) - South Africa

- Environmental Protection Council (EPC) - Ghana
- Federal Environmental Protection Agency (FEPA) - Nigeria
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- Makerere University, Dept. of Women's Studies (DWS) - Uganda
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- Ministry of Natural Resources & Environmental Affairs - Malawi
- Moi University, School of Environmental Sciences - Kenya
- National Environmental Management Council, Environmental Information Centre - Tanzania
- National Research Center - Egypt
- Nigerian Environmental Study Group (NEST) - Nigeria
- South Africa Municipal Workers Union (SAMWU) - South Africa
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- Université des Sciences/Technologie Houari Boumedienne - Civil Engineering - Algeria
- Université Nationale du Benin, Faculty of Health Sciences - Benin
- University Cape Coast, Dept. Chemistry - Ghana
- University of Botswana, Dept. of Environmental Sciences - Botswana
- University of Khartoum, School of Public Health & Environmental Hygiene - Sudan
- University of Liberia Library - Liberia

### **G. Topic g: Waste Characterization**

Waste characterization data specific to African cities are not generally available, though some regional evaluations have been made. Additionally, the income level of the generators has been shown to be correlated with the generation rate and composition of the MSW stream. This correlation has been established in case studies of cities in OECD countries and on the basis of GNP for countries as a whole. Such regional and global-level statistics may be the most reliable bases available for inferences about the characteristics of the MSW stream in Africa.

As cities consider upgrading their MSWM systems with international aid, system-specific characterization data assume a greater importance. As-delivered (wet basis) MSW from Accra, Ibadan, Dakar, Abidjan, and Lusaka shows a range of per capita generation rates of 0.5 to 0.8 kg per day (compared to 1 to 2 kg per person per day in the OECD); putrescible organic content ranging from 35% to 80% (generally toward the higher end of this range); plastic, glass, and metals at less than 10%; and paper with a percentage in the low teens. The bulk density and calorific value of the waste stream are also common statistics of interest in MSW waste characterization. Bulk densities in the range of 90 to 180 kg/m<sup>3</sup> for uncompacted MSW are common in OECD case studies. MSW with a high moisture content, such as putrescible organic matter or MSW in areas of high precipitation, can have densities that are twice to three times these values. Thus, densities in Africa may be expected to fall in the range of 180 to 540 kg/m<sup>3</sup>. Compacted MSW, as delivered by collection vehicles with mechanical compactors, can have

densities in the range of 180 to 420 kg/m<sup>3</sup>, depending on the composition of the waste and the type of compacting equipment. Calorific values are reported to be low.

To the extent that these data can be generalised, they indicate a waste stream of limited potential commercial value for the recovery of metals, glass, plastic, and paper. However, though the per capita generation rates of these materials are relatively low, they may be present in sufficient quantities in the MSW streams of densely populated cities to warrant labour-intensive recovery ventures. As noted earlier, the high organic content suggests possible value as composting material. However, the viability of these schemes is likely to depend highly on end markets for their products. The calorific values reported make the waste stream unsuitable for energy recovery via incineration.

In summary, although waste characterization is a key component in any MSWM scheme, such data are not commonly compiled in cities across Africa. This may change as cities upgrade their MSWM systems. The limited available data suggest that the MSW stream in the typical African city at point of disposal is high in putrescible organic matter. However, it is low in percentage of commercially recyclable components and too low in heating value for energy recovery by incineration.

#### G1. INFORMATION Sources in Africa on Topic g, Waste Characterization:

- Accra Metropolitan Assembly (AMA) - Ghana
- Alexandria University, Dept. Civil/Environmental Engineering-Egypt
- Associated Environmental NGOs, Cape Recycling Network - South Africa
- Blantyre City Council - Malawi
- Cairo University, Dept. Civil Eng. - Egypt
- Centre Recherche Technologie Appliquée (INFOCITA) - Guinea Bissau
- École Mohammadia des Ingenieurs, Section Génie de l'Environnement - Morocco
- École Nationale des Ingenieurs de Tunisie - Tunisia
- École Nationale Polytechnique - Civil/Environmental Engineering - Algeria
- École Polytechnique de Thies (EPT) - Senegal
- Environmental Council of Zambia (ECZ) - Zambia
- Federal Environmental Protection Agency (FEPA) - Nigeria
- Industrial Environmental Forum of Southern Africa (IEFSA) - South Africa
- Institut Africain de Gestion Urbain (IAGU) - Senegal
- Institute of Waste Management (South Africa)
- International Association on Water Quality (IAWQ) - Regional
- Lilongwe City Council - Malawi
- Ministère de l'Environnement et de l'Amenagement du Territoire - Tunisia
- Ministry for Coordination of Environmental Affairs (MICOA) - Mozambique
- Ministry of Natural Resources & Environmental Affairs - Malawi
- National Environmental Management Council, Environmental Information Centre - Tanzania
- Projet Assainissement et Protection de l'Environnement (PrAPE) - Benin
- UNEP-INFOTERRA - Regional
- Universidade Agostinho Neto, Faculty of Engineering - Angola
- Université des Sciences/Technologie Houari Boumedienne - Civil Engineering - Algeria
- Université Nationale du Benin, Faculty of Health Sciences - Benin
- University Cape Town, Dept. Environmental & Geographical Sciences - South Africa
- University of Botswana, Dept. of Environmental Sciences - Botswana

- University of Liberia Library - Liberia

## **H. Topic h: Management and Planning**

Administration of MSWM systems takes many different organizational forms across the continent. However, the institutional arrangements are fairly consistent across countries. Generally, administration is relayed through three layers of responsibility.

*Government ministries in charge of MSWM often have other responsibilities that are considered more important. Given budget constraints and limited staff, MSWM may not receive due attention or financial allocation from the ministerial level.*

At the highest level is the Ministry of Environment or its equivalent. In some countries, responsibility for MSWM rests with the Ministry of Health or the Ministry of Planning and Development. The ministry is generally responsible for overseeing MSWM across the country. It controls the allocations for MSW capital investments by city municipal waste authorities. In many cases, this ministry is charged with setting standards for MSWM based on laws enacted by the legislature. It is also through this ministry that international cooperation in MSWM is effected.

Often, the central government ministry, such as the Ministry of Environment, is charged with other responsibilities like tourism, wildlife conservation, and land and/or water resources management. These responsibilities generally carry a higher national priority than MSWM, since they often directly generate income. When combined with limited staff and budget constraints, MSWM may not receive due attention or financial allocation from the ministerial level.

Besides the ministries, other national environmental agencies share oversight for MSWM. The Federal Environmental Protection Agency of Nigeria and the Environmental Council of Zambia are two such examples.

Under the national ministry are the various municipal agencies responsible for planning and urban affairs in the country's major cities. These generally take the form of district governates, such as the Governate of Cairo, the Communauté Urbaine in Dakar, the Gouvernorat de District in Bamako, and the municipal governments in Ibadan, Accra, and Harare. The planning and design of MSWM services is carried out by these agencies. They receive their annual operating budget from the central ministry and generally do not charge a fee for their services. They are generally not empowered to levy taxes. There are some notable exceptions. For example, in Accra, Ghana, the solid waste department is authorised to raise and retain revenues through direct user charges. In Conakry, Guinea and Lagos, Nigeria, municipal agencies raise revenue through direct user fees.

The municipal agency is also charged with implementing the MSWM plan in its respective city. Thus, in collaboration with the central ministry or national environmental agency, it constructs the necessary facilities, purchases the required equipment, and hires the necessary staff to operate and maintain the system. Because such agencies are generally restricted from retaining any revenue they raise independently, the scope of their operations is limited by the budget they receive from the central treasury or general municipal funds. This budget may not often match the needs of the MSWM agency. As a result, necessary MSW services and operations are compromised.

The actual execution of day-to-day MSWM operations is carried out by a combination of official municipal workers and contractors from the private sector. The contractors provide collection

services for a fee. In Cairo, the Zabbaleen operate as a cooperative and use trucks, plastics pelletizers, and rag pullers in their collection and recycling operations. In Côte d'Ivoire, Ghana, South Africa, and Tanzania, initiatives are underway for private operators to provide MSW collection in all or parts of their major cities. Cooperatives and community groups may also be involved in collection, recycling and composting of MSW. For example, in Cotonou, Benin, community groups participate in the collection process under contracts with the municipal agency.

In several cases, the Ministry of Environment shares responsibility for MSW administration with the Ministry of Health and the Ministry of Public Works. However, performance and compliance monitoring as well as enforcement of regulations are still not routinely conducted. This adversely affects system performance.

Several of the major cities in South Africa have organised MSWM systems in place. These are run by municipal agencies with clear mandates of administrative responsibility. Additionally, these systems are supported by and accountable to academic institutions and professional organizations active in the field of solid waste management. There are privately owned landfills in South Africa. Many are associated with industrial and hazardous waste. However, a few are owned by private collection services. In general, however, private ownership and/or operation of MSWM facilities are rare in Africa.

In summary, administration is one of the major weaknesses of MSWM systems in Africa. Limited funding and restrictions on raising or directly accessing user fee revenues is another. Any plans to upgrade MSWM at the country level would do well to first focus on the administrative and organizational systems on which the service ultimately depends. Provisions must also be made for public feedback and for input from related professional organizations in the planning, evaluation, and upgrading of the system. Cost recovery by municipalities through retained user fees and taxes has shown promise in several cities. Private enterprise may play a role in vastly improving MSWM services in Africa. In many cases improvements may be obtained with high-labour, low-capital alternatives and enabling administrative changes. Cooperatives and community organizations may also play a role in providing MSWM services, from primary collection to recycling and composting.

#### H1. INFORMATION Sources in Africa on Topic h, Management and Planning:

- Accra Metropolitan Assembly (AMA) - Ghana
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- Environmental Council of Zambia (ECZ) - Zambia
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- Institut Africain de Gestion Urbain (IAGU) - Senegal
- Institute of Waste Management (South Africa)
- International Association on Water Quality (IAWQ) - Regional
- Kenyatta University, Dept. Environmental Sciences - Kenya
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- National Environmental Management Council, Environmental Information Centre - Tanzania
- National Research Center - Egypt
- Nigerian Environmental Study Group (NEST) - Nigeria
- Nigerian Institute of Social & Economic Research (NISER) - Nigeria
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- Regional Water & Sanitation Group/West & Central Africa (RWSG/WCA) - Ivory Coast
- UN Centre for Human Settlements (HABITAT) - Kenya
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- University of Liberia Library - Liberia
- University of Nairobi, Housing Research & Development Centre - Kenya
- University of Zimbabwe, Dept. of Geography - Zimbabwe

## **I. Topic i: Training**

Various academic departments at universities across Africa provide training in the engineering principles of MSWM. In addition, most countries have sufficient resident personnel to develop and manage effective MSWM systems that are appropriate for local conditions and resources. These can be enhanced as the pool of human and other resources grows with time. However, the evolution of MSWM systems requires an enabling policy and administrative environment to be successful. Thus, in connection with MSWM in Africa, training and human resource development are subordinate issues to institutional and organizational change and to appropriate infrastructure development.

*Several universities in Africa provide training in the principles of MSWM. However, organizational and infrastructural changes are needed before a corps of trained people can bring about significant improvements in MSWM.*

Training and human resource development generally focuses on the training of process and operations personnel. For example, drivers may be trained to operate a new compactor truck or other piece of equipment donated by an international aid agency. However, to be sustainable, such education would need to be supplemented by training of support staff in the maintenance and repair of this equipment. Landfill staff, where available, may be trained in the daily operations of spreading and covering the cells. However, equipment failures or the practice of open scavenging may quickly render such training ineffective.

NGOs active in MSWM train waste handlers from the informal sector in the safe handling of MSW for pre-collection, sorting for recycling, and composting. The Cape Recycling Network of South Africa is a good example of an NGO involved in MSW training and awareness for members of community organizations. Among the issues addressed by the South Africa Municipal Workers Union (SAMWU) are safety and health issues affecting municipal waste handlers.

The Biology Department of Bunda College of Agriculture trains students and community groups in the practice of composting. Several other national universities across Africa provide curricular training to undergraduates in MSW-related fields.

The Environmental Council of Zambia promotes periodic public information campaigns on the safe handling of MSW. The health department also trains sanitation workers responsible for monitoring sanitary conditions at the landfill. Other health ministries across Africa also provide similar training for municipal health workers on the MSW detail. In addition, the sanitation or public works departments of major municipal governments often provide some period of probationary training for their new workers. This includes MSW collection truck crews as well as manual and supervisory staff at the landfill.

In summary, training and human resource development for MSWM may be broken into three main areas of need. First, ground-level process, operations, and maintenance personnel require occupational training targeted to the duties to which they are assigned and will be held accountable for. Next, supervisors and mid-level managers require the necessary education and experience to prepare them for the job of managing people, equipment, time, and money in the provision of MSWM services. Finally, system managers should be assigned to the planning and implementation of MSWM systems on the basis of their expertise in the area. MSWM in Africa rests largely in the hands of government agencies. It is from this source that the main thrust of training and human resource development is likely to be most effective.

#### II. INFORMATION Sources in Africa on Topic i, Training:

- Alexandria University, Dept. Civil/Environmental Engineering-Egypt
- Cairo University, Dept. Civil Eng. - Egypt
- École Mohammadia des Ingenieurs, Section Génie de l'Environnement - Morocco
- École Nationale des Ingenieurs de Tunisie - Tunisia
- École Nationale Polytechnique - Civil/Environmental Engineering - Algeria
- ENDA/TM - RUPA Participatory Urban Management Program - Senegal
- Federal Environmental Protection Agency (FEPA) - Nigeria
- FOCARFE - Cameroon
- Institut Africain de Gestion Urbain (IAGU) - Senegal
- Institute of Waste Management (South Africa)
- International Association on Water Quality (IAWQ) - Regional
- Kenyatta University, Dept. Environmental Sciences - Kenya
- Makerere University, Dept. of Women's Studies (DWS) - Uganda
- Mauritius University, Division of Environmental Sciences - Mauritius
- Ministry for Coordination of Environmental Affairs (MICOA) - Mozambique
- Ministry of Natural Resources & Environmental Affairs - Malawi
- Moi University, School of Environmental Sciences - Kenya
- National Environmental Management Council, Environmental Information Centre - Tanzania
- Projet Assainissement et Protection de l'Environnement (PrAPE) - Benin

- UNEP-INFOTERRA - Regional
- Universidade Agostinho Neto, Faculty of Engineering - Angola
- Université des Sciences/Technologie Houari Boumedienne - Civil Engineering - Algeria
- Université Nationale du Benin, Faculty of Health Sciences - Benin
- University Cape Coast, Dept. Chemistry - Ghana
- University Cape Town, Dept. Environmental & Geographical Sciences - South Africa
- University of Botswana, Dept. of Environmental Sciences - Botswana
- University of Khartoum, School of Public Health & Environmental Hygiene - Sudan
- University of Liberia Library - Liberia
- University of Malawi, Chancellor College - Malawi
- University of Nairobi, Housing Research & Development Centre - Kenya

## **J. Topic j: Public Education**

Until the late 1980s, solid waste management policies and programs in most African cities were formulated and implemented by government agencies without significant public participation. Political and social changes across the continent, including the growth of NGOs, have fostered an increased awareness of environmental issues among the public. Urban populations have become more involved in the issues surrounding MSW. Resistance to the construction of MSW incinerators in countries like Côte d'Ivoire, Senegal, and South Africa reflects an emerging involvement of the public in the debate and policy formation process of MSWM.

The key to changing MSWM practice at the consumer level is to make the distinction between public awareness and public education. An informed public can do much to improve the effectiveness of municipal waste management programs. Public agencies engage in this education primarily through initiatives based in the departments of health and education. School children are given instruction in sanitation, which includes reference to the safe handling of human and household wastes. Community service organizations, in collaboration with the health department and international health organizations such as the World Health Organization, conduct training seminars on sanitation for women. Included in these seminars are segments on waste handling.

These efforts reach small segments of the urban population. Their impact is too small to produce the widespread change in attitudes needed to increase public participation in MSWM. Broad-based education campaigns would require the initiative of the appropriate MSWM authorities. They could work with the health, education, media, and other related services, as well as with professional organizations, to educate the public about the MSWM system, its programs, and their role in it.

Such initiatives are only feasible in an enabling institutional setting. This requires the assignment of an appropriate priority to MSWM, the presence of an administrative strategy to meet set management goals, and the marshalling of financial and human resources to implement all phases of the program. As examples, successful public education campaigns of some note have been carried out in Bamako, Cairo, Cotonou, Dakar, and Johannesburg. In Nigeria, a nationwide public education campaign was conducted under the banner of sanitation. Some of these programs began in the mid-1980s and continue in operation to the present time. In most cases, they were undertaken by the district government for the municipal area in collaboration with community service organizations, the health department, the education department, and the media. The results of these programs ranged from drastic reductions in indiscriminate dumping to community-based MSW pre-collection and street cleaning.

In short, there are ongoing public education efforts that address MSW issues in the schools and through health extension services. Broad-based initiatives by the agencies responsible for MSWM are sporadic across the continent but have had some level of success in those cities where they have been conducted. An educated public implies an MSWM system that is accountable to its constituents. This is likely to improve the service and performance of the system.

#### J1. INFORMATION Sources in Africa on Topic j, Public Education:

- Associated Environmental NGOs, Cape Recycling Network - South Africa
- Association pour la Protection de la Nature et de l'Environnement (APNE) - Tunisia
- Center for Refuse Treatment (CRT) - Benin
- Centre Recherche Technologie Appliquée (INFOCITA) - Guinea Bissau
- Direction de l'Hygiène du Milieu et de la Protection de l'Environnement - Tunisia
- EarthLife Africa (ELA) - South Africa
- ENDA/TM - RUPA Participatory Urban Management Program - Senegal
- Environmental Council of Zambia (ECZ) - Zambia
- Environmental Protection Council (EPC) - Ghana
- Federal Environmental Protection Agency (FEPA) - Nigeria
- FOCARFE - Cameroon
- Institut Africain de Gestion Urbain (IAGU) - Senegal
- Institute of Waste Management (South Africa)
- International Association on Water Quality (IAWQ) - Regional
- Lilongwe City Council - Malawi
- Makerere University, Dept. of Women's Studies (DWS) - Uganda
- Maseru City Council - Health & Environment Division - Lesotho
- Ministère de l'Environnement et de l'Aménagement du Territoire - Tunisia
- Ministry for Coordination of Environmental Affairs (MICOA) - Mozambique
- Ministry of Natural Resources & Environmental Affairs - Malawi
- Moi University, School of Environmental Sciences - Kenya
- National Environmental Secretariat (NES) - Lesotho
- Projet Assainissement et Protection de l'Environnement (PrAPE) - Benin
- Regional Water & Sanitation Group/West & Central Africa (RWSG/WCA) - Ivory Coast
- South Africa Municipal Workers Union (SAMWU) - South Africa
- UNEP-INFOTERRA - Regional
- Université Nationale du Benin, Faculty of Health Sciences - Benin
- University of Khartoum, School of Public Health & Environmental Hygiene - Sudan
- University of Liberia Library - Liberia
- University of Nairobi, Housing Research & Development Centre - Kenya

#### **K. Topic k: Financing**

In African countries, the central government generally finances MSWM and other municipal activities through taxes collected by the Treasury. Even municipal property taxes and direct taxes on household refuse collection flow to the coffers of the central government. These funds are then allocated across the different central government ministries and to the municipalities. MSWM is then funded by allocations from the responsible ministry for capital projects and special projects (such as public education) and by municipal allocations for operation and maintenance.

Under this system, MSWM is just one of many ministerial and municipal responsibilities. Funding for MSWM reflects the priorities of the responsible ministry and of the municipal

government. It does not accommodate the actual budget required for the MSWM program, projects, and operations. Inadequate funding is often the result.

User fees are based on a flat rate for collection service to households and commercial establishments. Where this service is provided by the private sector it is likely that the fees yield full cost recovery plus a profit for the service provider. In other cases, where the municipality charges a user fee, full cost recovery may not be realised and the service is subsidised by funds from other sources. Examples where municipal user fees are used include Accra; Conakry, Guinea; and some cities in South Africa. In some cases, these revenues are retained by the municipality specifically for their MSWM activities. In others, the funds go into the general municipal pool. Special taxes are also used to raise revenue for MSWM services. In Dakar, an MSW collection tax is imposed by the central government and is collected by the Treasury. In Bamako, a cleansing tax based on property value is levied and direct user fees are also employed in some areas. Direct user charges also prevail where pre-collection services are provided by community organizations. These revenues cover part or all of the costs for community collections though they may not extend to covering the cost of emptying the communal receptacles and disposing of their contents. These latter costs are borne by the municipality. Direct municipal charges appear to be an emerging instrument for cost recovery in African cities. However, the practice is not yet widespread and in general, residents pay via indirect local taxes.

International aid has been provided for studies, projects, and equipment across the continent. Some of the agencies that have participated in such aid are UNCHS (Habitat), UNDP, DANCED and DANIDA of Denmark, GTZ-GATE of Germany, JICA of Japan, NORAD of Norway, SIDA of Sweden, USAID, several European Union programs, and, the World Bank. Aid ranges from little more than studies of the MSWM in specific African cities to funding and technical support. In the area of solid waste management, GTZ-GATE, JICA, and the World Bank provide the most substantial and regionally diverse assistance. Funds and technical support have been provided for program development, such as GTZ-GATE's involvement in changes to the MSW collection system in Accra, Ghana. Collection vehicles are also commonly donated for municipal operations.

In summary, financing options include taxes, user fees, bank financing (for private service providers), and international aid. The central government is the main mechanism by which these options are exploited. The Treasury generally controls the collection of taxes and the flow of funds to municipalities. Direct user fees collected and retained by municipalities are a relatively new instrument for cost recovery in several African cities. These generally provide partial recovery of the MSWM service costs. Direct user charges are also applied by private service providers. It is likely that these cover full costs of the service, which primarily involves collection.

#### K1. INFORMATION Sources in Africa on Topic k, Financing:

- Accra Metropolitan Assembly (AMA) - Ghana
- Alexandria University, Dept. Civil/Environmental Engineering-Egypt
- Associated Environmental NGOs, Cape Recycling Network - South Africa
- Blantyre City Council - Malawi
- Bulawayo City Council - Zimbabwe
- Cairo University, Dept. Civil Eng. - Egypt
- Centre Recherche Technologie Appliquée (INFOCITA) - Guinea Bissau
- Department of Energy (DoE) - Lesotho
- École Mohammadia des Ingenieurs, Section Génie de l'Environnement - Morocco

- École Nationale Polytechnique - Civil/Environmental Engineering - Algeria
- Ècole Polytechnique de Thies (EPT) - Senegal
- Environmental Council of Zambia (ECZ) - Zambia
- Federal Environmental Protection Agency (FEPA) - Nigeria
- Industrial Environmental Forum of Southern Africa (IEFSA) - South Africa
- Institut Africain de Gestion Urbain (IAGU) - Senegal
- Institute of Waste Management (South Africa)
- International Association on Water Quality (IAWQ) - Regional
- Lilongwe City Council - Malawi
- Maseru City Council - Health & Environment Division - Lesotho
- Ministère de l'Environnement et de l'Aménagement du Territoire - Tunisia
- Ministry for Coordination of Environmental Affairs (MICOA) - Mozambique
- Ministry of Natural Resources & Environmental Affairs - Malawi
- National Environmental Management Council, Environmental Information Centre - Tanzania
- Nigerian Environmental Study Group (NEST) - Nigeria
- Nigerian Society of Engineers (NSE) - Nigeria
- PADEULAC - Guinea
- Regional Water & Sanitation Group/West & Central Africa (RWSG/WCA) - Ivory Coast
- UNEP-INFOTERRA - Regional
- Universidade Agostinho Neto - Faculty of Engineering - Angola
- Université des Sciences/Technologie Houari Boumedienne - Civil Engineering - Algeria
- Université Nationale du Benin, Faculty of Health Sciences - Benin
- University Cape Town, Dept. Environmental & Geographical Sciences - South Africa
- University of Botswana, Dept. of Environmental Sciences - Botswana
- University of Liberia Library - Liberia

## **L. Information sources located in Africa**

Note: Because of the large number of countries in Africa and the difficulty of communicating within the region, these sources of information for Africa are listed alphabetically by country, rather than by name of the institution.

Note: UNEP-INFOTERRA, an important international source of information, is listed at the end of this section.

Note: At the end of this section, there are several information sources that apply to the entire region. Additionally, there is a list of relevant ministries from many countries in Africa.

Note: There are information sources about MSW issues in Africa that are located in other regions. These sources often cover several areas of the world, so they are listed in the Source Book under the region where they are located. Notable out-of-region institutions that offer information on MSW in Africa include:

### **Institutions located in Europe**

ISWA (International Solid Waste Association)  
SANDEC/EAWAG  
WASTE, Advisers on Urban Environment and Development  
Water, Engineering and Development Centre (WEDC)  
World Resource Foundation/*Warmer Bulletin*

### **Institutions located in North America**

Canadian International Development Agency  
US Agency for International Development (AID)  
The World Bank

### **Institutions located in South and West Asia**

Centre for Environmental Health Activities (CEHA)

Note: In the following listings “Email” refers to an organisation’s electronic mail address. “Internet” refers most often to an organisation’s site on the World Wide Web, although it can also refer to gopher, ftp, or direct dial-in sites.

#### TOPICS:

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

## L1. ALGERIA

### L1.1. Université des Sciences et de la Technologie Houari Boumedienne - Institute of Civil Engineering

BP 32, El Alia  
Bab Ezzouar, Algiers  
Algeria

**Telephone:** +213-2-75-12-85

**Fax:** +213-2-76-43-11

**Email:**

**Contact:** Chaker Amar, Director

**Topics covered:** a b e f g h i k

**Description:** The University of Science and Technology is a publicly supported institution offering instruction and research in the sciences and engineering. The Institute of Civil Engineering offers undergraduate training in MSWM as an academic track. The program includes a traditional unit operations approach to MSWM from waste generation (and minimisation) to collection, recycling, resource recovery, and landfilling. The University houses an extensive library on related topics and is accessible to students and researchers.

**Format of information:** Books, periodicals, journals, academic reports.

**Internet:** www.siu.no

**Language:** Arabic and French

**Consulting or support services:** None.

**Fees:** At cost.

### L1.2. École Nationale Polytechnique

Dept. of Civil Engineering  
Specialty in Environmental Engineering  
BP 182, Ave. Pasteur  
EI-Harrach, Algiers 10  
Algeria

**Telephone:** +213-2-52-53-01

**Fax:** +213-2-52-29-73

**Email:**

**Contact:**

**Topics covered:** a b c d e f g h i k

**Description:** The National Polytechnic University was founded in 1962. The program in Environmental Engineering provides an offering in MSWM from the unit operations approach.

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Students learn the practice and technologies of collection, incineration, landfilling, recycling, and ancillary operations. The University has a library of volumes on related topics, which is accessible to students and researchers.

**Format of information:** Books, journals, periodicals.

**Internet:** www.enp.edu.dz

**Language:** Arabic, French, and English

**Consulting or support services:**

**Fees:** At cost.

## L2. ANGOLA

### L2.1. Universidade Agostinho Neto, Faculty of Engineering

CP 815, Av. 4 de Fevereiro 7, 2° andar  
Luanda  
Angola

**Telephone:** +244-2-350517

**Fax:** +244-2-330520

**Email:** depinf@diee.fe.uan.ao

**Contact:** Director

**Topics covered:** a b c f g h i k

**Description:** Agostinho Neto University is a publicly funded institution founded in 1963. Its Faculty of Engineering offers a program in MSWM in the Civil Engineering Department. The University carries a library of volumes on related topics that is accessible to students and researchers.

**Format of information:** Books, journals, periodicals.

**Internet:** www.uan.ao

**Language:** Portuguese

**Consulting or support services:** None.

**Fees:** None.

## L3. BENIN

### L3.1. Projet Assainissement et Protection de l'Environnement - PrAPE

PO Box 03-1730

Cotonou

Benin

**Telephone:** +229-32-11-29

**Fax:** +229-32-29-65

#### TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

**Email:** bethesda@intnet.bj  
**Contact:** Raphael Edou, Coordinator

**Topics covered:** a b i j

**Description:** PrAPE is a local organisation working on primary collection and decentralised composting of MSW in one peri-urban zone of Cotonou. The project uses non-conventional technologies (human pushcarts) to collect and convey the garbage to a mini-transfer station where organic components are sorted out and manually and composted. PrAPE has been authorised by the Municipal Authority of Cotonou. PrAPE conducts public education workshops and seminars. It does not maintain documentation but can provide information on this project and on the MSWM system in Benin.

**Format of information:** Manuals, pamphlets.

**Internet:**

**Language:** French

**Consulting or support services:** None.

**Fees:** None.

### **L3.2. Université Nationale du Benin, Faculty of Health Sciences**

Abomey-Calavi, BP 188  
Cotonou  
Benin

**Telephone:** +229-30-25-13

**Fax:** +229-30-40-96

**Email:** fssciuf@intnet.bj

**Contact:** Dean of Health Sciences

**Topics covered:** b e f i j

**Description:** The National University of Benin is a publicly funded institution founded in 1970. It provides undergraduate instruction in sanitation on topics related to MSW. It supports public education campaigns for increased urban sanitation and houses a library of volumes on related material.

**Format of information:** Books, journals, periodicals.

**Internet:**

**Language:** French

**Consulting or support services:** None.

**Fees:** None.

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

## L4. BOTSWANA

### L4.1. University of Botswana, Faculty of Science, Dept. Environmental Sciences

Private UB 00704  
Gaborone  
Botswana

**Telephone:** +267-355-2526  
**Fax:** +267-585-097  
**Email:** envscience@mopipi.ub.bw  
**Contact:** Prof. R.M.K. Silitshena

**Topics covered:** a b c d e f g h i j

**Description:** The University of Botswana is the national university of Botswana. It is publicly funded and was founded in 1976. The Dept. of Environmental Sciences offers instruction in MSWM on materials recovery and the siting and environmental impacts of landfills. The University is associated with the National Institute of Development and Cultural Research, which conducts research on related issues.

**Format of information:** Books, journals, periodicals.

**Internet:** [www.ub.bw/departments/science/environmental\\_mission.html](http://www.ub.bw/departments/science/environmental_mission.html)

**Language:** English

**Consulting or support services:** None.

**Fees:** None.

## L5. BURKINA Faso

### L5.1. Centre Régional pour l'Eau Potable et l'Assainissement - CREPA

PO Box 7112  
Ouagadougou 03  
Burkina Faso

**Telephone:** +226-36-6210  
**Fax:** +226-36-6208  
**Email:** crepa@fasonet.bf  
**Contact:** Director

**Topics covered:** b c

**Description:** CREPA is a regional organisation established under the International Training Network (ITN) of the UNDP/World Bank Water and Sanitation Program. The ITN includes institutions throughout Africa, Latin America, and Asia. CREPA's activities cover 14 francophone countries with focal points in Mali, Côte d'Ivoire, Benin, Burkina Faso, and

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Senegal. CREPA develops and promotes low cost technologies for sanitation in rural and peri-urban areas. CREPA operates under the administrative umbrella of the Inter-States School of Rural Engineering, the Inter-States Centre of Hydraulic Studies, and the Inter-States School of Hydraulic Studies. It supports local organisations in the field of MSW primary collection with non-conventional technologies and in composting (Burkina Faso, Mali, Benin, Côte d'Ivoire, and Senegal). CREPA has a library, which is open to the public. It lists several hundred volumes on sanitation.

**Format of available information:** Books, journals, reports, databases, the journal, *Info-CREPA*

**Internet:** [www.oieau.fr/crepa/organigr.html](http://www.oieau.fr/crepa/organigr.html)

**Language:** French, some English

**Consulting or support services:** Available upon request.

**Fees:** Materials available at cost. Consulting services negotiable.

## L6. CAMEROON

### L6.1. Fondation Camerounaise pour une Action Rationalise des Femmes sur l'Environnement - (FOCARFE)

PO Box 3494  
Yaoundé-Messa  
Cameroon

**Telephone:** +237-23-31-82

**Fax:** +237-22-51-61

**Email:** [focarfe@sdnemr.undp.org](mailto:focarfe@sdnemr.undp.org)

**Contact:** Ndoumbe Honore, Coordinator

**Topics covered:** b c i j

**Description:** FOCARFE is a national NGO specialised in environmental and women's issues. FOCARFE provides primary refuse collection service and runs a decentralised composting unit of organic waste. These activities cover 14 zones of the metropolitan area of Yaounde. FOCARFE has also organised an exhibition of recycled articles from MSW and produced a guidebook and video on MSW composting. FOCARFE provides substantive assistance to women and youth grassroots organisations. FOCARFE has established relationships with the National Institute of Technology (University of Yaounde-Cameroon), the Friedrich Ebert Foundation, the Hans Seidel Foundation, the Netherlands Embassy in Cameroon, UNICEF, several ministerial departments, and bilateral cooperation agencies.

**Format of information:** Manuals, Guidebooks, Videos.

**Internet:**

**Language:** French

**Consulting or support services:** Negotiable.

**Fees:** At cost.

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

## L7. CÔTE d'Ivoire

### L7.1. Regional Water and Sanitation Group/West and Central Africa-RWSG/WCA

PO Box 1850  
Abidjan  
Côte d'Ivoire

**Telephone:** +225-44-22-27

**Fax:** +225-44-16-87

**Email:**

**Contact:** Annie Many Savina, Acting Regional Manager

**Topics covered:** h j k

**Description:** RWSG/WA is a program launched by the UNDP and implemented by The World Bank. The aim of the program is to assist Central Governments to formulate strategy and implement policy in the sectors of water and sanitation. RWSG/WA provides technical assistance to help develop human resources and strengthen institutional capacities of public organisations involved in water and sanitation issues. The RWSG/WA has cooperative relationships with UN agencies, bilateral institutions, African organisations, and ITN International Training Network Centres. The RWSG/WA has a documentation centre on water and sanitation issues and has access through The World Bank to various information sources

**Format of available information:** Books, journals, reports, databases.

**Internet:**

**Language:** French and English

**Consulting or support services:** Negotiable.

**Fees:** At cost.

## L8. EGYPT

### L8.1. National Research Center

El Tahrir Str. Dokki  
Cairo  
Egypt

**Telephone:** +20 2-337-1362

**Fax:** +20 2-337-0931

**Email:** mtobgw@nrc.sci.eg

**Contact:** Prof. Hassan Ibrahim EI-Sisi, Director

**Topics covered:** a c e f

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

**Description:** The National Research Center is a government research centre. It carries out basic and applied research on issues related to public health, industry, agriculture, and others affecting the Egyptian national economy. It publishes its findings in periodic technical reports, which are available upon request.

**Format of information:** Technical reports, journal articles.

**Internet:** www.nrc.sci.eg

**Language:** Arabic and English

**Consulting or support services:** Negotiable.

**Fees:** Fixed schedule of charges.

### **L8.2. Alexandria University, Faculty of Engineering, Dept of Civil/Environmental Engineering**

22 El-Geish Ave, El-Shatby  
Alexandria  
Egypt

**Telephone:** +20-2-71675/8

**Fax:**

**Email:**

**Contact:** Dean of Engineering

**Topics covered:** a b c d e f g h i k

**Description:** Alexandria University is one of the largest universities in Egypt with an enrolment of 92,000. It is publicly funded and was founded in 1942. The Department of Civil Engineering offers instruction in MSWM and conducts on selected topics such as recycling and composting. The University has an extensive library system with volumes on related topics and publishes the *Collection of Public Affairs Lectures*, which occasionally deals with urban issues like solid waste.

**Format of information:** Books, journals, periodicals, university research reports.

**Internet:**

**Language:** Arabic and English

**Consulting or support services:** None.

**Fees:** None.

### **L8.3. Cairo University, Faculty of Engineering, Dept. Civil Engineering**

POB 12611  
Orman, Giza  
Cairo  
Egypt

**Telephone:** +20-2-572-9584

**Fax:** +20-2-628-884

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

**Email:**

**Contact:** Prof. Dr. Ahmed Azia Kamal

**Topics covered:** a b c d e f g h i k

**Description:** Cairo University is a publicly funded institution founded in 1942. The Department of Civil Engineering offers instruction in MSWM and conducts research on selected topics such as recycling and composting. The University has an extensive library system with volumes on related topics accessible to students and researchers.

**Format of information:** Books, journals, periodicals, university research reports.

**Internet:** [www.eng.cu.edu.eg/dept/en/arc/index.htm](http://www.eng.cu.edu.eg/dept/en/arc/index.htm)

**Language:** Arabic and English

**Consulting or support services:** None.

**Fees:** At cost.

## L9. GHANA

### L9.1. The Accra Metropolitan Assembly (AMA)

Waste Management Dept.

PO Box 1269 (or PO Box 385)

Accra

Ghana

**Telephone:** +233-21-225-465

+233-21-226-816

+233-21-665-951

**Telex:** 2376ACCGH

**Fax:** +233-21-774-689

+233-21-665-711

**Email:**

**Contact:** Mr. Solomon Ofei-Darko, Chief Executive, AMA

**Topics covered:** a b c e f g h k

**Description:** The AMA is the municipal agency charged with MSWM in the Accra metropolitan area. Its MSWM system is run by the Waste Management Division. The AMA is funded by appropriations from the Ministry of local Government and the Ministry of Public Works and Housing for MSW-related activities. The Ministry of Environment also allocates resources for capital projects. The AMA-Waste Management Department produces periodic reports on MSW operations. Details of municipal operations and plans for MSW systems upgrades may also be obtained from the minutes of AMA meetings and from resolutions of the Assembly. The AMA is mirrored by similar councils in Kumasi, Tamale, Tema, and Sekondi-Takoradi. Together their Waste Management Departments perform the “on-the-ground” management of MSW in Ghana.

**Format of information:** Written minutes of the Assembly. Periodic project and planning reports.

TOPICS:

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

**Internet:**

**Language:** English

**Consulting or support services:** None.

**Fees:** None.

**L9.2. Environmental Protection Agency (EPA)**

PO Box M326

Accra

Ghana

**Telephone:** +233-21-664697/8

**Fax:** +233-21-662690

**Email:** support@epaghana.org or epaed@africaonline.com.gh

**Contact:** Jacob Gyamfi Aidoo

**Topics covered:** f h j

**Description:** The EPC is the executive agency in charge of environmental policy in Ghana. It advises the Ministry of Environment on development planning, including the environmental impacts of MSW facilities and is involved in educating the public about environmental issues. The EPC can provide information on a broad range of topics related to MSWM. It will generally respond to written requests.

**Format of information:** Reports, journals, conference and workshop proceedings, regulatory guidelines.

**Internet:** www.epa.gov.gh

**Language:** English

**Consulting or support services:** None.

**Fees:** None.

**L9.3. University of Cape Coast, Department of Chemistry**

University Post Office

Cape Coast

Ghana

**Telephone:** +233-42-32480

**Fax:** +233-42-32485

**Email:**

**Contact:** D.K. Dodoo, Head of Department

**Topics covered:** e f i

**Description:** The University of Cape Coast is a publicly supported University offering undergraduate and postgraduate studies in a broad range of subjects. The Department of

TOPICS:

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Chemistry conducts research into the chemical and thermal treatment of waste. This includes a focus on hazardous chemicals found in the household. The department periodically publishes its research findings in regional journals and offers consulting advice to government agencies.

**Format of information:** Periodic publications.

**Internet:** [www.uccghana.net/departments/Department\\_of\\_chemistry.htm](http://www.uccghana.net/departments/Department_of_chemistry.htm)

**Language:** English

**Consulting or support services:** For funded research.

**Fees:** None.

#### **L9.4. University of Science and Technology - Bureau of Integrated Rural Development**

Kumasi  
Ghana

**Telephone:** +233-0-51-60406

**Fax:** +233-0-51-60137

**Email:** [ustlib@ust.qn.apc.org](mailto:ustlib@ust.qn.apc.org)

**Contact:** Akwasi Owusu, Acting Director

**Topics covered:** a c

**Description:** This is a publicly funded university, which offers undergraduate and graduate instruction and research in the sciences and engineering. It conducts research on waste conversion, including composting and pyrolysis. Its research reports may be obtained from the university library.

**Format of information:** Research reports.

**Internet:** [www.ghanauniversities.com/university\\_for\\_development\\_stud.htm](http://www.ghanauniversities.com/university_for_development_stud.htm)

**Language:** English

**Consulting or support services:** For funded research.

**Fees:** None.

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

## L10. KENYA

### L10.1. Council for Human Ecology-Kenya (CHEK)

c/o NEHSS  
PO Box 20360  
Nairobi  
Kenya

**Telephone:** +254-2-720-399  
**Fax:** +254-2-718-730  
**Email:** oscar@tt.sasa.unep.no  
**Contact:** Chairman

**Topics covered:** b e h

**Description:** CHEK is a non-profit organisation that seeks to promote the awareness of and interest in human ecology in Kenya. In the area of MSWM, it is interested in the collection and disposal of MSW as well as planning for the capacity to carry out these functions safely and sustainably. CHEK works with community groups and other environmental NGOs.

**Format of information:** Pamphlets, position papers.

**Internet:**

**Language:** English and Kiswahili

**Consulting or support services:** None.

**Fees:** None.

### L10.2. UN Centre for Human Settlements (Habitat)

PO Box 30030  
Nairobi  
Kenya

**Telephone:** +254-2-621-234  
**Fax:** +254-2-624-266  
**Email:** infohabitat@unhabitat.org  
**Contact:** Dr. Graham Alabaster

**Topics covered:** a c h j

**Description:** Habitat is a UNEP program that focuses on a broad range of issues related to living, conditions in urban areas. Municipal waste management is one of the issues of concern. The Nairobi office runs a program entitled, "Small-scale Composting and Digestion of Solid Wastes", which focuses on community-based composting systems for MSW. The program aims at reducing the volume of waste for disposal in urban areas through resource recovery.

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

**Format of information:** Research reports.  
**Internet:** [www.unhabitat.org](http://www.unhabitat.org)  
**Language:** English  
**Consulting or support services:** Negotiable.  
**Fees:** Material available at cost.

### **L10.3. University of Nairobi - Housing Research and Development**

PO Box 30917  
Nairobi  
Kenya

**Telephone:** +254-2-711211  
+254-2-721682  
**Fax:** +254-2-718549  
**Email:**  
**Contact:** Director

**Topics covered:** b e h i j

**Description:** The Housing Research and Development (HRD) Unit helps in the development of appropriate standards for housing and assists in the planning of MSWM systems. It conducts research into urban development issues and trains students in urban and regional planning and environmental science. It is funded by the government.

**Format of information:** Instructional material, periodic policy papers.  
**Internet:** [www.uonbi.ac.ke/colleges/faculty\\_details.php3?t](http://www.uonbi.ac.ke/colleges/faculty_details.php3?t)  
**Language:** English  
**Consulting or support services:** Negotiable.  
**Fees:** Fixed schedule of charges.

### **L10.4. Kenyatta University, Dept. Environmental Science**

PO Box 4384400100 GPO  
Nairobi  
Kenya

**Telephone:** +254-2-810901  
**Fax:** +254-2-811575  
**Email:** [info@ku.ac.ke](mailto:info@ku.ac.ke)  
**Contact:** Dr. Theresa Aloo, Chair Person

**Topics covered:** b e f h i

**Description:** Kenyatta University is a publicly funded institution originally established in 1972 and elevated to full university status in 1985. The Environmental Science program offers

**TOPICS:**

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instruction in MSWM at the undergraduate and graduate levels. The University houses an extensive library collection accessible to students and researchers.

**Format of information:** Books, journals, periodicals.

**Internet:** [www.ku.ac.ke/academic/departments.asp?dcode=ens](http://www.ku.ac.ke/academic/departments.asp?dcode=ens)

**Language:** English

**Consulting or support services:** None.

**Fees:** None.

### **L10.5. Moi University, School of Environmental Studies**

PO Box 3900

Eldoret

Kenya

**Telephone:** +254-321-43620

**Fax:** +254-321-43047

**Email:** [vcmu@mu.ac.ke](mailto:vcmu@mu.ac.ke)

**Contact:** Prof. C.O. Okidi

**Topics covered:** b e f h i

**Description:** Moi University is a publicly funded institution founded in 1984. The Environmental Studies program provides instruction and research in the planning and organisation of MSWM systems. These courses are offered only at the graduate level. The University library covers a wide range of related topics and is accessible to students and researchers.

**Format of information:** Books, journals, periodicals.

**Internet:** [www.mu.ac.ke/senvir/senvir.htm](http://www.mu.ac.ke/senvir/senvir.htm)

**Language:** English

**Consulting or support services:** None.

**Fees:** None.

## **L11. LESOTHO**

### **L11.1. Department of Energy (DOE)**

Private Bag A91

Maseru 100

Lesotho

**Telephone:** +266-22-316784

**Fax:** +266-22-310360

**Email:** [petro@energy.gov.ls](mailto:petro@energy.gov.ls)

**Contact:** Mr. B. Kanetsi, Director of Energy

**TOPICS:**

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**Topics covered:** c h j

**Description:** The DOE is the government agency that overlooks energy affairs in Lesotho. Its interest in MSW stems from its involvement in promoting centralised composting systems for MSW. This promotion includes the planning and management proposal for such a system. The department also conducts public education campaigns on energy matters of public interest, including composting. The Department serves the public and has experience in providing information and service to students, professional organisations, and researchers interested in energy. The DOE provides reports and other documents on a loan basis.

**Format of information:** Technical reports, pamphlets, workshops.

**Internet:**

**Language:** English

**Consulting or support services:** None.

**Fees:** None.

### L11.2. National Environment Secretariat (NES)

Post Office Building, 6<sup>th</sup> Floor  
Maseru 100  
Lesotho

**Telephone:** +266-22311-767

**Fax:** +266-22310-194

**Email:** lea@lea.org.ls

**Contact:** H. Partow

**Topics covered:** e j

**Description:** The NES is a public agency responsible for coordinating the policies, programs and projects of government agencies, parastatals, NGOs, industry associations, and the public that relate to the environment. The NES conducts seminars and workshops. It publishes a monthly newsletter and hosts radio and TV programs to promote environmental issues (including urban waste management).

**Format of information:** Seminars, workshops, monthly newsletter, radio, and TV shows.

**Internet:** www.lea.org.ls

**Language:** English and Sesotho

**Consulting or support services:** None.

**Fees:** At cost.

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## L12. LIBERIA

### L12.1. University of Liberia Library

PO Box 9020  
Monrovia  
Liberia

**Telephone:** +231-222448

**Fax:**

**Email:**

**Contact:** Annabel Urey-Tingba, Director

**Topics covered:** a b c d e f g h i j k

**Description:** The University of Liberia library is a non-profit association responsible for collecting, organising and disseminating information on all branches of knowledge covered by the university. Its solid waste holdings cover all aspects of MSWM. It gives unlimited access to academics during regular hours and access by permit to the general public.

**Format of information:** Books, journals, newspapers, conference proceedings, technical reports.

**Internet:**

**Language:** English

**Consulting or support services:** Available.

**Fees:** Fixed schedule for consultant's time. Processing cost for materials.

## L13. MALAWI

### L13.1. Ministry of Natural Resources and Environmental Affairs

Private Bag 350  
Lilongwe 3  
Malawi

**Telephone:** +265-1 789 488

**Fax:** +265-1 773 379

**Email:** naturalres@malawi.gov.mw or naturalresources@malawi.net

**Contact:**

**Topics covered:** a b c d e f g h i j k

**Description:** The Ministry of Natural Resources and Environmental Affairs accommodates the country's National Documentation Centre for information and publications on environmental affairs. These include information on MSWM. It serves students, scientists, researchers, and engineers through its library of data and published materials. The Ministry will respond to telephone requests for and can direct inquiries to local sources of information on MSWM.

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**Format of information:** Quarterly newsletter, research papers, technical reports, planning reports, budget reports, workshop, and seminar proceedings.

**Internet:** [www.malawi.gov.mw/natres/environ/natresenviron.htm](http://www.malawi.gov.mw/natres/environ/natresenviron.htm)

**Language:** English

**Consulting or support services:** Available upon request.

**Fees:** Publications sold at cost, including postage.

### L13.2. Blantyre City Council

Civic Centre

PB 67

Blantyre

Malawi

**Telephone:** +265-670-211

**Fax:** +265-670-417

**Email:**

**Contact:** Town Clerk/Chief Executive

**Topics covered:** b e h j k

**Description:** The City Council is responsible for the daily MSWM operations in the Blantyre municipal area. The council meeting minutes can give detailed insights into the workings of the MSWM system and show how it works with the oversight Ministries to effect local MSWM in accordance with national regulations.

**Format of information:** Council minutes, periodic planning reports.

**Internet:**

**Language:** English

**Consulting or support services:** None.

**Fees:** None.

### L13.3. Lilongwe City Council

City Centre

PO Box 30396

Lilongwe

Malawi

**Telephone:** +265-783144

**Fax:** +265-780885

**Email:**

**Contact:** Town Clerk/Chief Executive

**Topics covered:** b e h j k

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

**Description:** The City Council is responsible for the daily MSWM operations in the Lilongwe municipal area. The council meeting minutes can give detailed insights into the workings of the MSWM system and show how it works with the oversight Ministries to affect local MSWM in accordance with national regulations.

**Format of information:** Council minutes, periodic planning reports.

**Internet:**

**Language:** English

**Consulting or support services:** None.

**Fees:** None.

#### **L13.4. University of Malawi, Chancellor College**

PO Box 280

Zomba

Malawi

**Telephone:** +265-1-524-222

**Fax:** +265-1-524-046

**Email:** amsiska@chanco.unima.mw

**Contact:** Dr. A. Msiska, Librarian

**Topics covered:** a c i

**Description:** Chancellor College is part of the University of Malawi system. It is a publicly funded institution founded in 1964. The Department of Biology runs a composting demonstration and training centre that utilises agricultural and municipal waste. The College also holds an extensive collection (through the University of Malawi library system) on related subjects. These are accessible to students and researchers.

**Format of information:** Books, journals, periodicals.

**Internet:** www.chanco.unima.mw

**Language:** English

**Consulting or support services:** None.

**Fees:** None.

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing



## L14. MALI

### L14.1. ALPHALOG (L'Association Libre pour la Promotion de l'Habitat et du Logement)

BP 262  
Ségou  
Mali

**Telephone:** +223-320 527  
**Fax:** +223-320 527  
**Email:** alpha-pdus@spider.toolnet.org  
**Contact:** Seydou Diakite, Coordinator

**Topics covered:** a b c

**Description:** ALPHALOG is a national NGO assisting local organisations in the sectors of water and sanitation. In Bamako there are more than 60 small business enterprises called “Economic Interest Groups” and community-based organisations running water and sanitation projects. ALPHALOG plays the role of facilitator in coordinating the activities of these associations to supplement the limited municipal service. ALPHALOG’s membership includes representatives from grassroots organisations, the municipal council, and central government departments. ALPHALOG has strong ties with training and research institutions in Mali and the sub-region.

**Format of information:** Technical project reports, workshop and seminar proceedings.

**Internet:** [www.promali.org/ong/alphalog](http://www.promali.org/ong/alphalog)

**Language:** French

**Consulting or support services:** Negotiable.

**Fees:** Materials available at cost.

## L15. MAURITIUS

### L15.1. Mauritius University School of Science Marine Science Division

Mauritius

**Telephone:** +230-4541041  
**Fax:** +230-4549642  
**Email:** mitra@uom.ac.mu  
**Contact:** Mr. Matrasen Bhikajee

**Topics covered:** e f i

**Description:** Mauritius University is a publicly funded institution offering a broad range of undergraduate and graduate instruction in the arts and sciences. The Marine Science Division has a joint graduate program with the Environmental Sciences Division. It provides instruction and

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research opportunities into the disposal of special wastes. Research findings may be obtained from the University library and are also published in scholarly journals.

**Format of information:** Graduate theses, published papers.

**Internet:** [www.uom.ac.mu](http://www.uom.ac.mu)

**Language:** French and English

**Consulting or support services:** For sponsored research.

**Fees:** At cost.

## **L15.2. University of Mauritius-Regional Compost Network**

Rduit  
Mauritius

**Telephone:** +230-454-1041 x1540

**Fax:** +230-467-6733

**Email:** [compostnet@uom.ac.mu](mailto:compostnet@uom.ac.mu), [rmh@uom.ac.mu](mailto:rmh@uom.ac.mu)

**Contact:** Coordinator

**Description:** The aim of the Compost Network is to regroup researchers working in the field of Composting in the Southern African region, mainly from Botswana, Kenya, Mauritius, Reunion, South Africa and Zimbabwe. This project will demonstrate the benefits of networking in the African region in the context of sustainable agricultural programs. It enables sharing of experiences, dissemination, and diffusion of information.

**Format of information:** Periodic newsletters, bulletins, workshops, demonstration modules.

**Internet:** [www.uom.ac.mu/compostnet](http://www.uom.ac.mu/compostnet)

**Language:** French and English

**Consulting or support services:** None.

**Fees:** None.

TOPICS:

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## L16. MOROCCO

### L16.1. Ecole Mohammadia des Ingenieurs

Section Génie de l'Environnement  
Dept. Génie Civil  
77, Rue de Tansift  
Rabat BP 765  
Morocco

**Telephone:** +212-7-749-44  
**Telex:** 31052 CND  
**Fax:** +212-7-731-34  
**Email:**  
**Contact:** Directeur, Dept. Génie Civil

**Topics covered:** a b c d e f g h i k

**Description:** The Environmental Engineering program in the Department of Civil Engineering at the Mohammadia School of Engineering (EMI Sect. ENVIR) offers undergraduate instruction in all aspects of Environmental Engineering, including MSWM. The university is publicly funded and houses a large library offering unlimited access to students and researchers and limited access to the general public.

**Format of information:** Books, journals, reports, conference proceedings, periodicals.  
**Internet:** [www.emi.ac.ma/depts/gciv/labo\\_env.html](http://www.emi.ac.ma/depts/gciv/labo_env.html)  
**Language:** Arabic, French, and English  
**Consulting or support services:** Negotiable.  
**Fees:** At cost.

## L17. MOZAMBIQUE

### L17.1. Ministry for Coordination of Environmental Affairs (MICOA)

Av. Acordos de Lusaka 2115  
Caixa Postal 2020  
Maputo  
Mozambique

**Telephone:** +258-1-466245  
**Fax:** +258-1-465849  
**Email:** [micoa@ambinet.uem.mz](mailto:micoa@ambinet.uem.mz)  
**Contact:** Dr. Carlos Caminho Zomane

**Topics covered:** a g h i j k

#### TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

**Description:** MICOA is the Ministry responsible for coordinating all environmental affairs in Mozambique. These affairs include bio-resources and biodiversity, air, land and water pollution, hazardous waste, and MSWM. MICOA works with the provincial governments and the governate of the City of Maputo MSWM. They approve the budget for capital projects and equipment, develop standards for MSW facilities and operations, and are ultimately responsible for monitoring and enforcement of related regulations. MICOA works with the Ministries of Planning and Finance, Health, and Public Works/Housing on MSW related matters including the design and implementation of a national MSWM plan, personnel training, public education, and financing mechanisms. They can provide information on the national plan for MSW and estimates of the budget for MSWM nationwide.

**Format of information:** Limited departmental reports, pamphlets.

**Internet:**

**Language:** Portuguese

**Consulting or support services:** None.

**Fees:** Postage and processing.

## L18. NIGERIA

### L18.1. Federal Environmental Protection Agency (FEPA)

Independance Way South  
PMB 265  
Federal Capital Territory  
Garki-Abuja  
Nigeria

**Telephone:**

**Fax:**

**Email:**

**Contact:** Mrs. O.O. Babade, Assistant

**Topics covered:** a b c d e f g h i j k

**Description:** The FEPA is responsible for environmental policy, regulation, monitoring, and enforcement in Nigeria. It works with the Ministry of Health, provincial governments, municipal agencies, and private organisations to carry out its responsibilities. The FEPA is the ultimate source of permits to facility operators (authority delegated to local government agencies) and the final arbiter on matters of enforcement for violations of environmental regulation. The FEPA issues a wide variety of reports on issues related to MSWM technology, planning, training, and public education. It can also direct inquiries to source of information within the country.

**Format of information:** Books, bulletins, reports, manuals, regulatory guidelines.

**Internet:**

**Language:** English

**Consulting or support services:** Negotiable.

**Fees:** At cost.

TOPICS:

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

### **L18.2. Nigerian Institute of Social and Economic Research (NISER)**

Oyo Road  
Ojoo  
Ibadan-Oyo State  
Nigeria

**Telephone:** +234-1-02-810-2904  
**Fax:** +234-1-02-810-1194  
**Email:** info@niser.org  
**Contact:** Dr. A.O. Agunbiade

**Topics covered:** h k

**Description:** NISER conducts research on environmental management, policy, and general statistics. It provides expert advice to public and private agencies on recycled material, MSWM system planning in terms of social indicators and on issues of human health. NISER is publicly funded and produces technical reports on a wide variety of topics including urban sanitation.

**Format of information:** Published reports.  
**Internet:** www.NISER.org  
**Language:** English  
**Consulting or support services:** Negotiable.  
**Fees:** At cost.

### **L18.3. Nigerian Environmental Study Team (NEST)**

Nest House  
1, Oluokun Street, Off Awolowo Avenue  
UIPO Box 22025  
Ibadan  
Oyo State  
Nigeria

**Telephone:** +234-2-810-2644  
**Fax:** +234-2-810-2644  
**Email:** nestnig@nest.org.ng  
**Contact:** Mr. Kole Ade-Odutola

**Topics covered:** b e f h j

**Description:** NEST is a non-profit association that collects basic information and comprehensive data on the Nigerian environment. In the area of MSW it focuses on planning for MSWM systems (land use for the siting of facilities), sewage sludge, the implications of demographics on

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MSWM and public awareness about waste and its impacts on the environment. NEST information is available to the public.

**Format of information:** Reports, bulletins, booklets.

**Internet:** [www.nest-interactive.org](http://www.nest-interactive.org)

**Language:** English

**Consulting or support services:** None.

**Fees:** At cost.

#### **L18.4. Nigerian Society of Engineers (NSE)**

National Engineering Center

1 Engineering Close

POB 72667

Victoria Isl

Lagos

Nigeria

**Telephone:** +234-1-261-7349

**Fax:** +234-1-261-7315

**Email:** [nse@nse.org.ng](mailto:nse@nse.org.ng)

**Contact:** Secretary

**Topics covered:** a b e k

**Description:** The NSE is the national association of professional engineers in Nigeria. Its membership includes engineers from all disciplines and all regions of the country. MSW is represented by the Civil and Environmental Engineering membership. The NSE provides a database of experts in different disciplines throughout Nigeria and periodically publishes articles on a variety of issues of interest to the engineering profession. The group is affiliated with other professional engineering organisations in the United States and Europe with many of its members holding joint memberships in those organisations.

**Format of information:** Database of experts. Occasional papers.

**Internet:** [www.nse.org.ng](http://www.nse.org.ng)

**Language:** English

**Consulting or support services:** Available through members.

**Fees:** Negotiable for access to the database.

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

## L19. SENEGAL

### L19.1. Institut Africain de Gestion Urbaine (IAGU)

Liberté 6 Extension N°5  
BP 7262  
Dakar  
Senegal

**Telephone:** +221-827-2200  
**Fax:** +221-827-2813  
**Email:** iagu@cyg.sn  
**Contact:** Ousseynou Eddle Diop, Executive Secretary

**Topics covered:** a b c e f g h i j k

**Description:** IAGU is a regional NGO created in 1989 to assist organisations in Sub-Saharan Africa in urban environmental management and planning. IAGU's activities concern human resources development, capacity building, and information dissemination via networking. IAGU's programs include water, sanitation, solid waste, drainage, environmental health, industrial risk, and marine pollution, with a special focus on MSWM. IAGU has a public library (with several hundred documents on urban management and development). IAGU and the Urban Management Program jointly produce four issues per year of the journal, *Villes Africaines*.

IAGU has cooperative relationships with several organisations including: UMP (Urban Management Programme - UNDP/World Bank/UNCHS), MDP (Municipal Development Programme - World Bank/French Cooperation), CREPA (International Training Network/UNDP-World Bank), RWSG (Regional Water and Sanitation Group/UNDP-World Bank), IDRC (International Development Research Centre Canada), Sahel Centre (University of Laval, Quebec-Canada), SANDEC (Sanitation in Developing Countries/Federal Institute of Technology, Zurich-Switzerland), AIHS (Institute of Housing and Urban Studies/Rotterdam, Netherlands).

**Format of information:** Books, seminar proceedings, journals, catalogues, reports, databases.

**Internet:** www.iagu.org

**Language:** French and English

**Consulting or support services:** For fee.

**Fees:** Postage and handling.

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

## L19.2. École Nationale Supérieure Universitaire de Technologie - ENSUT

PO Box 5085  
Dakar-Fann  
Senegal

**Telephone:** +221-824-13-88  
**Fax:** +221-25-55-94  
**Email:** esp@ucad.sn  
**Contact:** M. Oumar Sock

**Topics covered:** a c

**Description:** ENSUT is a national public school running training, research, and technical assistance activities. ENSUT's programs include civil and mechanical engineering, computer science, economics, and management studies. The Department of Biology has established a regional network on organic waste composting. The network aims to disseminate composting technologies throughout the continent. ENSUT is conducting research on organic waste anaerobic digestion. ENSUT is an institutional unit of the University of Dakar and has cooperative programs with academic institutions in Africa and France. ENSUT has a public library and shares the resources of the francophone universities network.

**Format of information:** Books, journals, reports, databases.

**Internet:** www.esp.sn

**Language:** French

**Consulting or support services:** Available.

**Fees:** Negotiable.

## L19.3. École Polytechnique de Thies - EPT

BP 10 Thies  
Thies  
Senegal

**Telephone:** +221-951-13-84  
**Fax:** +221-51-14-76  
**Email:** espth@ucad.sn  
**Contact:** Seny Tamba, Head of Civil Engineering Department

**Topics covered:** d g

**Description:** EPT is a national public school running training, research, and technical assistance activities. EPT's programs include civil and mechanical engineering. EPT has established cooperative relations with the Institute of Technology of Montreal (Canada) and the Federal Institute of Technology of Lausanne (Switzerland), which provide scientific and financial assistance. EPT has its own documentation centre.

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing



**Format of available information:** Books, journals, reports, databases.

**Internet:**

**Language:** French

**Consulting or support services:** Negotiable.

**Fees:** At cost.

#### **L19.4. ENDA/TM - RUPA Participatory Urban Management Programme**

PO Box 3370

Dakar

Senegal

**Telephone:** +221-822-09-42

**Fax:** +221-823-51-57

**Email:** rup@enda.sn

**Contact:** Malick Gaye, Coordinator

**Topics covered:** a b i j

**Description:** ENDA conducts a program in Rufisque, Senegal that focuses on wastewater collection and treatment with low-cost technologies, onsite sanitation facilities, and MSW primary collection and composting. MSW is conveyed by animal pushcarts and the organic content is composted. Households pay a fee for the collection service. The program is funded by the Canadian Cooperation Agency with a Senegalese counterpart. For this program, ENDA works closely with the local health committee, the community-based organisations, the Municipal Council of Rufisque, and various central government departments. ENDA/TM is an international NGO that has strong relationships with various institutions worldwide, including UN and External Support Agencies.

This program operates in conjunction with ENDA TM (Environnement et Développement du Tiers Monde, Délégation Europe), 5 rue des Immeubles Industriels, 75011 Paris, France. Tel: +331 43 72 13 36; Fax: +33-1 43 72 16 81; Email: endaparis@globenet.gn.apc.org.

**Format of information:** Journals, catalogues, technical reports, manuals, guidebooks, videos.

**Internet:** [www.enda.sn/rup/cadreup.htm](http://www.enda.sn/rup/cadreup.htm)

**Language:** French

**Consulting or support services:** Available for fee.

**Fees:** Materials available at cost.

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

## L20. SOUTH Africa

### L20.1. Associated Environmental NGOs - Cape Recycling Network

PO Box 238  
Hout Bay, 7872  
South Africa

**Telephone:** +27-21-462-2040

**Fax:**

**Email:**

**Contact:** Ms. Barbara Jenman

**Topics covered:** a b c d e f g h k

**Description:** The Cape Network is an NGO that promotes an holistic approach to integrated solid waste management. It works with local authorities, industry and other environmental groups to design and implement low-impact processes for MSWM. The network is also used by municipal workers and others working with solid waste.

**Format of information:** Conference, workshop, and seminar documentation, pamphlets.

**Internet:**

**Language:** English

**Consulting or support services:** Negotiable.

**Fees:** Negotiable.

### L20.2. Earthlife Africa (ELA) - Pretoria

PO Box 40373  
Pretoria, 0007  
South Africa

**Telephone:** +27-12-841-1192

**Fax:** +27-12-841-1203

**Email:**

**Contact:** Mr. Henk Coetzee

**Topics covered:** a b e f j

**Description:** Earthlife Africa is an environmental NGO with offices throughout Africa. In South Africa, there are branches in Capetown, Durban, East London, Grahamstown, Johannesburg, Midrand, Pietermaritzburg, Pretoria, and Zululand. The group advocates on a wide range of environmental issues, including hazardous and solid waste. ELA works with trade unions, civic service associations, and other environmental groups to bring pressure on environmental policy makers on issues related to resource recovery, worker safety, pollution from landfills and other

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means of waste disposal, and the management of toxic wastes. ELA also conducts public education campaigns.

**Format of information:** Campaign literature, position papers, pamphlets, booklets.

**Internet:** [www.earthlife.org.za](http://www.earthlife.org.za)

**Language:** English

**Consulting or support services:** Negotiable.

**Fees:** At cost.

### **L20.3. Environmental Justice Networking Forum (EJNF)**

PO Box 11920  
Dorpspruit 3206  
South Africa

**Telephone:** +27-331-949-073

**Fax:** +27-331-949-073

**Email:** [greenco@gem.co.za](mailto:greenco@gem.co.za)

**Contact:** Mr. Chris Albertyn

**Topics covered:** b d e f h

**Description:** EJNF is a shared networking resource established by a wide cross-section of South African NGOs. Their interest is in promoting the values of environmental justice in an effort to bring about a sustainable people-centred society. They provide a range of networking support and information assistance to community based organisations, other NGOs, trade unions, churches, and civic groups. They focus on coordinating and improving the participation of all sectors of society in the environmental decision-making process. They also focus on building the lobbying capacity of the organisations they support. In the area of MSW, the issues they cover include worker safety, service to disadvantaged communities, the siting of facilities and equity in the design and implementation of MSWM systems.

**Format of information:** Campaign literature, position papers, pamphlets, booklets.

**Internet:**

**Language:** English

**Consulting or support services:** At cost to members. On a fee basis to others.

**Fees:** Processing and postage.

**TOPICS:**

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

#### **L20.4. Industrial Environmental Forum of Southern Africa (IEFSA)**

PO Box 1184  
Saxonwold 2132  
South Africa

**Telephone:** +27-11-482-5100  
**Fax:** +27-11-482-5507  
**Email:** bcsd@ief.co.za  
**Contact:** Ms. Linda von Holdt

**Topics covered:** a b c d e f g h k

**Description:** The IEFSA is a membership service organisation representing business and industrial interests in environmental issues. It provides a variety of services and information to the business community in general and also assists academic institutions on occasion. IEFSA sponsors workshops and seminars and publishes periodic papers on environmental issues. The organisation can provide expert information on all aspects of MSW and special waste management in Southern Africa.

**Format of information:** Conference, workshop and seminar proceedings, journals.

**Internet:** www.ief.co.za.

**Language:** English

**Consulting or support services:** At cost to members. On a fee basis to others.

**Fees:** Processing and postage.

#### **L20.5. South African Municipal Workers Union (SAMWU)**

Private Bag X9  
Athalone 7760  
South Africa

**Telephone:** +27-21-697-1153  
+27-21-697-1147  
**Fax:** +27-21-638-6410  
+27-21-696-9175  
**Email:** SAMWU@Samwu.org.za  
**Contact:**

**Topics covered:** b e f j

**Description:** SAMWU is one of the main unions representing municipal waste workers nationwide in South Africa. It pursues issues related to the occupational safety and health of municipal workers. It represents the interests of its members in dealing with municipalities on contract and benefits issues. SAMWU can provide insightful information on MSWM policy and

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the implications for workers and MSWM operations of the recently enacted Occupational Health and Safety Act (OHSA).

**Format of information:** Conference, workshop, and seminar proceedings.

**Internet:** [www.SAMWU.org.za](http://www.SAMWU.org.za)

**Language:** English

**Consulting or support services:** At cost to members. On a fee basis to others.

**Fees:** Processing and postage.

## **L20.6. University of Cape Town, Faculty of Science**

Dept. of Environmental and Geographical Science

Private Bag

Rondebosch 7701

Cape Town

South Africa

**Telephone:** +27-21-650-2873

+27-21-650-2874

**Fax:** +27-21-650-3791

**Email:** [admin@enviro.uct.ac.za](mailto:admin@enviro.uct.ac.za)

**Contact:**

**Topics covered:** e g h i k

**Description:** The University of Cape Town is a state supported institution founded in 1829. The Department of Environmental and Geographical Science offers courses in MSWM and conducts research in the area. Prof. Fuggle and Dr. Sowman head the Environmental Evaluation Unit of the University. The University is associated with several research institutes that do work on related areas, among them, the Urban Problems Research Unit. It also houses multiple libraries with volumes on related subjects. This is accessible to students and researchers.

**Format of information:** Books, journals, periodicals.

**Internet:** [www.egs.uct.ac.za](http://www.egs.uct.ac.za)

**Language:**

**Consulting or support services:** Negotiable.

**Fees:** At cost.

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

## L21. SUDAN

### L21.1. University of Khartoum, School of Public Health and Environmental Hygiene

PO Box 203  
Khartoum  
Sudan

**Telephone:** +249-11-772690

**Fax:**

**Email:** health@uofk.edu

**Contact:** Dean

**Topics covered:** b e f i j

**Description:** The School is part of the publicly funded University of Khartoum. It provides undergraduate training in Environmental and Health studies, in which one area of concentration is MSWM. It focuses on the sanitary management of wastes and includes training in infectious wastes and sewage sludge.

**Format of information:** Instructional material, limited research reports.

**Internet:** www.uofk.edu/index.htm

**Language:** Arabic and English

**Consulting or support services:** None.

**Fees:** None.

## L22. TANZANIA

### L22.1. National Environment Management Council, Environmental Information Center

PO Box 63154  
Dar es Salaam  
Tanzania

**Telephone:** +255-022-213-4603

+255-022-232-3210

**Fax:** +255-022-213-4603

**Email:** nemc@simbanet.net, nemc@nenactz.org

**Contact:** Mrs. Anna Maembe

**Topics covered:** a b c d e f g h j k

**Description:** The council is charged with coordinating, overseeing, and documenting all environmental activities in the country. It promulgates environmental regulations based on the law, sets standards for facilities and operators, and oversees the monitoring of facilities and the

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enforcement of violations. The council has access to a variety of reports on MSWM and can direct inquiries to appropriate local sources of information.

**Format of information:** Planning and progress reports, case studies, bulletins.

**Internet:** www.nemctz.org

**Language:** English

**Consulting or support services:** None.

**Fees:** At cost.

## L23. TUNISIA

### L23.1. Direction de l'Hygiène du Milieu et de la Protection de l'Environnement

1 rue de Libéria 1002

Tunis-Belvédère

Tunisia

**Telephone:** +216-01-789-855

**Fax:** +216-01-790-440

**Email:**

**Contact:** M. Cheniti Slaheddine, Directeur

**Topics covered:** e h j

**Description:** The Department's MSW responsibilities entail the monitoring and documentation of the performance of waste management facilities. It also has enforcement powers to control the operations of these facilities. The Department is involved in raising public awareness about sanitation. It provides technical assistance to waste management agencies and conducts research into the health effects of waste.

**Format of information:** Periodic technical reports, bulletins.

**Internet:**

**Language:** French

**Consulting or support services:** None.

**Fees:** At cost.

### L23.2. Ministère de l'Environnement et de l'Aménagement du Territoire

Unité de Documentation

32 Rue de la Monnaie

1001 Tunis

Tunisia

**Telephone:** +216-1-343-200

**Telex:** 13140 MEAT

**Fax:** +216-1-345-040

**TOPICS:**

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

**Email:**

**Contact:** Najib Daouas, Conservateur de la Documentation

**Topics covered:** a b e f g h j k

**Description:** This Ministry is responsible for drafting General Environmental regulations, including those that affect MSW. It is involved in policy formulation as it affects resource recovery, MSWM system planning and financing, monitoring and control of facilities, emergency responsiveness, demography and land use, and the education of the public on issues of sanitation and the environment. It produces periodic planning and progress reports and a number of research reports.

**Format of information:** Progress reports, research reports.

**Internet:**

**Language:** Arabic and French

**Consulting or support services:** None.

**Fees:** None.

### **L23.3. Ècole Nationale des Ingenieurs de Tunisie**

Le Belvedere  
Tunis BP 37  
Belvedere  
Tunisia

**Telephone:** +216-1-514-700

+216-1-872-279

**Fax:**

**Email:**

**Contact:** Director

**Topics covered:** h i

**Description:** The Tunisia National School of Engineering is a public university. The program in Civil Engineering offers courses (undergraduate) in the planning and design of urban systems. These include systems for the management of MSW. The University houses a well-stocked library accessible to students and researchers.

**Format of information:** Books, journals, periodicals.

**Internet:**

**Language:** Arabic and French

**Consulting or support services:** For sponsored research.

**Fees:** At cost.

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing



#### **L23.4. Association pour la Protection de la Nature et de l'Environnement (APNE)**

12 Rue Tantaoui  
El Jawhari  
E: Omrane 1005  
Tunis  
Tunisia

**Telephone:** +216-1-288-141  
**Fax:** +216-1-797-295  
**Email:** mohamedali.abrougui@atrpe.rnrt.tn  
**Contact:** President

**Topics covered:** j

**Description:** APNE is a non-profit organisation engaged in raising public awareness about the environment. In the case of MSW, it focuses on the impacts of MSW disposal on the environment and promotes waste minimisation, recycling, and resource recovery. APNE can refer inquiries to other sources of information on MSW.

**Format of information:** Brochures, pamphlets.

**Internet:**

**Language:** Arabic and French

**Consulting or support services:** None.

**Fees:** At cost.

#### **L24. UGANDA**

##### **L24.1. Makerere University, Department of Women Studies (DWS)**

PO Box 7062  
Plot 45, Pool Road  
Kampala  
Uganda

**Telephone:** +256-041-531-484  
**Fax:** +256-041-543-539  
**Email:** gendermu@africaonline.co.ug  
**Contact:** Department Head

**Topics covered:** a c e f i j

**Description:** Makerere University is the premiere institution of higher learning in Uganda. It is publicly funded. The DWS offers courses in urban sanitation geared to graduates who will be community and public health workers. The department also advises public information campaigns on MSW issues and maintains a good collection of references on urban sanitation issues in Uganda.

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

**Format of information:** Books, journals, research reports.

**Internet:** [www.makerere.ac.ug/womenstudies](http://www.makerere.ac.ug/womenstudies)

**Language:** English

**Consulting or support services:** None.

**Fees:** Material available at cost.

L25. ZAMBIA

### **L25.1. The Environmental Council of Zambia**

PO Box 35131

Lusaka

Zambia

**Telephone:** +260-1-254-130

+260-1-254-131

**Fax:** +260-1-254-164

**Email:** [ecz@necz.org.zm](mailto:ecz@necz.org.zm)

**Contact:** Mr. Paul M. Banda, Senior Inspector, Waste Management Unit

**Topics covered:** a b c e f g h i j k

**Description:** The Environmental Council of Zambia (ECZ) is the executive agency responsible for implementing environmental legislation through regulation and enforcement in Zambia. With respect to MSW, it pursues the regulations of the Environmental Protection and Pollution Control Act. The ECZ prepares the working MSWM plan for the country. It licenses and monitors MSW facilities, operators and operations. It prepares annual progress reports and technical planning reports on MSW. The ECZ can also refer inquiries to specific personnel in municipal or private agencies for matters related to MSWM.

**Format of information:** Annual progress reports. Technical reports.

**Internet:** [www.necz.org.zm](http://www.necz.org.zm)

**Language:** English

**Consulting or support services:** Negotiable.

**Fees:** Negotiable.

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

## L26. ZIMBABWE

### L26.1. Bulawayo City Council

PO Box 591  
Bulawayo  
Zimbabwe

**Telephone:** +263-9-75011

**Fax:**

**Email:**

**Contact:** Town Clerk

**Topics covered:** b e h k

**Description:** The city council is responsible for MSWM in the Bulawayo municipal area. It licenses collectors and authorises the location of the landfill in Consultation with the Ministry of Health and the Ministry of Public Works. The council must finance municipal operations and plan upgrades to its MSWM system.

**Format of information:** Limited documentation. Council minutes.

**Internet:**

**Language:** English

**Consulting or support services:** None.

**Fees:** None.

### L26.2. University of Zimbabwe, Department of Geography

PO Box MP 167  
Mount Pleasant  
Harare  
Zimbabwe

**Telephone:** +263-4-303211

**Fax:** +263-4-332059

**Email:** geogdept@arts.uz.ac.zw

**Contact:** Dr. Dan Tevera

**Topics covered:** e h

**Description:** The University of Zimbabwe is a publicly funded institution with programs in the liberal arts and engineering. The Department of Geography has a research interest in the siting of landfills in geologically sensitive areas and in the design of the MSWM system for the City of Harare.

**Format of information:** Books, journals, project and research reports.

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

**Internet:** [www.uzweb.uz.ac.zw](http://www.uzweb.uz.ac.zw)

**Language:** English

**Consulting or support services:** Negotiable.

**Fees:** Material available at cost.

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

## M. Regional sources of information

### UNEP-INFOTERRA

INFOTERRA Programme Activity Centre  
The Global Environmental Information Exchange Network  
UNEP  
PO Box 30552  
Nairobi  
Kenya

**Telephone:** +254-2-62-12-34  
+254-2-62-32-74  
**Fax:** +254-2-22-69-49  
+254-2-62-42-69  
**Email:** spen@pan.cedar.univie.ac.at, spencerl@unep.no  
**Contact:** See below.

**Topics covered:** a b c d e f g h i j k

**Description:** INFOTERRA is the acronym for the United Nations Environment Programme's (UNEP) global Information Exchange Network. It provides information and technical support on environmental issues worldwide through a network of focal points in each country. The focal points for Africa are listed below. They can provide information on MSW in their respective home countries, regionally, and in some cases, continent-wide. INFOTERRA has access to other global networks of information on environmental issues and to international and regional agencies operating in the field of MSW in Africa.

**Format of information:** *The International Directory of Sources* of environmental information, both printed and as a database. Specialised directories, sourcebooks, manuals, and the quarterly *INFOTERRA Bulletin*. *INFOTERRA* email subscription list. Archived environmental information on the World Wide Web.

**Internet:** [www.cedar.univie.ac.at/data/infoterra](http://www.cedar.univie.ac.at/data/infoterra)

**Language:** English

**Consulting or support services:** None.

**Fees:** Most services are free.

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

## **N. INFOTERRA national focal points for Africa**

Asse A. Sivirin  
PFN d'INFOTERRA  
Directeur, Direction de l'Aménagement du Territoire  
Ministère de l'Environnement, de l'Habitat et de l'Urbanisme  
B.P. 01-3621  
Cotonou, BENIN  
Telephone: +229 30 07 42/30 05 41  
Telex: 5118 MINIPLAN

Ms. Mmapula Matsheka  
INFOTERRA National Focal Point  
Department of Town and Regional Planning  
Ministry of Local Government and Lands  
Private Bag 0042  
Gaborone, BOTSWANA  
Telephone: +267-354277/35428S  
Telex: 2S89 MLGL BO  
Fax: +267-313280/354273  
Email: unepbot@wn.apc.org

M. Bruno R. Salo  
PFN d'INFOTERRA  
Direction de la Prévention des Pollutions et de l'Amélioration du Cadre de Vie (DIPAC)  
Ministère de l'Environnement et de l'Eau  
03 B.P. 7044  
Ouagadougou 03, BURKINA FASO  
Telephone: +226 31 19 19  
Fax: +226 30 67 67/30 12 32

M. Sapock Ndem Samuel  
PFN d'INFOTERRA  
Directeur de l'Aménagement du Territoire et de l'Environnement  
Ministère du Plan et de l'Aménagement du Territoire  
Yaounde, CAMEROON  
Telephone: +237 233672

M. Emarou Clement  
PFN d'INFOTERRA  
Chef de Service de l'Hygiène du Milieu  
Direction de l'Assainissement et de la Salubrité de l'Environnement  
B.P. 711  
Bangui, CENTRAL AFRICAN REPUBLIC

PFN d'INFOTERRA  
Secretariat d'état chargé de l'environnement  
Direction des Forêts et de la Protection de l'Environnement  
B.P. 447  
N'Djamina, CHAD  
Telephone: +235 21-21 x344 & 417  
Telex: RENSONPT 1116 KO  
Cable: UNDEVPRO NDJAMENA

Marius Issanga-Ngamissimi  
PFN d'INFOTERRA  
Directeur Général de l'Environnement  
Direction Générale de l'Environnement  
B.P. 958  
Brazzaville, CONGO  
Telephone: +242 83-30-46  
Telex: PRECONGO 5210 KG  
Fax: +242 83-71-50 or c/o UNbP +242 83-39-87

Kouakou James Koffi  
Manager REN. Infoterra  
Nour Al Hayat  
2e Etage Porte 8  
BP V 67  
Abidjan, COTE D'IVOIRE  
Telephone: +225 22-53-54  
Telex: 23 399 MINI MACI

M. Anis Abdallah  
PFN d'INFOTERRA  
Director, Institut Supérieur d'études et des recherches scientifiques et techniques  
B.P. 486  
DJIBOUTI  
Telephone: +253 35 27 95  
Telex: 5811 OBSIDJIB DJ  
Fax: +253 35 48 12

INFOTERRA National Focal Point  
Director General  
Executive Office for Environmental Information  
Academy for Scientific Research and Technology  
101 Kasr El Aine Street  
Cairo, EGYPT  
Telephone: +20-2-31985  
Telex: 93069 ASRT

INFOTERRA National Focal Point  
Documentation & Information  
National Environmental Protection Authority  
PO Box 12760  
Addis Ababa, ETHIOPIA

M. J. Marcel Malolas  
Point Focal PNUE/INFOTERRA  
Directeur des études, du contentieux et du droit de l'environnement  
Direction Générale de l'environnement et de la protection de la nature  
B.P. 3903  
Libreville, GABON  
Telephone: +241 73.17.07/73.08.73

Ms. Ndey-Isatou Njie  
INFOTERRA National Focal Point  
Executive Director  
National Environment Agency  
5 Fitzgerald Street  
PMB 48  
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PFN/INFOTERRA  
Direction nationale de l'environnement  
Ministere des ressources naturelles et de l'environnement  
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M. Cipriano Cassama  
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Directeur General, Direction des forêts et chasse  
Ministère du developpement rural et de l'agriculture  
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Ministry of Environment and Natural Resources  
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Fax: +263-4 793123  
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## **O. International Association on Water Quality Specialist Group on Appropriate Waste Management Technologies for Developing Countries**

**Topics covered:** a b c d e f g h i j k

**Description:** The specialist group is a network of professionals with expertise in the area of waste management. They are interested in promoting technologies for waste management in Africa that are appropriate for the local contexts in which they are to be implemented. Individual members are listed below.

**Format of information:** Books, journals, project and research reports, manuals.

**Internet:**

**Language:** English

**Consulting or support services:** Negotiable with individual members.

**Fees:** Negotiable.

### **BURUNDI**

Dr U. Neis

GTE, BP 78, Bujumbura, Burundi

### **EGYPT**

Prof. F. El Gohary

Water Pollution Control Laboratory, National Research Centre, Tahreer St., Dokki, Cairo, Egypt

Mr M.K. Mostafa

National Organisation of Portable Water & Sanitary Drainage 11 A - Ali Alrobi Street, Roxi Square, Cairo, Egypt

Dr M.I. Sheikh

Eastern Mediterranean Region

World Health Organisation

PO Box 1517, Alexandria 21511, Egypt

### **MAURITIUS**

T. Ramjeawon, Faculty of Science

University of Mauritius, Recluit, Mauritius

### **NIGERIA**

Mr T.G. Leton

Miwlem, ENSIC

Nigeria Society of Engineers (NSE)

Dept. of Civil Engineering, University of Portharcourt, PMB 5323, Portharcourt, Rivers State, Nigeria

#### **TOPICS:**

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

SOUTH AFRICA

Mr. A.L. Batchelor or Mr. J.A. Pearson  
Watertek-CSIR, PO Box 395, Pretoria 0001, South Africa

Mr. G.A. Norris  
CSIR Div. of Building Tech., PO Box 3~5, Pretoria 0001, South Africa

W.A. Pretorius  
Water Utilisation Division, Dept. Chemical Engineering, University of Pretoria, Pretoria,  
South Africa

P.J. Pybus  
C/O Stewart Scott Inc., PO Box 784506, Sanolton 2146, South Africa

Mr Bill Ross  
Ross Consultancy, PO Box 3483, Tygerpark 7536, South Africa

TANZANIA

Mr. A.K. Kigingi  
Ministry of Water, PO Box 3020, Arusha, Tanzania

Dr. A.K. Kivaisi  
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Microbiology Unit, Botany Dept.  
PO Box 35060, Dar Es Salaam, Tanzania

Mr Romuald A.L. Matteru  
Sewerage and Water Authority  
PO Box 762, Mbeya, Tanzania

Mr Gaspar Muhangi  
Center for Agricultural Mechanical & Rurural Technology (CAMARTEC)  
PO Box 764, Arusha, Tanzania

Mr R.S.T. Rubindamayugi  
Microbiology Unit, University of Dar Es Salaam  
PO Box 350 Dar Es Salaam, Tanzania

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

## **P. Ministries not listed above that can also provide information on MSWM**

Ministry of the Interior, Local Authorities, Administrative Reform and the Environment

18 rue Docteur Saadane, Algiers, Algeria

Tel: +213-2-71-12-20

Fax: NA

Email: None

Contact person: Minister Mustapha Benmansour

Topics covered: a b e h k

Ministry of Health

Rua Diego Cio, Luanda, Angola

Tel: NA

Fax: None

Email: None

Contact person: Minister Dr. Martinho Sanches Epalanga

Topics covered: b e i j

Ministère de l'Environnement, de l'Habitat et de l'Urbanisme

BP 01-3621, Cotonou, Benin

Tel: +229-31-21-00

Fax: NA

Email: None

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Topics covered: b e f g h j k

Ministry of Local Government, Lands and Housing - Dept. Town/Regional Planning

Private Bag 006, Gabarone, Botswana

Tel: +267-3S4100

Fax: NA

Email: None

Contact person: Minister Patrick Balopi

Topics covered: b e h j k

Ministry of Public Works, Housing and Town Planning/Ministère de l'Environnement et de l'Eau

Ouagadougou/BP 7044, Ouagadougou, Burkina Faso

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Telex: 5555

Fax: +226-31-53-83

Email: NA

Contact person: Minister Joseph Kaboré

Topics covered: b e h j k

### TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing



Ministry of Public Health/Ministry of Public Works and Equipment  
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Fax: +257-2-26840  
Email: None  
Contact person: Minister Charles Batungwanayo/Minister, Bernard Barandereka  
Topics covered: b e i i k

Ministry of Public Health/Ministry of Public Works  
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Tel: +237-22-29-01 / +237-22-01-56  
Telex: +8565/8653  
Fax: +237-22-01-56  
Email: NA  
Contact person: Minister Joseph Owona/Minister Jean Baptiste Bokam  
Topics covered: b e g j k

Ministry of Health  
Palácio do Governo, Varzea, Praia, Santiago, Cape Verde  
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Telex: 6059  
Fax: NA  
Email: None  
Contact person: Minister Dr. João Baptista Medina  
Topics covered: b e i j

Ministry of Public Works, Housing and Territorial Development  
Bangui, CAE, Central African Republic  
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Email: None  
Contact person: Minister Dieudonne Beket  
Topics covered: be k

Ministry of Public Health  
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Email: None  
Contact person: Minister Dangbe Laqubele  
Topics covered: b e i j

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

Ministry of Public Health and the Population  
BP 42, Moroni, The Comoros  
Tel: +269-73-2277  
Telex: 219  
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Email: None  
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Topics covered: b e j

Ministry of Equipment and Public Works/Ministry of Health and Social Affairs  
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Topics covered: b e f h i j k

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Topics covered: a b e h k

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Topics covered: b e i j

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TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
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BP 296, Djibouti  
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Topics covered: e f j

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Topics covered: b e h k

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Topics covered: a b e f g h i j k

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Topics covered: h k

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Topics covered: b e f h i j k

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

Ministry of Habitat, Lands and Urban Planning, and Welfare  
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Topics covered: b e h k

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Topics covered: b e f h j k

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Topics covered: a b c e f g h j k

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Topics covered: b e h j k

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Email: None  
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Topics covered: b e h j

TOPICS: a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing
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Topics covered: b e h i

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Fax: NA  
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Contact person: Min. Varlee Keita/Min. Vamba Kanneh  
Topics covered: b e

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Tel: NA  
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Topics covered: b e

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Contact person: Min. Olivier Amado  
Topics covered: b e h k

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

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Topics covered: b e h k

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Topics covered: a b c d e f g h i j k

Ministry of Public Works and Transport/Ministry of Urban Development and Housing  
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TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

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Topics covered: e

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Topics covered: a g h i j k

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Fax: +264-61-2972911 / +264-61-229936  
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Topics covered: b e h k

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Telex: 5533  
Fax: NA  
Email: None  
Contact person: Minister Sani Bawa/Minister Armstrong Kama  
Topics covered: b e h j k

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Fax: NA  
Email: None  
Contact person: Minister Dr. I.C. Maclubuilke  
Topics covered: b e i j

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

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Topics covered: be k

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Topics covered: b e j

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Topics covered: a b e g h k

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Topics covered: a b e j

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Topics covered: a b d e f h k

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Topics covered: b e j

TOPICS:

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

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Topics covered: a b d e h k

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Topics covered: b e j

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TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

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Topics covered: a b e f g h i k

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Topics covered: b e h k

Ministry of the Environment and Natural Resources  
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Contact person: Minister William Harrington  
Topics covered: b e f g h j Ilk

Ministry of Local Government, Rural and Urban Development  
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Telex: 22179  
Fax: NA  
Email: None  
Contact person: Hon. Minister John Landa Nkomo  
Topics covered: b e k

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
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## SECTION B. ASIA

Asia is an enormous and extraordinarily diverse region, characterised by widely varying MSWM practices. In this set of Regional Overviews and Information Sources, therefore, the description of the current situation for each of the 11 subtopics is divided into two sub-regions: “East Asia/Pacific” (encompassing Myanmar to the Pacific) and “South and West Asia” (covering from the Middle East to Bangladesh). Obviously, even these sub-regions are quite diverse, but the division serves to lend further order to the descriptions presented here.

Within the overviews for “South and West Asia”, there are many instances where the publication refers to smaller sections of this sub-region. Countries in the “northern” area include Syria, Lebanon, Israel, Gaza and the West Bank, Jordan, Iraq, Iran, and Afghanistan. The “central” area includes Saudi Arabia and the smaller Gulf states. The “subcontinent” refers to the Indian subcontinent (Pakistan, India, Sri Lanka, Nepal, Bhutan, and Bangladesh).

Note also that within the Information Sources section for Asia, this publication maintains the same structure as the Regional Overviews, presenting first the institutional sources of information from East Asia/Pacific and then from South and West Asia.

### A. Topic a: Waste Reduction

#### A1. EAST Asia/Pacific

MSW generation in the region has been increasing at a rate of 3% to 7% per year as a result of population growth, changing consumption patterns, and the expansion of trade and industry in urban centres. MSWM operations absorb large portions of municipal operating budgets, of which as much as 60% are for collection and transfer of the wastes for disposal. There is much discussion now about sustainable development through an integrated approach to waste management, including minimization of the production of wastes and maximizing waste recycling and reuse. Throughout the region, cities have been practicing source separation and recycling formally and informally.

Common recyclables include ferrous and nonferrous metals, construction debris, scrap tires, paper/ cardboard, plastics, textiles, glass, wood/timber, animal bones and feathers, waste oil and grease, and cinders.

In the economically more advanced urban centres of Australia, Hong Kong, Japan, Korea, and New Zealand a high degree of waste reduction, separation at source, and recycling is being brought about through public education, new practices (e.g., kerbside collection), and volume-based collection fees.

Korea implemented a volume-based fee system, which was extended to all towns in 1995. Waste generators must put out their wastes in bags bought from the municipality and must separate recyclables. Local governments are responsible for collecting the source-separated materials. These initiatives have resulted in a 20% to 30% decrease in wastes that require disposal.

Promoting the American concept of the “garage sale” as a means of waste reduction, some Japanese cities are now actively encouraging exchanges and gifts of unwanted clothes or daily

necessities within neighbourhoods. Osaka published *Osaka Recycling Monthly* to encourage exchanges, particularly of furniture and electrical goods.

*In the middle- and low-income cities of the East Asia/Pacific region, informal source separation and recycling of materials have always been practiced.*

The Hong Kong Productivity Council is promoting waste education in several ways. There are sophisticated waste trading businesses, some dealing internationally (for instance, used clothes export companies in Yokohama, Japan). These cities have specialised companies to collect recyclables for processing, sale, and export for reuse and recycling. For example, about 38% of the total MSW generated in Singapore is recycled by commercial companies. Although in this city-state waste materials recycled are largely from industry and commerce, commercially viable wastes such as papers, cardboard, textiles, plastics, and glass are collected from households. In Singapore, the Ministry of the Environment encourages private enterprises to set up recycling plants on land set aside at a closed dumping ground. There is little or no direct financial support from the government.

In the middle- and low-income cities of the East Asia/Pacific region, informal source separation and recycling of materials have always been practiced. This means that people have made work and enterprises from gathering, trading, and reprocessing materials.

Materials separated or picked out from mixed wastes include ferrous and nonferrous metals, papers/cardboard, glass, plastics, clothing, leathers, animal bones/feathers, books, and household goods (which are repaired and sold in secondhand markets). The main recyclables are purchased by street peddlers. Street peddlers sell to small and larger dealers and wholesalers, which may be registered businesses or not, according to the size of the business and the type of local economy. In Bangkok, Jakarta, and Hong Kong there are some very large industries dealing entirely with recyclable materials such as papers, ferrous metals, plastics, and glass. In the Pacific islands, repair and reuse are important and recycling industries are relatively small-scale.

In the People's Republic of China and in Vietnam, waste recovery and recycling has been organised at the city level and supported by national ministries. In China, especially, the major cities have large recovery companies that collect recyclables from offices, institutions, and factories. There are also neighbourhood redemption centres where people can sell bottles, paper, and clothes. State policies govern the trading of materials and prices and these companies are often inefficient. Since the new economic policy, they have preferred to deal mainly in profitable materials, such as metals, and not in most household recyclables. Other materials are now collected and traded by private entrepreneurs who may either sell to the government companies or directly to factories. The neighbourhood redemption centres have declined and as a result, more recyclables are put out as waste by residents. There are new attempts to deal with household recyclables, such as the source separation being organised in residential complexes in Shanghai.

In Hanoi and Ho Chi Minh City, a greater part of waste recovery and recycling is in the hands of family businesses. In Hanoi, there are close connections to particular rural villages from which most of the waste traders come. A notable feature of this sector in Ho Chi Minh City is that 50% of the operators are women; women are also prominent in Hanoi. This may be the result of the traditional trading culture and the opportunities that women gained in both government service in solid waste management and informal waste trading during the war period, when most men were in military service.

Several cities in Southeast and East Asia have experimented in a small way with source separation. Bangkok, Hanoi, Ho Chi Minh City, Shah Alam (Malaysia), and Shanghai have all tried it in selected neighbourhoods but none of them has persisted, as too many problems were encountered. . Support for community organizations to promote source separation was funded under UNEP's Asia-Pacific 2000.

The quantity of one material, plastic, has surpassed the recovery capacity of even the high-recycling cities. When plastics first started increasing in packaging in China, any piece of plastic was prized by waste buyers and pickers. Now, the larger cities of China are beginning to experience the proliferation of plastic waste that is so problematic in Hong Kong, Indonesia, the Philippines, South Korea, and Thailand. Even in Yangon, where inorganic wastes are minimal, increasing numbers of small plastic bags are found in open drains.

## A2. WASTE Picking and Cooperatives

Some materials are segregated from mixed wastes, often at garbage dumps. The number of scavengers is increasing as more recyclables reach dumpsites. At one point, at Manila's well known Smoky Mountain dump, it was reported that over 10,000 families lived in shacks built on or adjacent to old dump land. Occasionally cities in developing countries attempt to ban scavengers from dumpsites to discourage dependence on waste recovery as a livelihood, but it has proved impossible to enforce such regulations. The Manila dump in question was closed and while some of the scavengers have moved to nearby housing units, others now live at other dumpsites such as the one in Quezon City (Payatas).

Scavengers, who used to be relatively few twenty years ago in China, are on the increase. The influx of rural migrants to the cities has contributed to this trend. Most of the pickers are members of poor families with little or no formal schooling; they are often illegal immigrants from rural areas or even other countries. The incomes of these scavengers range from as low as US\$0.40 to around US\$3.00 a day. Some cities in Indonesia have introduced licensing of scavengers at dumpsites in an attempt to control the practice. Licensing has met with mixed success, in some cases being welcomed at first but then encountering resistance.

Organizations working with scavengers argue for better recognition of the usefulness of waste recovery to developing societies, and for humane treatment of pickers, who are usually regarded as illegals, thieves, and vagrants. In 1989, the president of Indonesia made a statement pleading for recognition of the valuable role of scavengers, and since then there have been many programs in the main cities of Java, some of them with international aid funds, to assist pickers in various ways. They aim to overcome the social prejudice that restricts pickers' ability to improve their status, acquire new skills, take alternative work, or simply move up the ladder to become buyers, dealers, or processors.

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The attempts to assist and improve the informal sector of waste recovery and recycling often take the form of promoting cooperatives. One such scavengers' cooperative operated at Bangkok's On Nooch dump in the 1980s until the dump was closed. A proposal from the Philippines comes from a group of community organizations, in collaboration with the Vincentian Missionaries, who are working with picker communities around the Payatas dump in Quezon City. They aimed to establish a materials recovery centre that would sort and process recyclables, in conjunction with source separation programs in surrounding neighbourhoods.

Another form of cooperative organization in Manila is that of waste dealers (known there as junk dealers). The Metro Manila Women Balikatan Movement has assisted dealers to improve the purchase of source-separated household materials and to make connections with recycling factories. From a small start in the San Juan area, the program now covers several cities in Metro Manila, and about 200,000 households are contributing materials.

There is ongoing discussion of whether informal private activities should be linked in some way to official solid waste management: for instance, whether municipalities should encourage source separation without carrying out collection of recyclables, and whether scavengers should be permitted to pick at transfer stations.

In summary, formal and informal source separation and recycling of most inorganic manufactured materials are significant in the region. The practice is essentially market-driven; industries have been interested in using recycled materials only when the cost of doing so is less than the cost of using virgin materials. As will be discussed below, however, reliable markets for organic wastes have not been developed as yet.

### A3. INFORMATION Sources in East Asia/Pacific on Topic a, Waste Reduction:

- Asian Productivity Organization (APO)
- Asian Society for Environmental Protection (ASEP)
- Center for Advanced Philippine Studies
- Cooperative Research Centre for Waste Management & Pollution Control
- Department of Environment & Natural Resources - Philippines
- Department of Environment - Malaysia
- Department of the Environment & Heritage - Australia
- Development Academy of the Philippines
- Development Technology Center of the Bandung Institute of Technology
- Economic & Social Commission for Asia & the Pacific (ESCAP)
- Engineering Services Department - Singapore
- ENSIC (Environmental Systems Information Center)
- Environment Protection Department - Hong Kong
- Environmental Health Department - Singapore
- Environmental Impact Management Agency (BAPEDAL) - Indonesia
- Environmental Protection Administration - Taiwan
- Environmental Technology Institute (ETI) - Singapore
- Global Environment Centre Foundation (GEC)
- Hanoi Urban Environment Company (URENCO)
- Hong Kong Productivity Council
- Institute of Public Health - Japan
- International Environmental Planning Center (INTEP)
- Japan Sewage Works Agency
- Japan Society of Waste Management Experts (JSWME)
- Japan Waste Management Association
- Korea Advanced Institute of Science & Technology (KAIST)
- Ministry of Construction - China
- Ministry of Development - Brunei Darussalam
- Ministry of International Trade & Industry (MITI) - Japan
- Ministry of Public Works - Indonesia



- Ministry of Science, Technology & Environment - Thailand
- National Institute of Environmental Research - Korea
- National Solid Waste Management Commission
- Policy & Planning Department Thailand
- Pollution Control Department - Singapore
- Regional Institute of Environmental Technology (RIET)
- Regional Network for Management & Utilisation of Wastes
- Shanghai Environmental Protection Bureau
- South China Agricultural University
- South Pacific Regional Environment Programme (SPREP)
- State Environmental Protection Agency - China
- United Nations Centre for Regional Development (UNCRD)

#### A4. SOUTH and West Asia

The low-income countries of South and West Asia illustrate the operation of a hierarchy of waste minimization based on frugal habits, resource scarcity, and poorly paid workers. Repair industries are important in waste reduction in such countries; secondhand markets thrive, some being very large, such as those in Bombay, Calcutta, and New Delhi. There are complex networks that serve the recovery and recycling of synthetic materials, inert wastes, and organics. Every useful sort of household, shop, or institutional waste is reused or traded. Materials include clothes and rags, small goods, bottles, plastics of all kinds (especially milk pouches), metals, toys, and cinders from coal fires. Food wastes are sold to poultry and pig farmers, and such wastes from large hotels are auctioned in big cities like New Delhi. Construction wastes are reused and the residues are taken as fill for road repairs.

In nearly every country of the region, the private informal sector (comprised of scavengers, buyers, traders, and recyclers) is significant in recovery and recycling. Clean, saleable components are separated in homes, offices, institutions, and shops; they are sold to itinerant waste buyers and nearby dealers. Waste components are segregated on streets and at transfer points by street scavengers and finally at disposal sites. The materials are largely recycled in small informal industries, but even large industries participate in waste exchange and the purchase of used materials as feedstock.

Some typical examples of the informal recycling industries are those that recycle broken glass into bottles, waste plastics to toys and shoes, and waste paper to paperboard. The activities are mainly driven by the scarcity and expense of raw materials.

In societies with significant levels of absolute poverty, poor people depend upon wastes for fuel, clothing, building materials, and even some food; recovery and recycling provide many income-earning opportunities for uneducated people. The large numbers of children working at waste picking and sorting is a matter of concern.

NGOs in these poorer countries have assisted scavengers in forming cooperatives to obtain source-separated wastes. The best known example is the work of the Self Employed Women's Association in India. Cooperative organization in waste management, however, is not developed to the extent that it is in the Andean countries of Latin America.

In the northern part of the region, which is characterised by lower-middle-income economies, informal waste picking is not as thorough as in the Indian subcontinent, but the characteristics of traditional economies are not entirely lost. The Palestinian settlements in Gaza and the West

Bank have been sites of intensive repair, reuse, and recycling since their inception. Waste separation at the household level with trade to itinerant buyers still takes place. There are also small-scale recycling industries for plastic, paper, and glass in the region, whereas scrap metal is recycled locally or transported to re-rolling mills of other countries.

In Israel, the informal sector has declined and the high quantity of recyclables reaching waste streams has necessitated government sponsorship of recovery and recycling. Recycling has been emphasised since 1993 (under the Collection of Wastes for Recycling law) to reduce waste quantities going to the landfills. A number of recycling centres (dropoff centres) operated successfully in Israel, where people can leave textiles, paper, and cardboard, and in Tel Aviv and Jerusalem there was kerbside pickup of papers in boxes supplied by the authorities. The Ministry of Environment set a target of a 25% reduction of waste quantities by weight by 2000. These goals are supported by a number of feasibility studies, research, pilot projects, and incentives to commercial recycling.

*In nearly every country of the region, the private informal sector (comprised of scavengers, buyers, traders, and recyclers) is significant in recovery and recycling.*

In the central part of the region, recycling and source separation are similarly promoted as government policy. There are some experiments with source separation of household waste, householders being encouraged to bring recyclables to dropoff depots. For example, in Dubai, dropoff centres accept paper, cardboard, aluminium, and PVC bottles. Large-scale recycling industries for paper and glass have received incentives. In Saudi Arabia, an industry has been supported to convert waste paper into egg trays. Another company in Sharjah, UAE processes plastic into rubbish sacks. Central governments endorse recycling industries in principle, but financial support (such as tax rebates) varies from country to country.

A waste transfer station at Petah Tikvah, in Israel, also serves as dropoff centre, receiving paper, packaging, and plastics. In the poorer countries, where there are numerous scavengers, it is common to find the same result achieved informally, with the pickers working over mixed wastes. The quantities and quality of recyclables are, of course, lower.

In many places, animals play a significant role in the reduction of organic wastes from going to the landfill, especially smaller cities and towns. Cattle, pigs, goats, dogs, cats, poultry, and crows feed regularly from garbage piles and open vats; animals kept in squatter areas, such as goats, sheep, and pigs, are fed household vegetable wastes. It has been calculated that up to 50% of domestic and restaurant organics are fed to animals. There is likely to be resistance to schemes for “wet/dry” separation and composting in areas where household organics are needed as animal feed. If the population of animals declines as such cities modernise, the organic fraction of MSW will increase.

Throughout the region, discussions are beginning on source reduction of certain materials. India, for instance, has put plastic waste on a restricted list and the Department of Chemicals and Petrochemicals is considering ways of reducing plastic wastes; Bangladesh is discussing limits on plastic packaging.

The many activities of repair, recovery and recycling in South and West Asia mean that the wastes finally disposed of by most municipalities have high percentages of organics, dirt, and in some places, ashes. If compost could be produced and sold in these areas, landfill space requirements would be reduced.

## A5. INTERNATIONAL Waste Trading

Recyclable materials are extensively traded, even internationally, particularly in the subcontinent. For instance, almost all the recyclables of Nepal are exported to India, this trade being controlled by Indians. Surplus materials from Calcutta are exported to Bangladesh. One of the most lucrative cross-border trades used to be that from Afghanistan to Pakistan, in used war materiel.

India imports large quantities of waste paper from western countries. There are proposals to expand importing, and such trade is eagerly sought by some western countries. Environmentalists are concerned that this trade may allow the importation of hazardous wastes (in violation of the Basel Convention), and social advocates fear that people who earn a living picking or trading local wastes would lose out, since the demand for these materials might decline.

## A6. INFORMATION Sources in South and West Asia on Topic a, Waste Reduction:

- All India Institute of Hygiene & Public Health (AIHP)
- All India Institute of Local Self Government (AIIISG)
- Asian Health, Environmental & Allied Databases (AHEAD)
- Centre for Environment Education (South) (CEE)
- Centre for Environmental Health Activities (CEHA)
- Development Alternatives
- International Centre for Diarrhoeal Diseases Research (ICDDR)
- Karachi Administration Women Welfare Society (KAWWS)
- Mythri Foundation Waste Wise Project
- Orangi Pilot Project (OPP)

## B. Topic b: Collection and Transfer

### B1. EAST Asia/Pacific

Collection and transfer usually dominate solid waste management costs in cities of the region. MSW collection and transfer in the East Asia/Pacific region is, in general, still the responsibility of the public sector, although there is a trend toward contracting out some services.

Various collection and container systems are used. There is both door-to-door collection and indirect collection, with containers/communal bins placed near markets, in apartment complexes, and in other appropriate locations and hauled to transfer stations and disposal sites by vehicles.

In cities of industrialised countries such as Australia, Hong Kong, Japan, New Zealand, and Singapore, collection and transfer services are capital-intensive and mechanised. Container sizes are standardised, as are collection vehicles and large onsite containers, which may also be fitted with compactors. There are regulations governing source separation and separate collection of recyclables. Collection is extended to all areas. Large trade and industrial establishments are responsible for the collection and disposal of their solid wastes. Private collection firms are contracted by small and medium enterprises. Collection coverage is good, reaching about 90%.

In all medium and large cities of the region, there are administrative structures for MSW collection and transfer services. The frequency of collection ranges from once or twice a week to daily collection. Collection crews are directly employed with fixed working hours, holidays, and other benefits.

*There is a wide variation in collection rates among countries in the region. In some cities, there is great disparity in collection service between richer and poorer areas, whereas other cities have made enormous progress in ensuring collection service for all.*

In developing countries, collection and transfer are labour-intensive, although all large cities maintain a fleet for motorised collection. In multi-story buildings, dust chutes are used for transfer to bin centres or collection vehicles. Manually or mechanically loaded compactors are often used in markets and commercial establishments. Where the solid waste authority accepts responsibility for collecting from congested areas, handcarts are used and communal bins are placed at appropriate locations for deposit and storage. Most vehicles and onsite large storage containers are not fitted with compaction equipment, as the density of the wastes is normally high. While large, stationary containers save municipal labour and transport costs, they create a temporary disposal problem: the bins are too high for children to reach, so much waste is discharged around the containers; the messier the site becomes, the fewer people attempt to approach the containers; if the containers are not emptied frequently enough, the sites become informal dumpsites. Often, collection crews are not responsible for picking up waste that is not in the containers (this being the work of street sweepers) so the container site may remain messy and obstructed even after a new container is placed there.

In the poorer countries of the region, collection rates can be lower than 50%. However, Bangkok, Jakarta, Kuala Lumpur, Seoul, and Shanghai, for example, all collect more than 80% of the waste generated. There are, of course, disparities in collection service between rich and poor areas.

Primary collection organised in a decentralised way is, in some cases, very useful in raising collection rates. For instance, as part of the formal system of waste collection, the kampungs (“villages”) of Indonesian cities have responsibility for primary collection; the wastes of the area are deposited at a transfer or temporary storage point for collection by the city service. Indonesia now has a good system of MSW collection.

Still, in some countries, collection service is not extended to the poor, especially those in illegal settlements. The reasons given by the authorities are that these residents are unable to pay for the service, or that the settlements are situated in places that collection vehicles cannot go. (Even in Vietnam, where the authority is willing to provide service to all residents, up to 30% of some places may not be served due to inaccessibility.). Another reason in some cities is that waste collection crews often supplement their wages by waste trading; there are fewer recyclables in poor areas and therefore collection crews are not as motivated to serve them.

In the large cities of the People’s Republic of China, equipment (vehicles, bins) is mostly supplied from national manufacturing plants, in contrast to the smaller developing countries, which have to import equipment. Hence, China has been able to design equipment more appropriate to the waste and local characteristics of most of its cities. Yangon, by contrast, has imported secondhand compactor vehicles from Singapore that were manufactured in Japan. The compaction machinery is not used, however, as the MSW is not suitable for compaction. Where equipment is imported, up to 50% of the vehicles may be out of operation at any one time because parts are not available for repairs.

Some Chinese cities (e.g., Shanghai and Beijing) have quite well structured systems for collection, transport, treatment, and reuse of MSW. However, a weak link in collection and transportation in Chinese cities is the lack of good transfer stations.

In large cities where the disposal sites are located far from cities, transfer stations are used to put wastes collected from several points into larger vehicles. Transfer stations often serve as processing centres where recyclables are separated for recycling/reuse. The stations of cities in industrialised countries are usually mechanised, with adequate operation and maintenance programs. Most developing countries have insufficient and inadequately designed transfer stations. In any case, they would tend to use less mechanised equipment, because the denser wastes characteristic of the poorer of these countries cannot be compacted very much.

*Privatization of collection is a significant trend in the region. This has occurred to a much lesser extent with transfer stations.*

Increasingly, collection services are being privatised. In the region as a whole, roughly 20% of collection service is now contracted to private waste collection companies. This practice is gaining momentum, especially in countries such as Indonesia, Korea, Malaysia, Singapore, and Thailand. In Singapore, as elsewhere, the main motivation for privatization is cost savings; the cost of collection and disposal of refuse tripled during the last decade to more than US\$700 million. In 1994, a private limited company was created by the Ministry of the Environment, with an authorised capital fund of US\$250 million, to take over the collection unit of the Ministry of the Environment starting in 1996. Privatization of transfer stations in the region has occurred to a much smaller extent.

Financial constraints and the lack of education and training severely limit collection and transfer services in the cities and towns of poorer developing nations. Shortages of collection vehicles, inadequate transfer points, traffic congestion, and lack of public compliance are factors affecting collection efficiency, resulting in low waste collection rates. In some cities, heaps of refuse are routinely left uncollected; there are illegal deposits on open land, drains, and canals. The lack of coordination and overlapping of responsibility among government agencies and different levels of local government also contribute to the problem. Such deficiencies have contributed to serious degradation of the environment, have led to deteriorating urban health conditions, and have hurt the quality of life.

The role of women in MSWM needs recognition. Homemakers manage the garbage in the households, pay for the collection service, and very often separate recyclables and sell or barter them to itinerant waste collectors.

Both the informal collection by itinerant buyers in cities of developing countries and specialised collection and recycling industries in cities of industrialised countries play a significant role in reducing wastes for collection.

Research and development of alternatives to conventional MSWM systems are needed in some countries, as western-style technology and organization is not well suited to the economy and society. To date, there have been two main areas of discussion: appropriate equipment and organization for collection from congested areas, and how to retain the useful aspects of informal waste recovery and trading while reducing the problematic ones.

## B2. INFORMATION Sources in East Asia/Pacific on Topic b, Collection and Transfer:

- Asian Society for Environmental Protection (ASEP)
- Center for Advanced Philippine Studies
- Department of Environment - Malaysia
- Department of Environment & Natural Resources - Philippines
- Department of the Environment & Heritage - Australia
- Development Technology Center of the Bandung Institute of Technology
- Economic & Social Commission for Asia & the Pacific (ESCAP)
- ENSIC (Environmental Systems Information Center)
- Environment Protection Department - Hong Kong
- Environmental Health Department - Singapore
- Environmental Protection Administration - Taiwan
- Hanoi Urban Environment Company (URENCO)
- International Environmental Planning Center (INTEP)
- Japan Sewage Works Agency
- Japan Society of Waste Management Experts (JSWME)
- Japan Waste Management Association
- Ministry of Construction - China
- Ministry of Development - Brunei Darussalam
- Ministry of International Trade & Industry (MITI) - Japan
- Ministry of Public Works - Indonesia
- National Institute of Environmental Research - Korea
- National Solid Waste Management Commission
- Policy & Planning Department Thailand
- Regional Institute of Environmental Technology (RIET)
- Shanghai Environmental Protection Bureau
- South China Agricultural University
- South Pacific Regional Environment Programme (SPREP)
- State Environmental Protection Agency - China

## B3. SOUTH and West Asia

While there is considerable variation in collection and transport systems in South and West Asia (not only from country to country, but within sections of one urban area) there are common issues. The most important issue in collection for most countries of the region is the irregularity or lack of municipal service for squatter settlements or congested low-income areas. Another general problem in all but the richer countries is the unnecessary handling of wastes (time consuming procedures that carry high health risks for workers), which is partly a result of simple equipment and partly due to the lack or paucity of designed transfer points.

*Major public health concerns arise from the fact that many dense, urban settlements are not entitled to any service, since the residents are squatters and the city government does not wish to legitimise their presence by providing waste services.*

Collection rates vary from 20% to 90% of municipal wastes. The frequency of scheduled collection is partly governed by climate, and by the system in use. In the Indian subcontinent, temperatures are high and the system is often “open” (i.e., the street containers and transfer points are not covered and waste is exposed to the elements). In such circumstances, daily or even

twice-daily collection is required. In those parts of the central and northern areas where there is kerbside or door-to-door collection, collection may be less frequent, although regular.

Irregular and inadequate collection is usually a function of the legal and economic status of the neighbourhood. Many illegal settlements are not entitled to waste services. A contributing factor is that municipal collection crews have less incentive to pick up garbage from poor neighbourhoods as the wastes contain fewer recyclables that the collectors can sell.

In the prestigious areas of larger cities waste is contained, streets are swept regularly (sometimes with mechanical sweepers), and transfer points are adequately maintained. Often a disproportionate amount of funds is spent on meticulous sweeping of such areas, while basic collection and street sweeping is neglected for the poorer ones.

Apart from the problems of collecting waste from slum areas and squatter settlements, collection systems often break down at food markets, where large quantities of wastes contain rotten foodstuffs. With inadequate management, conditions at such markets create health risks and nuisances to vendors and shoppers.

War, civil disturbance, and labour unrest periodically or chronically affect the frequency and quality of municipal service in a number of the countries of South and West Asia. The most serious disruption has been in Afghanistan, where the managerial and physical infrastructure for MSWM has been devastated. Strikes by municipal unions have been serious at times in India; the desire to avoid strikes has led managers to agree to union demands regarding the size of collection crews, pay, and duty scales. The disruption of city services by disturbances has been chronic in Bangladesh for a few years.

In most cities and towns of the subcontinent, the municipality is not responsible for collecting refuse from houses and small shops; rather, people are required to deposit their wastes in communal containers (stationary or haul types), from which it is collected by municipal crews. House and shopkeepers frequently make private arrangements, usually with the municipal sweepers, to have their garbage taken to the containers or transfer points. The small monthly fees are a welcome supplement to the low wages of these workers, but this activity is not supervised and may be poorly performed. Citizens' groups are organizing in several cities to hire regular collectors to ensure that household wastes are taken to collection points (e.g., Civic Exnora street-beautifying groups in places like Madras and Baroda).

*There is often a large disparity in street sweeping services provided to rich and poor areas.*

A collection point may be a container, a concrete vat, a roadside, or an open area. The type of vehicles used varies from city to city, and within one urban area, according to the type of container system and the funds available for purchasing or hiring vehicles. For example, in large cities, open flatbed trucks, covered trucks, and some compactors are in use, whereas in smaller cities tractor-trailers and animal carts are common.

Collection and transfer in the low-income and northern middle-income economies is still labour-intensive, although in certain large cities there is a trend towards hydraulically lifted or roll-on, roll-off containers to reduce handling. There are a few experiments with kerbside and house-to-house collection in high-income areas. In areas of Tel Aviv and Jerusalem, the authority supplies containers to households; these containers are lifted hydraulically and emptied into compactor trucks. In the larger cities of countries like Jordan and Syria, waste is generally disposed of in plastic bags and collected from houses, except in very congested areas.

With the exception of Israel and the oil-rich cities, the working conditions for municipal sweepers and collection crews leave much to be desired and affect the efficiency of service and the health of workers and the public. Workers lack appropriate protective clothing, equipment, and washing facilities, and they are inadequately supervised. Because of the infectious and hazardous substances in waste streams, the lack of protection and washing facilities greatly increases the risks for workers, as has been shown in the rare studies of workers' health.

Managed, purpose-built transfer stations are found in some large cities, such as New Delhi and Bombay. In most cities and towns, MSW is transported to disposal areas after collection from the street transfer points. With the spatial spread of urban settlement, solid waste managers express the need for more transfer stations, and the large cities are all now planning these. Building transfer stations in cities is often constrained by unavailability of suitable land, lack of funds, and public objections to the proposed facilities.

#### B4. INFORMATION Sources in South and West Asia on Topic b, Collection and Transfer:

- All India Institute of Hygiene & Public Health (AIHP)
- All India Institute of Local Self Government (AIIISG)
- Applied Research Institute - Jerusalem
- Asian Health, Environmental & Allied Databases (AHEAD)
- Centre for Environmental Health Activities (CEHA)
- International Centre for Diarrhoeal Diseases Research (ICDDR)
- Karachi Administration Women Welfare Society (KAWWS)
- Mythri Foundation Waste Wise Project
- National Environmental Engineering Research Institute (NEERI)
- National Housing Development Authority (NHDA) - Sri Lanka
- Orangi Pilot Project (OPP)
- Rajkot Municipal Corporation (RMC)

### C. Topic c: Composting

#### C1. EAST Asia/Pacific

Backyard composting is a longstanding tradition in countries like Australia, Japan, and New Zealand, especially in rural towns. Now it is being promoted by local governments, with inexpensive compost bins being made available, along with “how-to” leaflets and demonstrations. Garden and park waste are also being composted by solid waste authorities to reduce wastes for landfilling.

A large portion of the household organic wastes in Asia is eaten by animals or fed to pets. In cities like Hong Kong, Bangkok, Manila, Cebu, and most cities and towns of China and Vietnam, pig and poultry farmers routinely collect food wastes from households and restaurants for animal feed. In some small Chinese cities, pigs are released on garbage dumps to reduce organic wastes. However, pig keeping itself often leads to pollution of streams and rivers and has been banned, for example, in Singapore.

Many of the large cities of the developing countries in the region in the past installed imported mechanical composting plants (for instance, built six). Most are now closed and the remaining ones are not operating at full capacity (e.g., Bangkok, Hanoi, Shanghai, and Tokyo). The reasons why centralised mechanical MSW composting plants are not functioning effectively, are



underutilised, or are closed down include: a) high operating and maintenance costs compared to open landfilling (including foreign exchange costs for replacement parts of imported plants); b) the cost of compost is higher than commercial fertilisers (both cost to purchase, and labour cost to apply to the fields); c) incomplete separation of materials such as plastic and glass, making the compost poor for agriculture application; and d) poor operation and maintenance of the facilities.

The traditional open-air windrow process is used in some countries, especially China. In many Chinese cities and towns, there are no garbage dumps, the wastes being delivered directly by collection vehicles to peri-urban farms. The farmers are instructed to compost the waste in windrows or pits for a prescribed period of time, but they often do not do this if they are in urgent need of the organics. It is difficult for the authorities to monitor the farmers' practices. The compost is also increasingly contaminated with plastics and broken glass.

*In several countries, it is common practice to remove compost from dumps or to farm on old dumpsites.*

It is a common practice for farmers in China and Myanmar to go to garbage dumps and remove compost. The Beijing Sanitation Department used to facilitate this practice by supplying sifting machines at the main dumpsite. Both Ho Chi Minh City and Medan allowed the mining of compost from dumpsites for a fee. With recent rapid increases in industrialization, these practices will require greater scrutiny unless there is effective control of toxic substances in the waste stream.

Small-scale, neighbourhood composting is being promoted through research and pilot projects, especially in Java. There have been experiments for over a decade, and now some small private enterprises have been established in Jakarta that are supplying compost to estate gardens and golf courses. In Bandung, there is a type of box windrow composting at one garbage dump.

There are many technical and aesthetic problems to be solved in the composting of MSW. As one small example, an important, privately run vermiculture experiment in Indonesia failed when toxics in the MSW killed the earthworms.

Basic training and education of workers in technical, health, and safety aspects is essential. With better understanding of the composting process, improved processes, and public education, composting should increase at least in cities where sites and a skilled workforce are available, and markets can be developed. The cost of compost, whether used as fertiliser or soil conditioner, is still problematic when compared to costs of synthetic fertiliser/soil conditioner, and this has become a major factor for decision-makers.

Composting can be viable, especially for smaller cities with intensive agricultural areas near cities. Many international agencies and environmental consulting firms are offering Asian cities technology for composting as the process is increasingly gaining importance in all parts of the world. An issue here is whether or not the equipment offered is appropriate for the wastes of that particular place.

Biogas technology is well known in smaller towns in rural areas in China through government policies of comprehensive utilization of wastes. However, these biogas digesters use human and animal faeces as the main feedstock. Some agricultural wastes may be added. The number of biogas digesters in rural towns is declining with the breakup of communes. Household-level

digesters have not proved practical. The potential remains for anaerobic digestion of wastes, but organizational problems need to be overcome.

## C2. INFORMATION Sources in East Asia/Pacific on Topic c, Composting:

- Asian Productivity Organization (APO)
- Asian Society for Environmental Protection (ASEP)
- Center for Advanced Philippine Studies
- Cooperative Research Centre for Waste Management & Pollution Control
- Department of Environment - Malaysia
- Department of Environment & Natural Resources - Philippines
- Department of the Environment & Heritage - Australia
- Development Technology Center of the Bandung Institute of Technology
- Economic & Social Commission for Asia & the Pacific (ESCAP)
- ENSIC (Environmental Systems Information Center)
- Environment Protection Department - Hong Kong
- Environmental Impact Management Agency (BAPEDAL) - Indonesia
- Environmental Protection Administration - Taiwan
- Environmental Technology Institute (ETI) - Singapore
- Global Environment Centre Foundation (GEC)
- Hanoi Urban Environment Company (URENCO)
- Institute of Public Health - Japan
- International Environmental Planning Center (INTEP)
- Japan Sewage Works Agency
- Japan Society of Waste Management Experts (JSWME)
- Korea Advanced Institute of Science & Technology (KAIST)
- Ministry of Construction - China
- Ministry of International Trade & Industry (MITI) - Japan
- Ministry of Science, Technology & Environment - Thailand
- National Solid Waste Management Commission
- Policy & Planning Department Thailand
- Regional Institute of Environmental Technology (RIET)
- Regional Network for Management & Utilisation of Wastes
- Shanghai Environmental Protection Bureau
- South China Agricultural University
- South Pacific Regional Environment Programme (SPREP)
- State Environmental Protection Agency - China

## C3. SOUTH and West Asia

Since the organic fraction of the waste stream is high in most places, there is considerable interest in composting of MSW in the region, and a long history of experiments with composting. Large-scale centralised composting (as distinct from neighbourhood composting) has had little success; pure anaerobic digestion has been tried rarely and only in pilot projects in the region.

In the 1960s, many mechanical compost plants were constructed, often promoted by foreign firms. In India, the central government gave grants to eight cities to install plants (of foreign design, with imported parts) and the principal cities in the northern and central countries of the region built similar plants. Almost all of these are now not operating or are operating at a fraction

of capacity, because they were unsuitable for the local wastes, parts and skilled operators were not available, and/or the product was too expensive or not good enough to secure markets.

*Mechanised composting plants imported to India have not worked well. There are other ongoing experiments in the region that do show promise.*

Although one of New Delhi's plants has been closed, another is still operating. The compost is absorbed by the city's parks department, an example of how city procurement policies can help the marketing problem. In Kathmandu, the compost from a municipal plant was in high demand by local farmers in the late 1980s and early 1990s, and the plant continued with a simple windrow system after the machinery broke down. It was forced to close when residents of new housing estates protested.

Private firms, alone or in public-private partnership, have revived centralised composting in a few places. Bangalore's windrow compost plant is reported to be cost effective since privatization, although there are now NIMBY ("Not In My Back Yard") pressures at the site. Experiments were conducted with new techniques for producing compost by processing partly decomposed wastes at dumpsites (being done by a private company subsidised by the Bombay and Ahmedabad municipal corporations).

In some middle- and high-income economies, private firms are also reported to be operating effectively and are able to market the compost locally or to other countries. In Sharjah, UAE, a compost plant is run by the municipality; there are, however, marketing constraints. In Israel, the Ministry of Environment reported that 20,000 metric tons of organics were converted into compost annually. Analysis of the compost from some plants in these areas, however, has shown high levels of contaminants, especially from nickel-cadmium batteries.

Backyard composting is casually practiced in areas where there are home gardens, the bulk of the input material being yard waste. This practice has been strongly discouraged by city health officers (for instance in Bangalore) after complaints about rodents. Consequently, backyard composting has declined in the past few years.

In the past decade, several projects have been initiated for small-scale, neighbourhood-level composting. In Bangalore, the Waste Wise Project of the Mythri Foundation and the Centre for Environmental Education combined vermiculture with composting on a small scale on land provided in local parks by the City. Bangalore University provided advice on vermiculture. Pilot research and development projects for the region are included in the current UNCHS project on small-scale digestion and composting of MSW.

The natural process of decomposition at waste disposal sites is commonly exploited by farmers and sometimes by the municipal corporations in cities and towns of the Indian subcontinent. Farmers go to dumps to remove compost, thus extending the life of the dumps. The Corporation of Calcutta leases out dump land at the city's main dump for vegetable farms. Small dumps near squatter settlements are regularly farmed. There are no studies of possible health risks from these practices.

*Vegetables are grown on dumps, and farmers remove compost from dumps for use on their land.*

The subcontinent has wide experience with anaerobic digestion of cattle dung, and it was assumed that similar digesters could be adapted to ferment MSW, but producing animal dung-like slurries from urban organic waste proved energy-intensive and the product was poor. A major

problem with anaerobic digestion is that MSW used as feedstock tends to float. A number of design changes have to be achieved to produce small-scale digesters. Research was conducted in Bangalore at the Indian Institute of Science, but there are no reports of successful large-scale anaerobic digestion of MSW.

#### C4. INFORMATION Sources in South and West Asia on Topic c, Composting:

- Asian Health, Environmental & Allied Databases (AHEAD)
- Centre for Environment Education (South) (CEE)
- Centre for Environmental Health Activities (CEHA)
- Development Alternatives
- International Centre for Diarrhoeal Diseases Research (ICDDR)
- Ministry of the Environment - Israel
- Mythri Foundation Waste Wise Project
- National Environmental Engineering Research Institute (NEERI)
- Tata Energy Research Institute (TERI)

#### **D. Topic d: Incineration**

##### D1. EAST Asia/Pacific

Incineration processes are capital-intensive and a skilled workforce is required for operation and maintenance. Up-to-date, full-scale incinerators are currently in service only in cities of more industrialised countries such as Australia, Hong Kong, Japan, Singapore, South Korea, and Taiwan. High capital investment, high operating and maintenance costs, and stringent air pollution control regulations have severely limited the use of incineration for disposal.

Singapore operates three plants, all of the same design, incinerating about 90% of the daily quantity of MSW collected. No sorting of wastes is carried out before the MSW is fed to the incinerators (except that bulky wastes are crushed). The wastes are mixed and burned using rotating roller grates. Auxiliary oil burners are used to start up the combustion process. Combustion is self-sustaining in some cases, while at other times wood is added. In general, the combustible fraction of MSW is high and in some instances has been raised by moisture-reducing compaction at transfer stations. Total electrical energy recovered from the plants is about 60 MW (250 to 300 kwh/tonne MSW incinerated), some of which is used to run incinerator operations.

Incineration plants in Japan, South Korea, and Taiwan are of similar design to those of Singapore. Hong Kong has closed its incinerators because they could not meet air pollution standards, but new facilities are under consideration. Authorities in South Korea are concerned about local opposition to incinerators and are exploring ways to resolve such conflicts. Plans there called for the incinerated portion of the waste to rise from 3% in 1994 to 20% by 1999.

There are many incinerators in Japan: Tokyo alone has thirteen. Some MSW incineration facilities in Japan are of two stages: pyrolysis, followed by thermal combustion. Some Japanese cities have made their MSW incinerators the centre of community complexes with indoor gardens, meeting halls, secondhand shops, and offices of NGOs.

*Industrialised countries of the region use incineration extensively, and some of them are planning to increase their reliance on incineration.*

Modern MSW incineration plants operate quite well in cities of industrialised countries, recovering energy in the form of steam for heating and for electricity generation. Incineration will remain popular in cities like Singapore, Hong Kong, Taipei, and Tokyo, as there is a serious lack of sites suitable for landfills. There is, however, controversy about greenhouse and other gases released by incineration.

In the developing countries, however, there have been many problems with imported incinerators. Some are not operated at a high enough temperature to destroy pathogens, and contribute to air pollution due to lack of environmental controls. The high moisture content and low calorific content of MSW in these countries means that at present incineration is not an efficient process for waste disposal.

Bangkok installed conventional incineration plants at two of its landfill sites mainly for the incineration of hazardous wastes collected; one was shut down.

China has one or two incinerators in cities like Shenzheng and Leshan. The one in Shenzheng was purchased secondhand from Hong Kong, when that city decided it could not be retrofitted to meet air pollution standards, but it has proved too expensive for Shenzheng to run. Nevertheless, Beihai, Shenyang, Guangzhou, Beijing, and Shanghai constructed pilot plants, with foreign assistance. One reason given is that, although the MSW is not currently suitable for incineration, engineers want to gain operational knowledge for the future.

Surabaya, Indonesia has an imported incinerator that can only operate at two-thirds of its design capacity, because the wastes need to be dried onsite for five days before they can be incinerated. Even without air pollution control mechanisms, the cost of incinerating the waste in this instance is roughly ten times greater than the cost of sanitary landfilling in other Indonesian cities.

In cities of developing countries, open burning of refuse is common in landfill sites, to reduce volume. This is especially done where the authority cannot afford bulldozers to compact the deposits.

Often refuse is burned by households at sundown as a means of disposal and to generate smoke to drive away mosquitoes in developing countries. This contributes to air pollution in cities and towns, particularly as there is now much plastic in the household wastes. Some authorities encourage this backyard burning as it reduces the amount of MSW they have to collect.

## D2. INFORMATION Sources in East Asia/Pacific on Topic d, Incineration:

- Asian Productivity Organization (APO)
- Asian Society for Environmental Protection (ASEP)
- Department of Environment - Malaysia
- Department of the Environment & Heritage - Australia
- Economic & Social Commission for Asia & the Pacific (ESCAP)
- Engineering Services Department - Singapore
- ENSIC (Environmental Systems Information Center)
- Environment Protection Department - Hong Kong
- Environmental Protection Administration - Taiwan
- Global Environment Centre Foundation (GEC)
- Hong Kong Productivity Council
- Institute of Public Health - Japan
- Japan Sewage Works Agency

- Japan Society of Waste Management Experts (JSWME)
- Japan Waste Management Association
- Korea Advanced Institute of Science & Technology (KAIST)
- Ministry of Construction - China
- Ministry of International Trade & Industry (MITI) - Japan
- Ministry of Science, Technology & Environment - Thailand
- National Solid Waste Management Commission
- Policy & Planning Department Thailand
- Shanghai Environmental Protection Bureau
- South Pacific Regional Environment Programme (SPREP)
- State Environmental Protection Agency - China

### D3. SOUTH and West Asia

Waste in the low-income countries is generally low in paper, plastic, and other combustibles as compared to high- or middle-income countries (although source separation programs will bring about some changes there in the future). As a result, large-scale incineration needs auxiliary fuel. Trained labour is usually not available to operate and maintain a controlled combustion incinerator or waste-to-energy (WTE) plant. High capital costs and stringent maintenance requirements are further discouragements.

Almost all large cities, however, have experimented with incinerators. The first failure of a municipal waste incinerator in the region was in Calcutta in the late 19th century; the most recent was in Delhi in the early 1990s. There is an abandoned plant in Jeddah, Saudi Arabia. Beirut is debating building a WTE plant, and some Saudi Arabian cities are considering converting existing incinerators to recover energy. No examples of successful and operating WTE plants have been reported.

Incinerators are in use by hospitals in the higher- and middle-income economies in the central part of the region. These incinerators are installed and maintained by private companies and monitored by the local environmental authority. A few hospitals and clinics in the northern area and the Indian subcontinent also use incinerators to dispose of their waste, but most of these cannot attain a high enough temperature to be safe.

### D4. INFORMATION Sources in South and West Asia on Topic d, Incineration:

- Applied Research Institute - Jerusalem
- Asian Health, Environmental & Allied Databases (AHEAD)
- Centre for Environmental Health Activities (CEHA)
- Ministry of the Environment - Israel
- National Environmental Engineering Research Institute (NEERI)
- National Housing Development Authority (NHDA) - Sri Lanka
- Tata Energy Research Institute (TERI)

## E. Topic e: Landfills

### E1. EAST Asia/Pacific

Landfilling is the cheapest and most prevalent method of MSW disposal in the region. The exhaustion of traditional disposal sites, stricter environmental controls, and greater quantities of wastes have resulted in high disposal costs, especially in medium and large cities of industrialised

countries. Large cities in countries such as Australia, Japan, and Singapore have experienced a more than five-fold increase in such costs, and further increases are expected.

*Landfilling is the cheapest and most prevalent method of MSW disposal in the region. In cities of developing countries, this most often means that wastes are disposed of in open dumps.*

Countries like Australia and Japan normally classify landfills into three categories, according to whether they are intended for hazardous wastes, special wastes, or MSW. The design specifications of landfills for hazardous wastes are very stringent. These are constructed with several layers of impermeable liners at the bottom and with leachate and gas control systems. Even for MSW, modern landfills at these cities are planned and constructed to minimise soil, groundwater, and surface water contamination from landfill leachate and the migration of landfill gas to surrounding areas. Landfill gases are sometimes collected for fuel. Some Japanese coastal cities (e.g., Kityakushu) use solid wastes for land reclamation, with sophisticated pre-treatment and compaction. In smaller towns near rural areas, MSW contains fewer hazardous substances as compared to MSW in large cities, and regulations for landfill disposal of MSW tend to be less stringent.

In cities of developing countries, the main disposal practice for MSW is open dumping. Very often swamp lands or low-lying areas are used as landfill sites, the wastes being used for land reclamation. Kuala Lumpur has used the old tin mines around the city. Although clay liners are occasionally used, little consideration is given to the water table and groundwater pollution and/or gas migration. The high percentage of organics, combined with much plastic that forms layers when compacted, contributes to the buildup of methane gases at dumps in cities like Bangkok and Manila; fires often break out.

Thus, these dumpsites are essentially uncontrolled, creating considerable health, safety, and environmental problems. It is difficult for these cities to adopt the regulations of industrialised nations. Affordable and appropriate waste disposal practices and policies with provision for flexibility in the development of waste management policies are needed.

Some cities of developing countries in the region, including Bandung, Jakarta, and Manila, have had relatively well designed and reasonably operated sanitary landfills. There has been much progress throughout the region in this regard over the last decade or so.

At Jayapura in Irian Jaya, wastes are dumped and then partly burned; some of the burned wastes are pushed off a cliff into the sea. Hence, disposal here combines open dumping, burning, and sea disposal.

E2. INFORMATION Sources in East Asia/Pacific on Topic e, Landfills:

- Asian Society for Environmental Protection (ASEP)
- Cooperative Research Centre for Waste Management & Pollution Control
- Department of Environment - Malaysia
- Department of Environment & Natural Resources - Philippines
- Department of the Environment & Heritage - Australia
- Economic & Social Commission for Asia & the Pacific (ESCAP)
- Engineering Services Department - Singapore
- ENSIC (Environmental Systems Information Center)
- Environment Protection Department - Hong Kong
- Environmental Impact Management Agency (BAPEDAL) - Indonesia

- Environmental Protection Administration - Taiwan
- Global Environment Centre Foundation (GEC)
- Hanoi Urban Environment Company (URENCO)
- Institute of Public Health - Japan
- International Environmental Planning Center (INTEP)
- Japan Society of Waste Management Experts (JSWME)
- Japan Waste Management Association
- Korea Advanced Institute of Science & Technology (KAIST)
- Ministry of Construction - China
- Ministry of Development - Brunei Darussalam
- Ministry of International Trade & Industry (MITI) - Japan
- Ministry of Public Works - Indonesia
- Ministry of Science, Technology & Environment - Thailand
- National Institute of Environmental Research - Korea
- National Solid Waste Management Commission
- Policy & Planning Department Thailand
- Shanghai Environmental Protection Bureau
- South China Agricultural University
- South Pacific Regional Environment Programme (SPREP)
- State Environmental Protection Agency - China

### E3. SOUTH and West Asia

Open dumping is the most common method of waste disposal throughout the region. Especially in the Indian subcontinent, and for smaller cities and towns, it is a crude dumping of waste, sometimes with sparse cover, and sometimes combined with partial burning in the dry season. Frequently, municipalities dump wastes in low-lying land, rather than at designated dumpsites, literally as landfill; for this reason the site in these cases is not permitted to rise above grade, as it is designated for development. Private landowners who wish to have depressions filled accept municipal wastes. Filling of wetlands with wastes has been important (e.g., in the land development of Calcutta, Bombay, Madras, and Colombo).

Metropolitan cities, and the main cities in the northern and central areas, have dumps that may be designated landfills, although rarely are all the components of good landfill practice present. Problems of shortage of soil cover lack of systems for leachate collection and treatment, inadequate compaction, poor site design, and many scavengers working at the site are common.

In cities where plastic shopping bags are used to set out wastes for collection, scavengers sometimes set refuse alight in order to find metal cans. Spontaneous fires also break out on dumps. This greatly adds to the air pollution from dumps, legal and illegal, in cities like Karachi and Tehran.

There is rarely any controlled disposal of hazardous, biomedical, or slaughterhouse wastes, although certain areas of dumps are usually designated for slaughterhouse and biomedical wastes.

*During the wet season in the Indian subcontinent, roads are often so bad that even municipalities operating disposal sites may dump their wastes illegally in more readily accessible places, or at the edge of a dump.*



In the subcontinent, many dumps are inadequately constructed and maintained due to lack of equipment. The roads leading to dumps and those on dumps themselves are often elementary, becoming impassable in the wet season.

Wastes are illegally dumped in water bodies of all kinds, especially by settlements that do not have municipal collection. In a few cases, sea disposal is carried out by the municipal authorities. More solid waste reaches the sea after being dumped illegally in rivers and canals.

Since most large dumps have hundreds of extra workers in the form of scavengers, and the municipal workers are not provided with protective gear, the health risks at dumps are much higher than in sanitary landfills in industrialised countries. These workers are exposed to risks from human faeces, slaughterhouse wastes, landfill gases, toxic dust, infectious biomedical wastes, snakes, scorpions, broken glass, and explosions. Deaths have occurred when scavengers, including children, were buried by slides while scavenging for recyclables in dumpsites.

Planning for environmentally safe landfills, monitoring their future impacts, and site remediation are rarely undertaken in the poorer countries of South and West Asia. Dumpsites are almost always used after closure, often immediately, either as building sites or for farming. Lack of planning, use of inappropriate equipment, and untrained personnel hold back improvements.

In the central countries, although landfills are designed and operated by the relevant authorities and are situated on sites owned by them, awareness about monitoring the long-term environmental impacts of waste disposal is still low. An exception is the newly industrialised city of Jubail, Saudi Arabia, whose landfill was divided into three areas, for hazardous, putrescible, and inert wastes. The site was lined and continually monitored with systematic data collection. The Ministry of Environment in Israel has closed down and remediated a number of improper dumping sites recently. The country is now planning for environmentally sound landfills using state-of-the-art technologies.

Gas capture has been tried on an experimental basis in just a few cases, for instance, in New Delhi, where landfill gas was supplied to a nearby hospital. In India, there is some cultural inhibition to using gas from dumps for domestic cooking.

#### E4. INFORMATION Sources in South and West Asia on Topic e, Landfills:

- All India Institute of Hygiene & Public Health (AIHP)
- All India Institute of Local Self Government (AILSG)
- Applied Research Institute - Jerusalem
- Asian Health, Environmental & Allied Databases (AHEAD)
- Centre for Environmental Health Activities (CEHA)
- Institute of Environmental Engineering & Research (IEER)
- Ministry of the Environment - Israel
- National Environmental Engineering Research Institute (NEERI)
- Rajkot Municipal Corporation (RMC)

## **F. Topic f: Special Wastes**

### **F1. EAST Asia/Pacific**

There is a wide variety of practices within the region regarding handling of special wastes. In the cities of industrialised countries, with the rapid development of small- and medium-size industries, more special and hazardous wastes are being produced. Stringent regulations and enforcement are being introduced, resulting in waste separation at source, with controlled storage and collection by specialised licensed contractors for reuse and disposal. Some very sophisticated industries have developed to deal with special wastes in Asian cities.

Regulations in Japan and Australia require suppliers to take back used batteries containing hazardous substances for recycling and disposal. Separation of special wastes at the household level is not common in cities of developing countries, unless they are saleable. Wastes such as oil and grease are often collected by vendors for recycling and disposal at household and workshop levels.

Construction and demolition debris contain useful items that are separated and collected by waste traders. These materials are often quickly picked up for reuse in developing countries. Even in Singapore, construction and demolition debris are sorted at sites and recyclables are collected for reuse and recycling. Sand, gravel, concrete, stone, and brick are useful construction and landfilling materials that are collected and sold to civil engineering contractors.

Sewage sludge, after digestion and stabilization, is sold as fertiliser/soil conditioner if the metal content is acceptably low. Sewage sludge disposal is problematic when contaminated by industrial toxic discharges. Human excreta are often collected for disposal in landfills in cities of developing countries. In cities of industrialised countries like Japan and Australia hazardous sewage sludges are collected and sent to a designated landfill, and in Japan sewage sludges are often incinerated.

Improved life expectancy and better health care contribute to the increase in hospital wastes, which include dressings, needles, medicines, pharmaceutical products, and even radioactive wastes. Proper disposal of these wastes is expensive. Currently, hospital wastes are often separated and contaminated items are incinerated at source. Alternatively, they are collected by licensed contractors for treatment and disposal, although it is not clear whether such wastes are being handled properly.

Used tires are collected and sent for processing and reuse as raw materials. There are some large industries dealing only with the recovery and processing of used tires for sale as raw materials for the rubber industry or for use as additives in road construction. Shredded used tires are also used for fuel in energy recovery plants. Tires are also retreaded. There is international trading of used tires, especially to China.

In cities of the more industrialised countries, with the rapid development of small- and medium-size industries, more special and hazardous wastes are produced. Stringent regulations and enforcement are being introduced, resulting in waste separation at source, with controlled storage and collection by specialised licensed contractors for reuse and disposal. Some very sophisticated industries have developed to deal with special wastes in Asian cities.

In South Korea, there are both private and state-owned hazardous waste treatment facilities. The latter give the government practical experience in this field, which is important for establishing a good regulatory system.

## F2. INFORMATION Sources in East Asia/Pacific on Topic f, Special Wastes:

- Asian Productivity Organization (APO)
- Asian Society for Environmental Protection (ASEP)
- Center for Advanced Philippine Studies
- Cooperative Research Centre for Waste Management & Pollution Control
- Department of Environment - Malaysia
- Department of Environment & Natural Resources - Philippines
- Department of the Environment & Heritage - Australia
- Development Academy of the Philippines
- Economic & Social Commission for Asia & the Pacific (ESCAP)
- Engineering Services Department - Singapore
- ENSIC (Environmental Systems Information Center)
- Environment Protection Department - Hong Kong
- Environmental Health Department - Singapore
- Environmental Impact Management Agency (BAPEDAL) - Indonesia
- Environmental Protection Administration - Taiwan
- Environmental Technology Institute (ETI) - Singapore
- Hanoi Urban Environment Company (URENCO)
- Hong Kong Productivity Council
- Information Centre for Technology - Singapore
- Institute of Public Health - Japan
- International Environmental Planning Center (INTEP)
- Japan Sewage Works Agency
- Japan Society of Waste Management Experts (JSWME)
- Japan Waste Management Association
- Korea Advanced Institute of Science & Technology (KAIST)
- Ministry of Construction - China
- Ministry of Development - Brunei Darussalam
- Ministry of International Trade & Industry (MITI) - Japan
- Ministry of Public Works - Indonesia
- Ministry of Science, Technology & Environment - Thailand
- National Institute of Environmental Research - Korea
- National Solid Waste Management Commission
- Policy & Planning Department Thailand
- Pollution Control Department - Singapore
- Regional Institute of Environmental Technology (RIET)
- Regional Network for Management & Utilisation of Wastes
- Shanghai Environmental Protection Bureau
- South China Agricultural University
- South Pacific Regional Environment Programme (SPREP)
- State Environmental Protection Agency - China

### F3. SOUTH and West Asia

Throughout most of South and West Asia, there is little systematic information about special wastes. One can assume that industrial hazardous wastes are relatively few in quantity in MSW where there is extensive recycling and low levels of industry. For instance, automobile tires do not appear in MSW, except in the oil-rich countries and Israel; industrial oils are reused in the Indian subcontinent (although there are final residues from these that are put into sewage canals); batteries are recycled; construction wastes are almost all reused. There is considerable medical waste, however, as hospital incinerators are rare. Where there are sewers but not sewage treatment plants, there is raw sewage sludge; there are latrine wastes from settlement areas with bucket or pit latrines.

In all but the most modernised of cities in the region, the lack of special control for hazardous wastes presents severe risks to municipal workers (who are not provided with clothing and facilities to reduce their exposure) and to scavengers.

Most of the countries in the region have some national legislation for the control of hazardous and sometimes special wastes. There are, of course deficiencies in such legislation; for instance, in India and Bangladesh, medical wastes are not classified as special wastes, and there are no national guidelines for hospital wastes. More importantly, implementation of regulations is often haphazard.

*Most of the countries in the region have some national legislation for the control of hazardous waste. Enforcement, however, is often nonexistent or haphazard.*

Since cities in the subcontinent are struggling to cope with MSW, special waste handling is not a priority. Furthermore, there are no special disposal sites or cells at dumps for hazardous wastes. At some dumps, special areas are allocated for slaughterhouse and hospital wastes, but there is no different treatment, and scavengers have free access to these spots, which also attract animals and birds.

The central area is showing more concern recently about the collection and disposal of hazardous wastes. All new industries are asked to separate and dispose of their waste, with the infrastructure for disposal being provided by the local governments. Hospital waste is also incinerated in a number of hospitals. An authority in Kuwait planned a waste treatment and reception station for the treatment of sludge from treatment plants and oil refineries. In a few cities of Saudi Arabia and Kuwait, special areas in landfills are designated for construction and demolition debris.

In Israel, the Ministry of Environment has initiated a national bid to collect and dispose of scrap tires. A battery collection campaign was organised and thousands of specially designed battery collection containers were provided to local authorities.

There is a trend to allow the private sector to deal with the collection and transportation of special wastes. This may help waste collection problems but does not address the need for proper disposal. Throughout the region, there is no example of separate municipal collection of hazardous components in household wastes; for the most part, they are separated, traded, and recycled as explained above, under “Waste reduction”. Household medical and sanitary wastes, however, have been found in organic wastes sent for community composting.

There are some signs of regional cooperation to control the movement of hazardous wastes. On the other hand, some countries would like to have the option to export their hazardous wastes to a neighbouring country that has adequate disposal facilities.

#### F4. INFORMATION Sources in South and West Asia on Topic f, Special Wastes:

- All India Institute of Local Self Government (AIIISG)
- Applied Research Institute - Jerusalem
- Asian Health, Environmental & Allied Databases (AHEAD)
- Centre for Environment Education (South) (CEE)
- Centre for Environmental Health Activities (CEHA)
- Institute of Environmental Engineering & Research (IEER)
- Ministry of the Environment - Israel
- National Environmental Engineering Research Institute (NEERI)

#### **G. Topic g: Waste Characterization**

##### G1. EAST Asia/Pacific

The solid wastes in Asian cities are blends of residential, commercial, institutional, industrial, and even tourist activities. As expected, characteristics of MSW vary from city to city and season to season. The solid wastes of rural towns in most of Asia are significantly different from those of large cities, having more organics but few plastics or food wastes (these latter being fed to animals).

In industrialised cities, MSW is quantified and characterised by municipal authorities at regular intervals. Engineering consultants and professionals from other government bodies such as scientific institutes and the universities also carry out the characterization of MSW.

While many cities report tables of MSW composition, it is often difficult to use this information, as the location and season for the sampling is not specified. Cities that do gather some useable data include Bangkok, Jakarta, Seoul, and Surabaya.

Paper and plastic contents are generally higher in cities like Tokyo and Singapore. In cities like Beijing and Shanghai, the ash/soil content is very high due to the burning of coal for space heating during the cold seasons and for cooking; the proportion of paper, textiles, and other light materials is very low, due to recovery and recycling.

##### G2. INFORMATION Sources in East Asia/Pacific on Topic g, Waste Characterization:

- Asian Productivity Organization (APO)
- Asian Society for Environmental Protection (ASEP)
- Center for Advanced Philippine Studies
- Chemistry Department - Malaysia
- Cooperative Research Centre for Waste Management & Pollution Control
- Department of Environment - Malaysia
- Department of the Environment & Heritage - Australia
- Development Academy of the Philippines
- Economic & Social Commission for Asia & the Pacific (ESCAP)
- Engineering Services Department - Singapore
- ENSIC (Environmental Systems Information Center)
- Environment Protection Department - Hong Kong
- Environmental Health Department - Singapore
- Environmental Protection Administration - Taiwan

- Environmental Technology Institute (ETI) - Singapore
- Global Environment Centre Foundation (GEC)
- Hanoi Urban Environment Company (URENCO)
- Hong Kong Productivity Council
- International Environmental Planning Center (INTEP)
- Japan Society of Waste Management Experts (JSWME)
- Japan Waste Management Association
- Ministry of Construction - China
- Ministry of Development - Brunei Darussalam
- Ministry of International Trade & Industry (MITI) - Japan
- Ministry of Public Works - Indonesia
- National Institute of Environmental Research - Korea
- National Solid Waste Management Commission
- Pollution Control Department - Singapore
- Regional Network for Management & Utilisation of Wastes
- Shanghai Environmental Protection Bureau
- South China Agricultural University
- South Pacific Regional Environment Programme (SPREP)
- State Environmental Protection Agency - China

### G3. SOUTH and West Asia

In general, the Indian sub-continental countries have high percentages of organic and inert matter in their disposed residues, whereas the northern and central ones have more synthetic and combustible materials, metals, glass, and toxic goods such as batteries.

Most of the reports on MSW note generation rates ranging from less than 0.5 kg/capita/day to 0.8 kg/capita/day for cities in the subcontinent; the central area reports show a higher generation rate of more than 0.75 kg/capita/day.

The sampling and analysis of waste streams is not undertaken on a regular basis in this region. For such studies as have been conducted, the methodology is often outdated. The reports do not record sampling procedures (e.g., from what points in the waste stream the samples were taken); usually, sampling is at one point only and is not repeated at different seasons of the year. Sampling at different points is important when significant amounts of recyclables are picked out of waste streams, or where animals eat organics.

*Contrary to what is generally thought, it is not always true that higher-income households produce more waste per capita.*

The traditional categories for solid waste analysis (organic, inert, paper, glass, metal, plastics, textile, wood/garden wastes, food wastes/bones, ash/soil) are usually not sufficiently helpful for understanding the appropriate treatment systems or the particular risks posed for workers. For instance, one cannot tell from any of the analyses whether or not human faeces and biomedical wastes are present, or what is the concentration of batteries and other toxic materials. The synergistic effects of indiscriminate mixing in MSW are not understood. The need to develop appropriate analytic categories and testing procedures for these countries is recognised, and this is under consideration by the National Engineering Environmental Research Institute in India. The Central Pollution Control Board there has recently commissioned a national study on solid waste generation and disposal in India.

Seasonal variations can significantly affect the nature of MSW: In the rainy periods, waste retains much moisture and is denser. In eastern and southern India and Sri Lanka, the “king coconuts” or green coconuts, which are sold on the streets as a drink, contribute heavy and bulky items to the waste stream. In the same areas, during the summer months, melon rinds alone can increase the amount of waste in the commercial and market areas by 20% or more.

Some inter-urban differences relate to climate and fuel use. The cities where heating is needed in winter, and where coal is the main source of energy, have much greater amounts of ash in those months. The basic infrastructure brings other variations as towns with unpaved or poorly paved streets have large amounts of dust and dirt from street sweeping. There are big differences in amounts of organic wastes among cities according to the number of trees and shrubs in public places and the prevalence of animal keeping (the latter reducing the amount of organics).

Large and bulky waste items such as abandoned motorised vehicles, furniture, and packaging materials are found in the higher-income economies of the northern and central areas, for example in Israel, Saudi Arabia, and UAE, whereas they are not put out for municipal pickup in the Indian subcontinent. In the oil-rich countries, used vehicles are often abandoned on desert roads outside of cities.

There are significant variations within urban areas, by social class and settlement type. While it is generally held that higher-income households dispose more waste per capita, this is usually not so in cities with much recycling and great extremes in living standards. Some of the factors that produce less disposed waste from high-income homes and more from low-income ones are: the initially large volume of recyclables of higher income households is source separated and sold, often by the servants; these households are more likely to use electricity or gas for fuel than coal, wood, or animal dung, so there is less likely to be ash waste; poorer families buy fruits and vegetables that are not trimmed, so they may have more leaves and stems in their organic waste (unless these are eaten by animals they keep); and low-income houses may have cottage industries that produce industrial wastes or large quantities of food wastes.

The amount of human faeces in the MSW is significant in squatter areas where “wrap and throw” sanitation is practiced or bucket latrines are emptied into waste piles and containers. The latter is very common in Kabul, for instance, where sewerage is minimal.

#### G4. INFORMATION Sources in South and West Asia on Topic g, Waste Characterization:

- All India Institute of Hygiene & Public Health (AIHP)
- Applied Research Institute - Jerusalem
- Asian Health, Environmental & Allied Databases (AHEAD)
- Centre for Environment Education (South) (CEE)
- Centre for Environmental Health Activities (CEHA)
- Institute of Environmental Engineering & Research (IEER)
- Ministry of the Environment - Israel
- National Environmental Engineering Research Institute (NEERI)
- Tata Energy Research Institute (TERI)

## H. Topic h: Management and Planning

### H1. EAST Asia/Pacific

Development concepts and technologies for integrated solid waste management are normally related to the public's awareness of resources, economics, and the quality of the environment in countries with high levels of education. The overall management responsibility lies with municipal authorities, but in most cases, the tasks are divided between different levels of central government and various levels of local authorities.

In cities of industrialised countries, resources and skills are available and planners may be quite well informed. Short-, medium-, and long-term plans are common. In Japan and Australia, for example, cities have implemented laws and regulations governing disposal bans on substances such as batteries, waste oil, tires, CFC gases, PCBs, etc. There is a mandatory deposit/take-back requirement for some goods such as mercuric oxide batteries, aluminium and plastic containers, tires, and non-degradable plastic bags. In Japan, to ensure that separation of wastes is carried out properly, households are required to use transparent plastic bags for waste disposal so that collection crews can see the contents. In 1992, South Korea passed a law promoting recycling. A major issue for MSW planning in these countries is public resistance to the siting of new disposal facilities.

*Many laws and regulations dealing with MSWM are outmoded and fragmented; they are inadequate to deal effectively with the complications of managing wastes in large cities.*

The most common MSWM problems in developing countries of the region are: institutional deficiencies, inadequate legal provisions, and resources constraints. There is considerable overlap of administrative and enforcement authorities at the national, regional, and local levels as far as environmental controls are concerned. There is a lack of long- and short-term planning due to resources constraints and the shortage of experienced specialists.

Many of the laws and regulations dealing with MSWM are outmoded and fragmented; they are inadequate to deal effectively with the complications of managing wastes in large cities. National legislation for land use and environmental control is now being formulated. In many cases, the regulations are directly copied from industrialised countries without any serious study of the social and economic conditions, the technology, the level of skill required, and the local administrative structure. As a result, they prove to be unenforceable. Often the old regulations are not cleared off the books. Lack of authority to effectively enforce existing environmental regulations is a major problem.

In most developing nations recycling laws, if they exist, are not enforced (China being the main exception). Although there are community initiatives to separate and collect recyclables for sale and reuse, these activities are “informal” and not supported by the municipal authorities, except in China, North Korea, and Vietnam. With regard to monitoring, again, in contrast to cities of industrialised countries where MSWM authorities have well structured programs to monitor waste management operation including leachate and gas migration at landfills, the monitoring programs of developing nations are in general not satisfactory. The decision-making process is slow and complicated due to unnecessary paper work and bureaucracy, and this is a factor in illegal dumping of hazardous substances on lands and into the waterways.

Better communications and more open and active international trade and aid in recent years have spurred reform in the current systems. The richer of the developing countries are examining a



variety of incentives such as tax exemptions, especially for foreign experts, to install, monitor, control, or operate waste management equipment. Reduced import duties on equipment and tools is encouraging more advanced technology in waste management.

Pilot projects are being tried out in cities like Manila, Bangkok, and Jakarta to make waste collection and disposal at squatter settlements an integral part of community improvement. A major challenge of many of the pilot projects is to compare how waste is viewed by the poor, on one hand, and urban planners and waste management authorities, on the other.

In developing countries, NGOs could play a more effective role in the improvement of solid waste management if they were given more recognition by the municipal authorities. Community participation in waste management is vital for improvement. Traditionally, decision-making has been top-down, with no input from the local communities. In places where the municipal authority does not do primary collection, however, people have created community organizations to collect wastes. These work well in parts of Jakarta and Hanoi, and are extensive in South Korean cities.

## H2. INFORMATION Sources in East Asia/Pacific on Topic h, Management and Planning:

- Asian Productivity Organization (APO)
- Asian Society for Environmental Protection (ASEP)
- Center for Advanced Philippine Studies
- Chemistry Department - Malaysia
- Cooperative Research Centre for Waste Management & Pollution Control
- Department of Environment - Malaysia
- Department of Environment & Natural Resources - Philippines
- Department of the Environment & Heritage - Australia
- Development Academy of the Philippines
- Development Technology Center of the Bandung Institute of Technology
- Economic & Social Commission for Asia & the Pacific (ESCAP)
- Engineering Services Department - Singapore
- ENSIC (Environmental Systems Information Center)
- Environment Protection Department - Hong Kong
- Environmental Impact Management Agency (BAPEDAL) - Indonesia
- Environmental Protection Administration - Taiwan
- Global Environment Centre Foundation (GEC)
- Hanoi Urban Environment Company (URENCO)
- Hong Kong Productivity Council
- Information Centre for Technology - Singapore
- Institute of Public Health - Japan
- International Environmental Planning Center (INTEP)
- Japan Sewage Works Agency
- Japan Society of Waste Management Experts (JSWME)
- Japan Waste Management Association
- Korea Advanced Institute of Science & Technology (KAIST)
- Ministry of Development - Brunei Darussalam
- Ministry of International Trade & Industry (MITI) - Japan
- Ministry of Public Works - Indonesia
- Ministry of Science, Technology & Environment - Thailand
- National Solid Waste Management Commission

- Policy & Planning Department Thailand
- Pollution Control Department - Singapore
- Regional Institute of Environmental Technology (RIET)
- Shanghai Environmental Protection Bureau
- South China Agricultural University
- South Pacific Regional Environment Programme (SPREP)
- State Environmental Protection Agency - China
- UNEP International Environmental Technology Centre (IETC)
- United Nations Centre for Regional Development (UNCRD)

### H3. SOUTH and West Asia

Planning, management, and decision-making depend on a country's administrative structures, bureaucratic style, and political values. In the Indian subcontinental urban areas, MSW departments still operate on the principles (and even regulations) set during the colonial period, when official concern about public health for central urban places governed administrative actions. Most municipalities do not have any legislation that uses the term “solid waste management”. While the health orientation remains extremely important, and many would argue that it should be paramount, it has limited the openness of authorities to integrated approaches to waste management and to citizen participation in decision-making.

Municipalities in most South Asian countries operate under the health, environment, or local government ministries of the central or regional governments. In the central part of the region and in some countries in the north, health ministries are expanding to more directly oversee municipal corporations. In the subcontinent, on the other hand, there is a movement toward decentralization, with municipalities being expected to raise their own funds and take on more responsibilities. MSWM here is characterised by bureaucratic fragmentation; interlinked aspects may be under different departments or ministries.

Although many countries now have environmental protection agencies that are directing their attention to this sphere, legislation relevant to modern waste management is deficient. As a result of great concern following the outbreak of plague in Surat, India in 1994, however, the country is formulating a national plan on MSWM, examining all laws relating to the subject.

Decisions on legislation, major capital spending, or administrative changes need approval from the super ordinate ministries or departments. With regard to routine management and planning, there is considerable variation in procedures throughout the region. For example, in Oman, the Ministry of Regional Municipalities is responsible for providing municipal services in all the cities except Muscat, where the municipal council has been given powers for decision-making; in the subcontinent, municipalities have responsibility for routine management.

In large cities, in democratic regimes, major decisions are made in city municipal corporations by elected councillors, headed by a mayor or equivalent officer. Important matters that influence MSWM, for instance revenues obtained through property taxes, are therefore determined by elected representatives. These urban areas thus have the advantage of access to citizen opinions through the representatives. On the other hand, there is the ever-present possibility of political resistance to technically and economically feasible, but unpopular, options. Politicians often endorse “visible” and large projects that may not be appropriate for local problems. Corrupt motives may seriously distort financial and technical decisions.

*Of great importance are weaknesses in basic legislation and powers of regulation. Most municipal authorities, especially in smaller urban places, do not possess the power to regulate and cannot provide incentives for good waste practices.*

Planning and decision-making are ad hoc. Major discussions about MSWM are initiated following public health crises. Master plans have been prepared for some of the large cities at considerable expense but very few of their proposals have been implemented. Smaller towns do not attempt long-term planning.

Planning for MSWM at the regional level has not yet responded to important worldwide trends in thinking about the subject (cf. the new “agenda for solid waste management” in the “Waste Reduction” portion of this document). Hence, waste minimization, recycling, helpful procurement policies, etc., for the most part find no place in MSW regulations. This should change gradually, under the influence of national legislation and advice on environmental protection.

There are management difficulties in workforce relations in several countries in the subcontinent. Management regards the strong labour unions as too powerful and as protecting inefficiency, whereas the unions find there are many deficiencies in the payment and working conditions for their members. Strikes affecting solid waste collection can quickly imperil public health in hot and humid climates. Very often solid waste managers opt for mechanised equipment in the hope of preventing an increase in workers and avoiding extra training and supervision. Privatization is being strongly opposed by labour unions of waste workers in the subcontinent.

The implementation of plans and systematic performance monitoring are deficient nearly everywhere. A problem with performance monitoring in MSWM is that there are no agreed-upon, up-to-date criteria for it. In some cases, there are no performance guidelines (to give one example: there are none governing street sweeping in India and Bangladesh). In general, solid waste workers are poorly paid, barely trained, and inadequately supervised.

The hierarchical structure of local bureaucracies, which results in lack of communication between top decision-makers and field staff, restricts the flow of practical experience and insights from field officers to planning departments. There are few opportunities for the operational staff to exchange information with their colleagues in similar cities and towns. The solid waste management department is usually considered low-status, and chief engineers frequently transfer out of it after a short stint, which hampers continuity in management.

Major changes toward decentralization are taking place in some countries (e.g., in India), which will have an impact on municipal taxation. Similarly, the trend to privatization has implications for planning and management. Abrupt privatization, without careful construction of contracts and good monitoring criteria, has led to problems. However, some functions such as provision, repair, and maintenance of vehicles have been successfully privatised. An important question is how well the poor sections of a city or town will be serviced under private arrangements.

A major challenge for MSW departments in this region (with the exception of Israel) is how the needs and views of underprivileged communities (e.g., squatter settlements) can be expressed, understood, and incorporated into decision-making. As long as squatter areas are treated as illegal and denied services, it is difficult for the solid waste authorities to arrange for effective interface between the MSWM system and the informal arrangements of the settlements. Such cooperation is being achieved, however, through the mediation of NGOs in several countries (for example,

Orangi Pilot Project in Karachi, PROUD in Bombay, Society for Clean Environment and United Way in Baroda, Sneha Bhavan in Cochin, Save Pune Committee in Pune).

Citizens' environmental organizations are on the increase in the region, and, especially since the plague cases in India in 1994, they are turning their attention to MSWM. In general, the role of NGOs and local communities can be extremely helpful in checking on performance, and in experimenting with waste reduction through neighbourhood composting and the promotion of more recycling. Even in middle-class areas in the subcontinent, local groups are organizing to improve street cleanliness and to facilitate more efficient waste collection (e.g., the Civic Exnora street groups in India). Concern about the siting of, and conditions at, garbage dumps is developing in some large cities, such as Bangalore and Calcutta.

A recent development is computer modelling to aid administration and planning for MSWM, which is undertaken in national institutes. The National Environmental Engineering Research Institute in Nagpur, India, for instance, is engaged in this work; the results will be disseminated to metropolitan cities. The usefulness of the models, however, depends on the reliability of the basic data for the place where conclusions are to be applied.

*The needs and views of poor communities need to be expressed, understood, and incorporated into decision-making.*

The role of international agencies and donors is sometimes a matter of debate. Expertise and funds delivered by multilateral and bilateral agencies and donors have been of great importance in the full range of MSW services and decisions in the less affluent countries. On the other hand, there are complaints that pressure from international loan agencies and equipment vendors has led to hasty or poorly conceived privatization or the adoption of inappropriate equipment and procedures. A recent example is the inoperative waste-to-energy incinerator built with foreign aid in New Delhi. This situation should improve with the increase in understanding of solid waste issues worldwide. Perhaps the greatest impediment to improving planning in MSWM in this region is lack of knowledge: of waste quantities and characteristics and factors that affect their variations; of generators' attitudes, behaviours and needs; of how much different operations actually cost; of staff performance; and of sound practices elsewhere. The smaller and poorer places will not have the capacity to conduct surveys in the foreseeable future; in the better-off areas, the main handicap is lack of knowledge of the appropriate ways to gather the data that would assist good planning.

#### H4. INFORMATION Sources in South and West Asia on Topic h, Management and Planning:

- All India Institute of Hygiene & Public Health (AllHP)
- All India Institute of Local Self Government (AllLSG)
- Applied Research Institute - Jerusalem
- Asian Health, Environmental & Allied Databases (AHEAD)
- Centre for Environment Education (South) (CEE)
- Centre for Environmental Health Activities (CEHA)
- Ministry of the Environment - Israel
- Mythri Foundation Waste Wise Project
- National Environmental Engineering Research Institute (NEERI)
- National Housing Development Authority (NHDA) - Sri Lanka
- National Institute of Urban Affairs
- Rajkot Municipal Corporation (RMC)

- Tata Energy Research Institute (TERI)
- Urban Resource Centre (URC)

## **I. Topic i: Training**

### II. EAST Asia/Pacific

In industrialised countries of the region, educational levels of workers and management staff for MSWM are generally high. Schemes for training and human resource development at both the national and local levels are well funded and organised. Operators of MSWM facilities are required to attend courses and pass certification examinations for promotion or to hold jobs. In addition to hands-on training on technology used in MSWM, health and safety courses are conducted for both sanitation workers and management staff. Staff at management levels is often sent for further education. There are also regular promotional campaigns organised by the government and NGOs to promote waste minimization through recycling/reuse. MSWM facilities are opened to the public for educational purposes. Japanese schoolchildren visit the local incinerator and learn about recycling in their area.

In the developing countries, however, although there is training, these activities are severely limited by the lack of resources. There are inadequate funds for promotional campaigns and training by government and NGOs.

There are many activities relating to training and human resources development that occur primarily in the industrialised countries:

- At the local level, municipal authorities conduct in-house training courses on technology, health, and safety at regular intervals to update and upgrade the skills of their workforce.
- At the regional and national level, cost-efficient models of MSWM systems and appropriate technology for local application are developed. Research programs for waste minimization, including the development of low-pollution products, closed-loop recycling processes, and other low-pollution manufacturing processes, are formulated and carried out, often jointly with industries and institutions of higher learning. Some countries also sponsor demonstration projects for technology transfer to achieve waste minimization through the improvement of manufacturing processes, recycling, and reuse.
- Government agencies involved in MSWM issue handbooks to the industry and waste separation and recycling/reuse guidebooks to the community in general (there are numerous examples in Japan).
- Waste management officers are sent abroad to learn about new technologies and to attend workshops or conferences.
- Professional bodies and trade and manufacturers' associations also conduct seminars, workshops, and demonstration projects for the benefit of their members.

The World Health Organization (primarily through its Western Pacific Regional Office in Manila) has been very active in providing training to a number of professionals throughout the region.

## I2. INFORMATION Sources in East Asia/Pacific on Topic i, Training:

- Asian Productivity Organization (APO)
- Asian Society for Environmental Protection (ASEP)
- Center for Advanced Philippine Studies
- Center for Environmental Training - Singapore
- Cooperative Research Centre for Waste Management & Pollution Control
- Department of Environment - Malaysia
- Department of Environment & Natural Resources - Philippines
- Department of the Environment & Heritage - Australia
- Development Academy of the Philippines
- Development Technology Center of the Bandung Institute of Technology
- Economic & Social Commission for Asia & the Pacific (ESCAP)
- Engineering Services Department - Singapore
- ENSIC (Environmental Systems Information Center)
- Environment Protection Department - Hong Kong
- Environmental Impact Management Agency (BAPEDAL) - Indonesia
- Environmental Protection Administration - Taiwan
- Environmental Technology Institute (ETI) - Singapore
- Global Environment Centre Foundation (GEC)
- Hanoi Urban Environment Company (URENCO)
- Hong Kong Productivity Council
- Information Centre for Technology - Singapore
- International Environmental Planning Center (INTEP)
- Japan Sewage Works Agency
- Japan Society of Waste Management Experts (JSWME)
- Japan Waste Management Association
- Korea Advanced Institute of Science & Technology (KAIST)
- Ministry of Development - Brunei Darussalam
- Ministry of International Trade & Industry (MITI) - Japan
- Ministry of Public Works - Indonesia
- Ministry of Science, Technology & Environment - Thailand
- National Solid Waste Management Commission
- Policy & Planning Department Thailand
- Regional Institute of Environmental Technology (RIET)
- Regional Network for Management & Utilisation of Wastes
- Shanghai Environmental Protection Bureau
- South China Agricultural University
- South Pacific Regional Environment Programme (SPREP)
- State Environmental Protection Agency - China
- UNEP International Environmental Technology Centre (IETC)
- United Nations Centre for Regional Development (UNCRD)

## I3. SOUTH and West Asia

Special training in the field of solid waste management is a fairly recent phenomenon in this region, and it has yet to adequately include important topics such as waste minimization and socioeconomic considerations. Nationally trained professionals usually are educated as engineers or medical doctors and have had short courses in waste management, which may be led by foreign consultants. Most of the staff of sanitation and public health departments are not trained

for their jobs, but may become very knowledgeable about routine operations through field experience; unfortunately, they usually are not able to bring this experience to bear on the curriculum of training programs. Systematic training does not extend to the street-level workers. In smaller towns, with the exception of Israeli ones, public bodies for waste management cannot afford to recruit specialised staff, nor would the countries be able to supply them if they could.

Universities in the region have not taken sustained interest in the practicalities of solid waste management, but a few are involved in research and training. The Asian Institute of Technology in Bangkok, however, occasionally runs short courses for municipal managers, including those from South and West Asia.

*Many institutions in the region have been involved in training professionals for MSWM activities, but a lack of resources has diminished the impact of these efforts. Numerous international agencies are also involved in training.*

Increasingly, special institutions are being developed (in Bangladesh, India, Israel, Jordan, Pakistan, Saudi Arabia, and Sri Lanka) that have incorporated waste management into their work. An example of a regional centre is the Centre for Environmental Health Activities in Amman, Jordan, which organises and supports a number of research and training programs in the Eastern Mediterranean region. . In Kathmandu, during the period of German technical assistance (1984 to 1994), the Solid Waste Management and Resource Mobilization Centre undertook some training. The oldest institutions involved with solid waste management are the National Environmental Engineering Research Institute and the All India Institute of Hygiene and Public Health in India. They, however, lack the resources to have a substantial impact in this field for a country as large as India.

Most of the expertise for training has been supplied by international agencies such as World Health Organization (South East Asia Program Office in New Delhi and the regional office in Malaysia), the United Nations Children Fund, the United Nations Development Programme, the United Nations Centre for Regional Development (Nagoya), and the Asian Development Bank. Bilateral involvement has come from the Overseas Development Administration, UK, drawing upon the Water, Engineering and Development Centre of Loughborough University of Technology and the Development Administration Group of Birmingham University; the Netherlands development ministry; German technical assistance (GTZ-GATE); and the Japan International Cooperation Agency (JICA), to name a few.

Substantial bilateral projects for MSWM that include training aspects have been few; the most important one in the subcontinent was the decade-long German project in Kathmandu, which ended in 1994. The European Union is currently supporting a project in waste analysis and training methods. Bilateral aid has sponsored a few conferences on solid waste management that have discussed issues of professional development.

A complaint in the past about training relating to MSWM has been that engineers were taught ideal management systems, such as “sanitary landfills”, when there was no prospect of constructing these for their cities and towns. The slow progress in improving MSWM had led to a questioning of the conventional approach, and key institutions in the region aim to supply training in integrated solid waste management in the future.

#### I4. INFORMATION Sources in South and West Asia on Topic i, Training:

- All India Institute of Hygiene & Public Health (AIHP)
- All India Institute of Local Self Government (AILSG)
- Asian Health, Environmental & Allied Databases (AHEAD)
- Centre for Environment Education (South) (CEE)
- Centre for Environmental Health Activities (CEHA)
- Ministry of the Environment - Israel
- National Environmental Engineering Research Institute (NEERI)
- National Institute of Urban Affairs
- Orangi Pilot Project (OPP)
- Urban Resource Centre (URC)

#### **J. Topic j: Public Education**

##### J1. EAST Asia/Pacific

Ecology and the role of environmental management are becoming part of the school curricula in Australia, Japan, and New Zealand. All the industrialised countries have frequent campaigns to promote environmental awareness. The “Clean Up Australia Day” has expanded to be the “Clean Up the World” movement.

The subjects of ecology and environmental management are being introduced in the school curricula in some developing countries, but there is not much expertise available to instruct teachers, especially with regard to waste management.

Despite the lack of resources, campaigns are organised regularly to promote environmental awareness and resource conservation through recycling/reuse of waste materials. An attitudinal problem to be overcome is that “it's the government's job to deal with garbage”. When Malaysia launched a national program for cleanliness, the Ministry of Housing and Local Government chose a slogan that translated as “When the public is clean, the nation will be healthy”. Some people said they found this very puzzling the public did not need to be clean as it was the government's responsibility to ensure cleanliness.

Examples of public education in both the industrialised and the developing countries include:

- Regular “Green and Clean” campaigns to promote environmental awareness (e.g., the campaigns of Metro Manila Women Balikatan Movement and Green Forum in Manila);
- Introduction of environmental education and ecology in the school curricula; organization of teachers' workshops (Australia, New Zealand);
- Television cartoons (e.g., the Magic Eyes movement in Bangkok);
- In many Japanese cities, extensive outreach by solid waste departments through school visits to explain MSWM problems and waste minimization, recycling, and reuse. In Osaka, there are “anti-littering” leaders and “no littering” forums; the first day of each month is designated “beautification day”, when there is a coordinated cleanup effort.
- Promotion of green products, green labelling, and green manufacturing;



- Establishment of instruction centres that are responsible for publishing newsletters and providing information to schools, businesses, the public, and plant managers to enhance performance and create awareness (e.g., in Osaka).

## J2. INFORMATION Sources in East Asia/Pacific on Topic j, Public Education:

- Asian Productivity Organization (APO)
- Asian Society for Environmental Protection (ASEP)
- Center for Advanced Philippine Studies
- Center for Environmental Training - Singapore
- Department of Environment - Malaysia
- Department of Environment & Natural Resources - Philippines
- Department of the Environment & Heritage - Australia
- Development Academy of the Philippines
- Development Technology Center of the Bandung Institute of Technology
- Economic & Social Commission for Asia & the Pacific (ESCAP)
- Engineering Services Department - Singapore
- ENSIC (Environmental Systems Information Center)
- Environment Protection Department - Hong Kong
- Environmental Impact Management Agency (BAPEDAL) - Indonesia
- Environmental Protection Administration - Taiwan
- Environmental Technology Institute (ETI) - Singapore
- Hanoi Urban Environment Company (URENCO)
- Information Centre for Technology - Singapore
- Institute of Public Health - Japan
- International Environmental Planning Center (INTEP)
- Japan Society of Waste Management Experts (JSWME)
- Japan Waste Management Association
- Ministry of Development - Brunei Darussalam
- Ministry of International Trade & Industry (MITI) - Japan
- Ministry of Public Works - Indonesia
- Ministry of Science, Technology & Environment - Thailand
- National Solid Waste Management Commission
- Regional Institute of Environmental Technology (RIET)
- Regional Network for Management & Utilisation of Wastes
- Shanghai Environmental Protection Bureau
- South China Agricultural University
- South Pacific Regional Environment Programme (SPREP)
- State Environmental Protection Agency - China

## J3. SOUTH and West Asia

There are two rather different conceptions of public understanding of MSWM. The prevalent approach is the conventional “public education” one. This assumes that citizens are largely ignorant about MSWM and lack motivation to learn; that behaviour will change as a result of educational exhortations; and that what is required most is public compliance with rules established by the authorities. The alternative is the community participation approach. In this the role of the public is conceived differently: waste management is seen as meeting citizens' needs so that citizens are entitled to transparency in decision-making; MSWM is not merely a service

delivered by urban authorities but a cooperative undertaking that requires the coordination of informal behaviours and conventional MSWM; and there is an assumption that watchfulness on the part of citizens is crucial to monitoring MSWM. Under this conception, citizens can voluntarily perform some of the work, and people should assess the performance of municipal staff and have the right to raise questions about decisions on, for instance, the siting of dumps and transfer stations.

*Anti-litter campaigns are launched in most large cities from time to time. Often they have only a temporary effect, since these campaigns, in most countries, do not address issues of waste generation and final disposal, and they do not result in better permanent facilities.*

There is often misunderstanding between the proponents of these views, and this may be observed in some Indian sub-continental cities where groups are mobilizing residents for better solid waste services. But, more importantly, there is room for constructive accommodation between the two approaches. In Bangalore, India, a stakeholder environmental organization (Swabhimana) was created that included representatives of both the city corporation and the residents.

Public knowledge, and the willingness to devote time and energy to cleanliness and waste reduction, varies along the full range of knowledge and motivation, both within societies and across societies in this region. In the countries with low levels of literacy, habits of frugality and recovery/recycling are strong, public awareness of modern solid waste management is very low, and there are many problems of collection and disposal. In the more wasteful economies, there are higher expectations for waste services, but insufficient attention to waste reduction and recycling. Understanding of the dynamics and the costs of MSWM needs to be increased among the public and also among government servants and politicians.

A constraint upon public education and community participation is that strongly held attitudes, often grounded in religious beliefs, do not change readily. In most of the societies in this region, waste handling is not a culturally acceptable practice for most categories of the population: waste collection work, and certain types of recycling, is done by designated groups or disadvantaged people, who are stigmatised. Waste left in public areas may not be perceived as a public health risk or even an eyesore. These are some of the attitudes that will need to change if the societies are to have effective waste management.

Anti-litter campaigns, a popular approach to public education, do not have lasting effect unless they are part of a more comprehensive strategy. Simple litter campaigns are, in effect, “end of the pipe” approaches, since they do not address issues of waste generation and disposal.

Some country campaigns are arranged as annual cleanliness weeks or lectures to schools. Information leaflets are also distributed before major festivals to inform the public about special arrangements at those times. The most outstanding example is during the Haj. The German-aided solid waste project in Kathmandu included public education that was developed by social workers familiar with the local cultures. Community education is a component of the solid waste management program in Karachi, funded by the Asian Development Bank. The campaigns run by the Water and Sewage Authority of Lahore, against solid waste dumping in sewers and streams, would be beneficial for any city or town in the region.

Most public awareness efforts are directed to children, since they are responsive and easily accessible, and it is believed that they can influence adult attitudes. In Karachi, an NGO (Gul

Bahoo) devised school recycling projects. In a few schools, dry and wet waste is being separated and the organization comes once a week to collect the waste in exchange for toys.

Since the late 1980s, Israel has greatly increased its efforts to support public awareness and cooperation. The Maintenance of Cleanliness Law (1984) allows members of the public to be appointed “cleanliness trustees”, who attend training sessions. The Ministry of Environment organises anti-litter campaigns. The full gamut of techniques is used for public education: press releases, television spots, distribution of stickers and posters, school programs, and beach cleanups. The Ministry of Environment began awarding environmental “green” labels to products, including ones that facilitate recycling.

The success of the inter-city cleanliness and health competition in Indonesia has prompted discussion of similar competitions in the Middle East. The important issues in such competitions are the criteria used to judge whether a city is “clean” and how good is the information presented on compliance with the criteria.

In India, Pakistan, and Sri Lanka, citizen groups have been spearheading changes in public awareness of waste and recycling issues. Organizations like Civic Exnora in India devote a considerable amount of time to public presentations on litter problems and the potential for cooperation to organise better waste collection in neighbourhoods. Community groups are paying more attention to source separation to enhance recycling and assist scavengers.

The corporate sector has begun to support awareness announcements, such as brief television announcements featuring recycling enterprises and the work of citizen groups. They also contribute to school campaigns, supporting recycling drives and canteen composting.

International workshops, bilateral action research projects, and the work of individual scholars and some entrepreneurs are beginning to fill the gaps in public education programs. For instance, expertise and funds from the Netherlands, the Economic and Social Commission for Asia and the Pacific, the United Nations Centre for Human Settlements, and foreign advisors (from Canada, the Netherlands, and Switzerland) have supported a small core of local experts and concerned citizens in Bangalore since 1989. The Centre for Environmental Education, the Mythri Foundation (Waste Wise project), and Swabhimana (a citizens' movement; the term means “self-respect”) are all active in keeping waste issues before the public and in lobbying the city administration. A point emphasised by a workshop on “linkages in solid waste management” was that education has to reach politicians and bureaucrats, as well as residents.

There is much scope for exchange of information and collaboration among city departments and NGOs on the subject of community participation in and knowledge about MSWM. While there are limitations to city- twinning arrangements, the exchange of ideas among similar cities and towns is developing. CITYNET is supporting such exchanges in Asia.

#### J4. INFORMATION Sources in South and West Asia on Topic j, Public Education:

- All India Institute of Local Self Government (AIIISG)
- Applied Research Institute - Jerusalem
- Asian Health, Environmental & Allied Databases (AHEAD)
- Centre for Environment Education (South) (CEE)
- Centre for Environmental Health Activities (CEHA)
- Development Alternatives
- International Centre for Diarrhoeal Diseases Research (ICDDR)

- Karachi Administration Women Welfare Society (KAWWS)
- Ministry of the Environment - Israel
- Mythri Foundation Waste Wise Project
- National Environmental Engineering Research Institute (NEERI)
- National Housing Development Authority (NHDA) - Sri Lanka
- National Institute of Urban Affairs
- Orangi Pilot Project (OPP)
- Rajkot Municipal Corporation (RMC)
- Urban Resource Centre (URC)

## **K. Topic k: Financing**

### K1. EAST Asia/Pacific

MSWM services account for a high percentage of the municipal budgets. For instance, in Malaysia, an average of 50% of the municipal operating budget is spent on MSWM, and of this, 70% is spent on collection. Financial options and mechanisms vary from city to city and from country to country. In general, there are three sources of funds, namely, municipal taxes, fees charged for services, and subsidies from municipal revenues received from government sources.

*Although privatization is a significant trend in the region, many believe that the most effective, efficient, and accountable system of MSWM will evolve through a combination of government-run and privatised services.*

Increasingly, MSWM authorities in industrialised and developing countries are seeking cost recovery through the levy of fees for services provided. Throughout the region, there is a range of methods by which costs are being recovered via user fees. The deposit-refund system for many recyclables is being expanded in cities like Bangkok, Singapore, Tokyo, and Jakarta. Volume-based fees are being tried out.

There are several forms of levy: a) direct fees based on waste volumes; b) indirect fees derived from, for instance, property taxes; and c) fees collected with payment of electric bills, or with water bills based on floor area and annual rental values of properties.

In some cities of industrialised countries of the region, fees are charged, directly or indirectly, for all services rendered. Some have laws to encourage recycling by specifying mandatory deposit and return requirements. The aim is to shift some of the burden of waste disposal and the recovery of materials back to the manufacturers of products by ensuring that retailers, and then wholesalers, take back materials. To fund cleanup programs some of these cities also levy advance disposal fees for a variety of products and packages.

Faced with resource constraints, many developing countries are looking to the private sector for solutions. Cities in Indonesia, Korea, Malaysia, Singapore, and Thailand, among others, have contracted out part of their MSWM services to private enterprises. In Malaysia and Singapore the privatization program has gone much further. All MSW incineration plants in Singapore were privatised by 1996 and a private limited company started handling all refuse collection starting in the same year. In Malaysia, private companies are invited to bid for any of the privatization-cum-concession agreements for MSWM services in the country. Private companies are free to form joint venture companies with foreign waste management companies that have the financial

resources and experience to win collection contracts from municipal authorities, and to design and build transfer stations and landfills or any final disposal systems.

An important cautionary note here is reflected in current thinking among many experts that the most effective, efficient, and accountable system of MSWM will evolve through a combination of government-run and privatised services. Although privatization advocates say that privatization is key to cost recovery, others in the region have shown that good cost recovery can occur without privatization.

The social implications of such privatization have yet to be evaluated. For some developing countries, fees, labour relations, and the role of pickers and waste dealers are points of tension when privatization is introduced. Private companies sometimes cut corners and often do not fulfil the conditions of the contracts. In most cases, private companies employ fewer workers and collect and transport more waste per vehicle.

#### K2. INFORMATION Sources in East Asia/Pacific on Topic k, Financing:

- Asian Society for Environmental Protection (ASEP)
- Department of Environment - Malaysia
- Department of the Environment & Heritage - Australia
- Development Academy of the Philippines
- Economic & Social Commission for Asia & the Pacific (ESCAP)
- Engineering Services Department - Singapore
- ENSIC (Environmental Systems Information Center)
- Environment Protection Department - Hong Kong
- Environmental Protection Administration - Taiwan
- Hanoi Urban Environment Company (URENCO)
- Japan Society of Waste Management Experts (JSWME)
- Ministry of Development - Brunei Darussalam
- Ministry of International Trade & Industry (MITI) - Japan
- Ministry of Public Works - Indonesia
- Shanghai Environmental Protection Bureau
- State Environmental Protection Agency - China

#### K3. SOUTH and West Asia

The different histories of colonial administrations, differences in city and town size and status, and the lack of national standards have resulted in a great variety in financial arrangements for MSWM in South and West Asia. There are also variations within cities, where services and payment methods differ. In general, most urban administrations do not have adequate financial resources to establish and maintain all aspects of sound waste management. They have difficulty raising loans for major improvements in collection, transportation, and disposal.

In the Indian subcontinent (excluding Nepal and Bhutan), municipal corporations allocate money for waste management activities. Usually there is no direct funding to urban local bodies from central or state governments for routine operations. In the 1970s, the Indian government gave grants to cities over a certain size for the purchase of mechanical compost plants and other infrastructure items. Since then, there have been special-purpose grants from time to time; solid waste management is often a component of grants for environmental improvement of urban slums, for instance. Sometimes neighbourhoods or corporations contribute voluntarily to local infrastructure in the form of street bins.

Cities and towns have to rely upon municipal taxes, mainly property taxes, for the funds to provide waste management services. There is no special tax, but institutions, hotels, and commercial firms may be required to pay for waste collection, either to the municipality or a private hauler; cooperative housing estates in India charge households special fees since the municipal service does not enter the estates. A widespread problem is the low rate of collection of taxes and special fees. The property tax base for municipal services has had implications for equitable coverage: illegal settlers, such as squatters, are not deemed eligible for collection services in most cities. In many cities, only 50% of the population is registered on the property tax assessments and, of course, some of the taxpayers are delinquent. Taxpayers have resisted suggestions for a direct tax for waste services or an increase in the property taxes.

*Most municipalities do not know what the various components of MSWM cost them, as financial reporting systems are poorly organised. This is a serious impediment to financial planning.*

It has been reported that solid waste management consumes 20% (or much more) of the entire municipal budget for services and within this, the salaries and wages component is usually over 75% of the annual expenditure on MSWM. Funds for capital investment are inadequate. Cities often have difficulty raising loans for infrastructure needs and must rely on agencies such as the World Bank, or national agencies such as the Housing and Urban Development Corporation in India. A great handicap to financial planning is that most municipalities do not actually know what the various components of MSWM cost them, as financial reporting systems are poorly organised. In addition, the funds needed for operations, maintenance, etc., may come from different categories of the municipal budget and be administered by departments other than that for solid waste.

In the central and northern parts of the region there are, in some rare cases, direct fees for MSWM. Capital expenditures are covered by the national ministries (of environment, for instance).

Decentralised modes of payment for service have developed in an ad hoc fashion. In a few cities in India, Nepal, and Sri Lanka, a portion of municipal salaries designated for workers in an area is paid by the community directly to the sweepers, an institutionalization of earlier informal arrangements. There are cases where residents have financed construction of communal bins and street sweeping in their neighbourhood.

An important trend affecting financial and other aspects of solid waste services is privatization, which takes several forms, including contracting out, franchises, and partnership arrangements. In some cases, private arrangements for collection are of long standing, since the authorities have been unable to provide services to peripheral areas, or have not had sufficient vehicles. In Bombay, more than 50% of vehicles for waste transportation are hired from private contractors.

In recent years, municipalities have sought to contract out to save expenditure on capital equipment and to improve efficiency. Collection has been privatised in parts of a number of Indian cities, including New Delhi, Madras, Ahmedabad, Baroda, Bangalore, and Rajkot. Some cases of leaving the assigned routes and disposing of waste at illegal sites have been reported. Disposal sites have mostly not been privatised (leaving aside when towns dump their wastes on private land to achieve landfilling), but the City of New Delhi recently invited bids for disposal. In Colombo, private firms will be building a new sanitary landfill.

Moves toward privatization may be opposed by labour unions, particularly in the subcontinent, and as a result, solid waste departments have not been able to reduce the current workforce after privatizing.

International aid from multilateral and bilateral agencies has been important for most of the large cities throughout the region. Such aid has covered infrastructure development, equipment, and training, but has not usually supported community-based approaches or traditions of waste reduction.

Decentralization from central and regional governments is forcing local governments to restructure their funding systems. Municipal managers are discussing the introduction of fees, decentralised modes of payments, and higher specific charges (where they already exist). In poorer countries, the poverty of many residents will make it difficult to achieve full cost recovery for adequate MSWM in the near future, but the demonstrated willingness of people to pay for a cleaner neighbourhood is an encouragement to reform of administrative and financial arrangements.

#### K4. INFORMATION Sources in South and West Asia on Topic k, Financing:

- All India Institute of Local Self Government (AIIILSG)
- Applied Research Institute - Jerusalem
- Asian Health, Environmental & Allied Databases (AHEAD)
- Ministry of the Environment - Israel
- National Environmental Engineering Research Institute (NEERI)
- National Institute of Urban Affairs
- Rajkot Municipal Corporation (RMC)
- Urban Resource Centre (URC)

## **L. Information sources located in East Asia/Pacific**

Note: Some of the listings refer to “Topic 1”. This consists of miscellaneous (Misc.) topics covered by the institution.

Note: There are information sources about MSW issues in East Asia/Pacific that are located in other regions. These sources often cover several areas of the world, so they are listed in this publication under the region where they are located. Notable out-of-region institutions that offer information on MSW in East Asia/Pacific include:

### **Institutions located in Africa**

UNEP-INFOTERRA

### **Institutions located in Europe**

ISWA (International Solid Waste Association)  
SANDEC/EAWAG  
WASTE, Advisers on Urban Environment and Development  
Water, Engineering and Development Centre (WEDC)  
World Resource Foundation /*Warmer Bulletin*

### **Institutions located in North America**

US Agency for International Development (AID)  
US Environmental Protection Agency (EPA)  
The World Bank

Note: in the following listings “Email” refers to an organisation’s electronic mail address. “Internet” refers most often to an organisation’s site on the World Wide Web, although it can also refer to gopher, ftp, or direct dial-in sites.

## **L1. Asian Development Bank**

PO Box 789  
Manila Central Post Office  
0980 Manila  
Philippines

**Telephone:** +63-2-632-4444  
**Fax:** +63-2-636-2444  
**Email:** Information@ADB.org  
**Contact:** Dr. B.N. Lohani, Manager, Office of Environment and Social Development

**Topics covered:** 1 (The Bank has a range of expertise within MSWM)

**Description:** The ADB is a regional development bank. It has over 60 regional and non-regional members from all parts of Asia, Europe, and North America. The Bank makes loans and equity

#### TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.



investments for the economic and social advancement of Asian countries, provides technical assistance in the preparation and execution of development projects, and catalyses investment of public and private capital for development purposes. Some of the Bank's projects have included MSWM.

**Format of information:**

**Internet:** [www.ADB.org](http://www.ADB.org)

**Language:** English

**Consulting or support services:** Responds to requests for assistance in coordinating development policies and plans.

**Fees:**

## L2. Asian Productivity Organisation (APO)

1-2-10 Hirakawacho, Chiyoda-Ku  
Tokyo 1020093  
Japan

**Telephone:** +81 3 5226 3920

**Fax:** +81 3 5226 3950

**Email:** [apo@apo-tokyo.org](mailto:apo@apo-tokyo.org)

**Contact:** Mr. Kenichi Yanagi, Secretary-General

**Topics covered:** a c d f g h i j

**Description:** The APO is an inter-governmental regional organisation established in 1961 by several governments in Asia. It aims to increase productivity, and consequently, accelerate economic development in the Asia and Pacific region through mutual cooperation among member countries: Bangladesh, Fiji, Hong Kong, Indonesia, Iran, Japan, Republic of Korea, Malaysia, Mongolia, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan, and Thailand. Its programs cover the industry, service, and agriculture sectors.

The APO is very active in cleaner technology and waste minimisation, particularly with respect to industrial waste.

**Format of information:** Books, reports, manuals, pamphlets, and guidebooks.

**Internet:** [www.apo-tokyo.org](http://www.apo-tokyo.org)

**Language:** Most of the publications are available in English

**Consulting or support services:** Undertakes contract studies and consulting services.

**Fees:** Some materials are distributed free and others at a low cost.

TOPICS:

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

### **L3. Asian Society for Environmental Protection (ASEP)**

Rm B219, AIT Center  
Asian Institute of Technology  
GPO Box 2754  
Bangkok 10501  
Thailand

**Telephone:** +66 2 524 5363

**Fax:** +66 2 524 5390

**Email:**

**Contact:** The Secretary General or Ma Doreen Canillas, Editor of ASEP Newsletter

**Topics covered:** a b c d e f g h i j k

**Description:** ASEP is a non-profit organisation. It has many publications on environmental and waste management issues. The ASEP newsletter publishes newsworthy articles on environmental protection, including research or project summaries, news reports, notices of current and upcoming events, and other interesting and relevant articles about the environment.

**Format of information:** Newsletters, news reports.

**Internet:**

**Language:** Materials are available in English

**Consulting or support services:** Members of the Society provide consulting and supporting services.

**Fees:** Annual membership fees: US\$20 (individual), US\$60 (institutional), US\$200 (individual life), US\$600 (institutional life)

### **L4. Center for Advanced Philippine Studies**

Waste Management Resource and Information Center  
Rm. 202, Loyola Heights Condominium  
Esteban Abada corner F. De la Rosa St., Loyola Hts  
Quezon City, Metro Manila 1108  
Philippines

**Telephone:** +63-2-912-3608

**Fax:** +63-2-912-3479

**Email:** Danlapid@caps.ph

**Contact:** Dan Lapid, Executive Director

**Topics covered:** a b c f g h i j

**Description:** The Center for Advanced Philippine Studies (CAPS) was incorporated under Philippine laws as a non-stock, non-profit research foundation in 1987. Its primary purpose is to conduct relevant research and projects on strategic issues and to make the results available to

TOPICS:

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national and local leaders, both in the government and private sectors, for sound decision-making. CAPS believes that the public good is best served by a well-informed leadership.

CAPS is engaged in urban environmental management research and projects most especially in the area of integrated sustainable waste management (ISWM). Since 1991, CAPS has been conducting research dealing with waste recovery, composting, recycling, hospital waste, municipal and community-based waste management.

CAPS is the Southeast Asian Region partner of the Urban Waste Expertise Programme (UWEP), an international program that promotes integrated sustainable waste management approaches.

**Format of information:** Computer printouts, reports, newsletters, and consultations.

**Internet:** www.caps.ph

**Language:** English

**Consulting or support services:** CAPS-W'MC provides research services to government and non-government organisations, and private and multilateral institutions.

**Fees:** Computer printouts are distributed free of charge; reports are at cost of reproduction or publication; research services are at cost depending on technical and administrative requirements.

#### **L5. Centre for Environmental Training - Singapore**

ENV Building, #06-00  
40 Scotts Road  
Singapore 228231

**Telephone:** +65 67 319286

**Fax:**

**Email:** Vilma\_tay@env.gov.sg

**Contact:** Mr. Ng Meng Hiong, Head

**Topics covered:** i j

**Description:** The center provides environmental training, primarily for staff at the Ministry of the Environment. It also conducts short courses and organises seminars, workshops, and conferences that are open to the public.

**Format of information:** The center develops curriculum for environmental training and publishes resource materials on environment and public health.

**Internet:**

**Language:** Most publications are available in English and some in Chinese, Malay, and Tamil

**Consulting or support services:** None.

**Fees:** Materials are available at very low cost.

#### **L6. Chemistry Department - Malaysia**

Jalan Sultan

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

46661 Petaling Jaya  
Malaysia

**Telephone:** +60 3 7985 3000  
**Fax:** +60 3 7955-6764  
**Email:** cochua@kimia.gov.my  
**Contact:** Director General

**Topics covered:** g h

**Description:** The Department is a government body that maintains and monitors environmental quality, pollution programs, water quality programs, and air quality programs. It keeps records and provides baseline data for planning and enforcement of regulations.

**Format of information:** Reports, pamphlets, manuals, analytical procedures, and materials for human resources development.

**Internet:** www.kimia.gov.my

**Language:** Materials are mainly in Malay and English

**Consulting or support services:** It provides supporting services to other government bodies and local authorities.

**Fees:** Materials are distributed free to other government bodies and libraries within the country, or at very low cost.

#### **L7. Cooperative Research Centre for Waste Management and Pollution Control Ltd**

University of New South Wales - Building H22  
Botany Street (Gate 11)  
Kensington, NSW 2033  
PO Box 1  
Kensington, NSW 2033  
Australia

**Telephone:** +61 293854886  
**Fax:** +61 296621971  
**Email:** crcwmpc@unsw.edu.au  
**Contact:** Dr. Ron Wainberg, Executive Director  
Also: Dr. Stephen Moore, School of Civil Engineering, UNSW, Sydney 2052,  
Australia, Tel: +612 9385 5073; Fax: +612 9385 6139; Email:  
s.moore@unswedu.au

**Topics covered:** a c e f g h i

**Description:** CRC is a national centre comprised of organisations committed to applied research in waste management and pollution control. It is committed to research, development, education, and commercialisation of innovative approaches to protecting and enhancing the natural

**TOPICS:**

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

environment and economic well being of Australia. Among its many R&D programs are waste reduction/minimisation and disposal of MSW,

The Australian Waste Database developed by the CRC will collect data on recycling and waste disposal to landfills from all parts of Australia. The database will assist state, territory, and local governments to monitor their progress towards the national waste minimisation and recycling targets and assist with the development of waste minimisation strategies. CRC has many publications on results of R&D work.

**Format of information:** Reports, manuals, pamphlets, newsletters, and technical papers.

**Internet:** [www.crcwmpc.com.au](http://www.crcwmpc.com.au)

**Language:** English

**Consulting or support services:** CRC carries out contract research and consultancy.

**Fees:** Some materials are available at cost.

## **L8. Department of Environment - Malaysia**

Ministry of Science, Technology and Environment  
12 & 13th Floor, Wisma Sime Darby  
Jalan Raja Laut  
Kuala Lumpur 50662  
Malaysia

**Telephone:** +60 3 293 8402

+60 3 293 8955

**Fax:** +60 3 293 1480

**Email:**

**Contact:** Dato Dr. Abu Baker b Jaafar, Director General

**Topics covered:** a b c d e f g h i j k

**Description:** The Department of Environment administers and enforces environmental laws in Malaysia. It evaluates the effectiveness of pollution control systems, enforces pollution control measures, and disseminates environmental information to the public in order to enhance environmental awareness.

**Format of information:** Reports of findings, databases, pamphlets, and guides on specific topics.

**Internet:** [www.jas.sains.my/jas/event\\_eng/default.html](http://www.jas.sains.my/jas/event_eng/default.html)

**Language:** Mainly in Malay and English; some materials are also in Chinese and Tamil

**Consulting or support services:** The Department provides consulting services to other government bodies.

**Fees:** Materials are free to government bodies and libraries in Malaysia and available to the public at very low cost.

**TOPICS:**

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

## **L9. Department of Environment and Natural Resources - Philippines**

DENR Building  
Visayas Ave., Diliman  
1100 Quezon City  
Philippines

**Telephone:** +63 2 928-1178  
**Fax:** +63 2 922-6991  
**Email:** web@denr.gov.ph  
**Contact:** Ms. Elisea Gozun, Secretary

**Topics covered:** a b c e f h i j

**Description:** The Department sets policies, formulates plans, and disseminates environmental information to the public to enhance environmental awareness.

**Format of information:** Reports, pamphlets, and guidebooks.

**Internet:** www.DENR.gov.ph

**Language:** Materials are available in Tagalog and in English

**Consulting or support services:** Provides technical supports to government agencies and local government.

**Fees:** None or at very low cost.

## **L10. Department of the Environment and Heritage - Australia**

John Gorton Building  
King Edward Terrace  
Parkes ACT 2600  
GPO Box 787  
Canberra ACT 2601  
Australia

**Telephone:** +61 6 274 1111  
**Fax:** +61 6 274 1666  
**Email:** epag@cepa.erin.gov.au  
**Contact:** Mr. Mark Hyman, Asst Secretary

**Topics covered:** a b c d e f g h i j k

### **Description:**

The Department of the Environment and Heritage advises the Australian Government on policies and programs for the protection and conservation of the environment, including both natural and cultural heritage places. The Department also works with Australian business organisations and

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industrial sectors, the community and other levels of government to protect Australia's atmosphere and to improve the environmental performance of Australian industry.

It is concerned with the conservation and appreciation of Australia's natural and cultural heritage places and is responsible for Australia's participation in a number of international environmental agreements. In addition, the department also administers environmental laws, including the Environment Protection and Biodiversity Conservation Act 1999 and a range of other Acts.

**Format of information:** Reports, guidebooks, and materials on waste minimisation, recycling, and reuse.

**Internet:** [www.erin.gov.au](http://www.erin.gov.au)

**Language:** English

**Consulting or support services:** The Department provides information on approvals and permits, programs and funding, taxation concessions and other matters.

**Fees:** Materials are distributed free or at low cost.

### **L11. Development Academy of the Philippines**

DAP Building, San Miguel Avenue  
Pasig City  
PO Box No. 12788, Ortigas Centre,  
Mandaluyong  
Metro Manila  
Philippines

**Telephone:** +63-2 6310921

**Fax:** +63 2 6335572

**Email:** [dap30th@dap.edu.ph](mailto:dap30th@dap.edu.ph)

**Contact:** Director

**Topics covered:** a f g h i j k

**Description:** The Development Academy of the Philippines (DAP) is a government corporation that serves as a technical resource institute. The Academy's mission is to promote, develop, and implement capability-building programs for individuals and organisations in the bureaucracy, the private sector, and local government in order to accelerate national development efforts. The DAP's Environmental Management Program seeks to build capacities within the national and local government through the provision of services that include training, organisational consultancy, management education, instructional materials development, research, and publications. An entirely self-financing organisation, the DAP operates through project contracts with client agencies in the private and public sectors, and foreign and local organisations.

**Format of information:** Reports, technical papers, newsletters, manuals, and guidebooks.

**Internet:** [www.dap.edu.ph](http://www.dap.edu.ph)

**Language:** Materials are in English and the national language

**Consulting or support services:** Undertakes contract consultancy projects.

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

**Fees:** Materials are available at cost (less than US\$20).

## **L12. Development Technology Center of the Bandung Institute of Technology**

Jalan Ganesha 17  
Bandung 40132  
Indonesia

**Telephone:** +62 22 250 3307  
**Fax:** +62 22 250 1768  
**Email:** dtcitb@ibm.net  
**Contact:** Lanny T. Hardhy

**Topics covered:** a b c h i j

**Description:** The Development Technology Center of the Bandung Institute of Technology works on MSWM issues as part of its Village Technology Development Program. It runs courses on composting and encourages communities to start and maintain composting and other appropriate recycling practices. It also conducts experiments on recycling hardware technologies related to plastics, paper, and energy recovery. The center evaluates and monitors composting programs all over Indonesia, working with other NGOs under the aegis of Habitat, through the Metropolitan Environmental Improvement Program (MEIP).

**Format of information:** Seminars, reports, pamphlets

**Internet:**

**Language:** Mainly Indonesian; English for international communication

**Consulting or support services:** Consults on urban solid waste management and community development projects, and conducts workshops on experimental technology.

**Fees:** Usually negotiated.

## **L13. Economic and Social Commission for Asia and the Pacific (ESCAP)**

UN-Building  
Rajadamnern Nok Avenue  
Bangkok 10200  
Thailand

**Telephone:** +66 2 288 1234  
**Fax:** +66 2 288 1000  
**Email:** webmaster@unescap.org  
**Contact:** Mr. Jens Overgaard, Chief, Human Settlements

**Topics covered:** a b c d e f g h i j k

**Description:** ESCAP is a UN agency that engages in all aspects of environmental control/conservation, urban environmental management, and environmental education. It works

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closely with government agencies dealing with the environment and waste management services. It provides funding and expertise in activities related to the environment.

**Format of information:** Reports, proceedings, environmental guidelines and standards, and materials for skill development and education.

**Internet:** [www.unescap.org](http://www.unescap.org)

**Language:** Materials are available in many languages

**Consulting or support services:** Provides funds and technical support services to member nations. Also maintains library facilities.

**Fees:** Materials are distributed free, with some postage charges.

#### **L14. Engineering Services Department - Singapore**

Ministry of the Environment  
40 Scotts Road  
Environment Building  
Singapore 228231

**Telephone:** +65 6732 7733

**Fax:** +65 6731 9456

**Email:** [Contact\\_NEA@NEA.gov.sg](mailto:Contact_NEA@NEA.gov.sg)

**Contact:** Mr. Koh Hee Song, Head

**Topics covered:** a d e f g h i j k

**Description:** The Engineering Services Department (ESD) of the Ministry of the Environment is a government body. ESD is responsible for the planning and development of solid waste disposal facilities, operation and maintenance of several incinerators. ESD maintains the fleet of vehicles of the Ministry, and gathers and keeps information on all activities under its charge. It publishes an annual report on MSW, which is distributed to other government bodies and libraries.

ESD also works closely with other government bodies such as the Environmental Policy and Management Division and the Waste Minimisation Department to achieve 40% recycling of wood and timber wastes, 60% of paper and cardboard wastes, 50% of plastic wastes, and 20% of construction and demolition debris, which are the targets of the Singapore Green Plan. ESD has some well-structured in-house training programs and facilities for hands-on training.

**Format of information:** Annual report, other documents, and database searches

**Internet:** [www.env.gov.sg](http://www.env.gov.sg)

**Language:** ESD has materials in English, Chinese, Malay, and Tamil

**Consulting or support services:** ESD maintains a list of qualified consultants active in Singapore and the region. ESD also provides consulting and engineering services through the Singapore Environmental Management and Engineering Services Pte Ltd.

**Fees:** Fees are charged for photocopying (less than 10 US cents/page) and for database searches.

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## **L15. ENSIC (Environmental Systems Information Center)**

Asian Institute of Technology  
GPO Box 2754  
Bangkok 10501  
Thailand

**Telephone:** +66 2 524-5640  
**Fax:** +66 2 524-5640  
**Email:** visu@emailhost.ait.ac.th  
**Contact:**

**Topics covered:** a b c d e f g h i j k

**Description:** ENSIC facilitates the dissemination, evaluation and discussion of research, case studies, and field experiments related to environmental policy, management, and engineering. Issues covered include solid waste, wastewater, hazardous waste, air and noise pollution, soil pollution, land management, water supply, clean technology, biological resources management, health and sanitation, environmental impact assessment, and environmental economics. The organisation publishes a newsletter about these issues, covering both technical and regulatory matters.

**Format of information:** Technical reports and papers, manuals, guidebooks, newsletters.

**Internet:** [www.ait.ac.th/clair/centers/ensic.html](http://www.ait.ac.th/clair/centers/ensic.html)

**Language:** Materials are in English

**Consulting or support services:** AIT undertakes contract research and consulting services.

**Fees:** ENSIC membership rates are US\$130 for institutions and US\$80 for individuals.

## **L16. Environment Protection Department - Hong Kong**

25/F Southern Centre  
130 Hennessy Road  
Wan Chai  
Hong Kong

**Telephone:** +852 835 1018  
**Fax:** +852 838 2155  
**Email:** enquiry@epd.gov.hk  
**Contact:** Mr. Ronnie L.N. Tong, Senior Environmental Officer

**Topics covered:** a b c d e f g h i j k

**Description:** The EPD is a government department charged with administering and enforcing environmental rules, regulations, and guidelines. It provides environmental input to development agencies to ensure that land and other natural resources are properly utilised based on the concept of sustainable development. It develops networks of monitoring systems in order to establish the

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state of the city's environment quality and to review the existing regulations and introduce new ones where necessary. It also disseminates environmental information to the public to enhance environmental awareness.

**Format of information:** Reports, code of practice, and guidebooks on specific topics.

**Internet:** [www.epd.gov.hk/epd](http://www.epd.gov.hk/epd)

**Language:** Materials are available in English and Chinese

**Consulting or support services:** Provides technical support services to other government agencies.

**Fees:** Materials are distributed free in Hong Kong or at very low cost.

## **L17. Environmental Health Department - Singapore**

Ministry of the Environment  
40 Scotts Road  
Singapore 228231

**Telephone:** +65 7319164

**Fax:** +65 7319749

**Email:** [S\\_Satish\\_APPOO@env.gov.sg](mailto:S_Satish_APPOO@env.gov.sg)

**Contact:** Mr. Lim Yew Hang, Head

**Topics covered:** a b f g

**Description:** The Environmental Health Department (EHD) is responsible for refuse and disposal services, cleansing services for roads, walkways, footpaths, and drains. Starting in 1996, the refuse collection unit was privatised and became a private limited company with an authorised capital of about S\$350 million. The new company took over the existing equipment and facilities. The Department collects and maintains especially detailed information on Topics a, b, and g.

**Format of information:** An annual report, newsletters, and other pamphlets for public education.

**Internet:** [www.env.gov.sg](http://www.env.gov.sg)

**Language:** Most of the materials are in English but publications in Chinese, Malay, and Tamil are also available

**Consulting or support services:** None except through Semac, a joint venture company of ENV Corporation, Singapore Technologies Industrial Corporation, and Sembawang Engineering.

**Fees:** Most of the publications are distributed free in Singapore, or at very low cost.

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

## **L18. Environmental Impact Management Agency (BAPEDAL) - Indonesia**

11 Floor, Jalan Jendral Udirman # 2  
Jakarta  
Indonesia

**Telephone:** +62 21570 3419

**Fax:** +62 21583 918

+62 21570 5321

**Email:**

**Contact:** Ms. Masnellyerti Hilman, Director, Hazardous Waste Management  
Also: Mr. Nabiel Makarim, Deputy, Pollution Control

**Topics covered:** a c e f h i j

**Description:** The Agency develops policies, formulates regulations and laws, reviews existing laws and regulations, and recommends amendments whenever necessary. It also disseminates information on environmental conservation, pollution control, and issues of waste management.

**Format of information:** Books, reports, code of practice, and materials for human resources development.

**Internet:** [www.bapedal.go.id](http://www.bapedal.go.id)

**Language:** Materials are mainly in Indonesian with some editions in others languages

**Consulting or support services:** Provides technical support services to government agencies, businesses, and the communities.

**Fees:**

## **L19. Environmental Protection Administration - Taiwan**

41, Sec 1, Chung-Hwa Road  
Taipei  
Taiwan

**Telephone:** +886 2 311 7722

**Fax:** +886 2 311 6071

**Email:** [mail@sun.epa.gov.tw](mailto:mail@sun.epa.gov.tw)

**Contact:**

**Topics covered:** a b c d e f g h i j k

**Description:** The EPA is a government body responsible for preserving the environment and maintaining public health. It sets regulations/laws on specific environmental issues, develops environmental monitoring systems, and carries out enforcement on pollution sources to ensure that they are complying with licensing conditions, and emission and discharge standards.

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The EPA carries out extensive studies on MSW incineration and composting. It has built incineration plants, and some composting facilities are under construction for the disposal of MSW. The EPA also has experience and information on special wastes handling and disposal, such as construction and demolition debris and hospital wastes. The EPA publishes reports, guidelines, code of practice and training manuals for human resources development and public education.

**Format of information:** Reports, handbooks, pamphlets, and newsletters.

**Internet:** [www.epa.gov.tw/english](http://www.epa.gov.tw/english)

**Language:** Materials are published in Chinese, with some translations into other languages

**Consulting or support services:** None except to other government bodies.

**Fees:** None or at very low cost.

## **L20. Environmental Technology Institute (ETI) - Singapore**

Innovation Centre #237  
Nanyang Technology University  
18 Nanyang Drive  
Singapore 637723

**Telephone:** +65 794 1533

**Fax:** +65 792 1291

**Email:** [kstan@eti.org](mailto:kstan@eti.org)

**Contact:** Prof. Tay Joo Hwa, Acting Director

**Topics covered:** a c f g i j

**Description:** The ETI was established by the National Science and Technology Board to (a) serve as a focus point for research and development on environmental technology in Singapore and (b) provide the international standing to attract multinational corporate investment that could create knowledge-intensive and high-value-added activities in Singapore. It also promotes the establishment of research capabilities in local technology-based environment companies in order to better prepare companies to deal with emerging environmental standards.

**Format of information:** Reports, technical papers, journals, manuals, and guidebooks.

**Internet:** [www.eti.org.sg](http://www.eti.org.sg)

**Language:** Materials are available in English, with editions in Chinese, Malay, and Tamil

**Consulting or support services:** ETI undertakes contract consultancy services and R&D projects.

**Fees:** Materials are available at cost, with some distributed free.

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

## L21. Global Environment Centre Foundation (GEC)

2-110 Ryokuchi-koen  
Tsurumi-ku  
Osaka 538-0036  
Japan

**Telephone:** +81-6-915-4121  
**Fax:** +81-6-915-0181  
**Email:** gec@unep.or.jp  
**Contact:** Prof. Nobuaki Kumagai, President

**Topics covered:** a c d e g h i

**Description:** The Global Environment Centre Foundation (GEC) is a non-profit organisation that supports the Osaka Office of UNEP's International Environmental Technology Centre (IETC). It also collects and disseminates information on environmentally sound technologies for MSWM and other fields related to the environment. The centre has constructed a searchable database on environmental technology within its website. Listings of technical information sources are also provided through the Internet. A list of specialists in several environmental fields is available for those seeking such advice.

**Format of information:** Reports, newsletters

**Internet:** Summaries of about 160 Japanese solid waste treatment technologies are provided on the Environmental Technology Database at [www.unep.or.jp/gec](http://www.unep.or.jp/gec)

**Language:** English and Japanese

**Consulting or support services:** Provides technical information upon request.

**Fees:** None.

## L22. Hanoi Urban Environment Company (URENCO)

18 Cao Ba Quat Street  
Ba Dinh, Hanoi  
Vietnam

**Telephone:** +84 4 8454807  
**Fax:** +84 4 8236384  
**Email:**  
**Contact:** Mr. Chu Van Chung, General Director

**Topics covered:** a b c e f g h i j k

**Description:** URENCO deals with all aspects of MSWM services, focusing on Hanoi. It carries out collection, transfer, and disposal of MSW and special wastes such as construction/demolition debris and hospital wastes. It supervises the picking of recyclables from MSW by waste pickers,

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and operates and maintains landfills and composting facilities. URENCO also sets guidelines and provides skill development for MSWM personnel.

**Format of information:** Reports, guidebooks, and pamphlets.

**Internet:**

**Language:** Materials are mainly in Vietnamese

**Consulting or support services:** Undertakes contract MSWM services.

**Fees:** Materials are available at cost.

### **L23. Hong Kong Productivity Council**

HKPC Building, 78 Tat Chee Avenue

Kowloon

Hong Kong

**Telephone:** +852 788 5678

**Fax:** +852 788 5900

**Email:**

**Contact:** Mr. Lin Chan-ming, Head, Environmental Management Division

**Topics covered:** a d f g h i

**Description:** The HKPC Environmental Management Division (EMD) has been providing consultancy services to business on all aspects of the environment since 1980. The range of services includes environmental policy, auditing, assessment, monitoring, and training. In addition, EMD also provides consultancy services on pollution control devices, system design, and installation. It undertakes all type of environmental study from initial studies to full-scale planning and environmental assessments of major projects.

**Format of information:** Reports, manuals, and guidebooks for environmental training and education.

**Internet:** [www.hkpc.org](http://www.hkpc.org)

**Consulting or support services:** The Council undertakes contract consulting services.

**Language:** Materials are available in English and Chinese

**Fees:** Materials can be purchased at cost (US\$0 to 200).

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

## L24. Information Centre for Technology - Singapore

Singapore Institute of Standards and Industrial Research (SISIR)  
1 Science Park Drive  
Singapore 118221

**Telephone:** +65 7729527

**Fax:** +65 7783798

**Email:**

**Contact:** Ms. Lena Kua, Gopika Gopalakrishnan, and Lana Soh, Editor Team

**Topics covered:** f h i j

**Description:** The Information Centre for Technology is the information arm of SISIR. It has a collection of Singapore Standards, the British Standards, and ISO and IEC Standards. It has also in its collections three standard data bases on CD-ROM: PERINORM, THS, and Standard Infodish.

**Format of information:** A quarterly newsletter.

**Internet:**

**Language:** Materials are mainly in English with some in Chinese, Malay, and Tamil

**Consulting or support services:** SISIR provides consulting services to industries.

**Fees:** Materials are available at a small charge.

## L25. Institute of Public Health - Japan

Waste Disposal Engineering Section  
Department of Waste Management Engineering  
Shirogandai 4-6-1, Minato-ku  
Tokyo  
Japan

**Telephone:** +81 3 3441 7111

**Fax:** +81 3 3446 4314

**Email:** webmaster@niph.go.jp

**Contact:** Dr. Kiyoshi Kanamura, Chief

**Topics covered:** a c d e f h j

**Description:** The Waste Disposal Engineering Section and the Department of Waste Management Engineering in general engage in R&D and technology development for waste management. They help formulate policy, develop plans and strategies for waste management, and provide technical support services to businesses and government agencies.

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.



**Format of information:** Reports, technical papers, journals, newsletters, manuals, and guidebooks.

**Internet:** [www.niph.go.jp/english2/english%20ver/index.html](http://www.niph.go.jp/english2/english%20ver/index.html)

**Language:** Materials are mainly in Japanese

**Consulting or support services:** Provides technical supporting services to industries and government agencies.

**Fees:** None or at very low cost.

## **L26. International Environmental Planning Center (INTEP)**

Dept. of Urban Engineering

University of Tokyo

7-3-1, Hongo, Bunkyo-ku

Tokyo 113

Japan

**Telephone:** +81-3-5800-5948

**Fax:** +81-3-5802-2956

**Email:** [aramaki@env.t.u-tokyo.ac.jp](mailto:aramaki@env.t.u-tokyo.ac.jp)

**Contact:** Prof. Hidetoshi Kitawaki

**Topics covered:** a b c e f g h i j

**Description:** As part of the Department of Urban Engineering at the University of Tokyo, INTEP is primarily responsible for the education of students and for research in water supply and sanitation related to developing countries. The development of planning methodologies is another of the center's priority areas of research. In addition, INTEP serves as an information centre active in information exchange on appropriate technology. The center publishes a newsletter in English to disseminate information from Japan to other countries; the Japanese version is meant to do the reverse. INTEP carries out its field research activities mainly in Indonesia, Vietnam, and Bangladesh.

**Format of information:** Publications are in paper format.

**Internet:** [www.env.t.u-tokyo.ac.jp/project/INTEP/intro.html](http://www.env.t.u-tokyo.ac.jp/project/INTEP/intro.html)

**Language:** English and Japanese

**Consulting or support services:** INTEP provides voluntary consulting and support services.

**Fees:** None.

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

## L27. Japan Sewage Works Agency

Planning Division  
18 Mori Building  
Toranomon 2-3-13, Minato-ku  
Tokyo 105  
Japan

**Telephone:** +81 3 3502 8374

**Fax:** +81 3 3504 1884

**Email:**

**Contact:** Dr. Takao Murakami, Deputy Chief, Regional Sludge Treatment Planning

**Topics covered:** a b c d f h i

**Description:** The Agency is a government body. The Regional Sludge Treatment Planning Section carries out research, planning and demonstration projects on sewage sludge management, among which is the sludge melting project. It helps formulate policy and develop guidelines for sludge treatment and disposal.

**Format of information:** Reports, technical papers, journals, newsletters, manuals, and guidebooks.

**Internet:** [www.JSWA.go.jp](http://www.JSWA.go.jp)

**Language:** Materials are mainly in Japanese with some in English and other languages

**Consulting or support services:** Undertakes contract R&D projects and provides technical support services to municipalities and other government bodies.

**Fees:** None or at very low cost.

## L28. Japan Society of Waste Management Experts (JSWME)

Buzenya Bldg. SF  
Shiba 5-1-9  
Minato-ku  
Tokyo 108  
Japan

**Telephone:** +81 3 3769 5099

**Fax:** +81 3 3769 1492

**Email:**

**Contact:** Dr. Kunitoshi Sakurai

**Topics covered:** a b c d e f g h i j k

**Description:** The Japan Society of Waste Management Experts (JSWME) was established in 1990 to organise individuals with sound experience and expertise in the different fields of waste management. As of 2003, it had over 4,000 members, including Japanese and international

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members. JSWME publishes a society journal, *Waste Management Research* (Haikibutsu Gakkaishi), including a research paper compendium (in Japanese with English abstracts) four times per year. It publishes Japanese and English newsletters six times and three times annually, respectively. Since November 1999, the JSWME began publishing the *Journal of Material Cycles and Waste Management* in English. This journal is published to promote the exchange of information in the field between Asia and the rest of the world. The JSWME also holds an annual conference every autumn to provide members with an opportunity to meet and to present and discuss professional papers.

**Format of information:** Technical papers, journals, newsletters, and manuals.

**Internet:** [jswme.gr.jp/international](http://jswme.gr.jp/international)

**Language:** Materials are mainly in Japanese with some in English

**Consulting or support services:** Provides information service to members and government agencies.

**Fees:** JSWME's journal is available only to members. The membership fee is approximately US\$110 per year. The English newsletter is sent free of charge to anyone who wishes to receive it. Subscriptions to the *Journal of Material Cycles and Waste Management* are about €124 (excluding VAT and postage) to countries except Japan, North and South America. Subscription rates for other countries vary.

## L29. Japan Waste Management Association

IPB Ochanomizu 7A  
3-11 Hongo 3-chome Bunkyo-Ku  
Chiyoda-ku  
Tokyo 113  
Japan

**Telephone:** +81 3 58046281

**Fax** +81 3 38124731

**Email:**

**Contact:** Dr. Katsumi Yamamura

**Topics covered:** a b d e f g h i j

**Description:** Members of the Association publish extensively in national and international journals on waste management. The Association holds seminars, workshops, national and international conferences at regular intervals.

**Format of information:** Books and journals on MSWM.

**Internet:**

**Language:** Materials are mainly in Japanese but some are in other languages

**Consulting or support services:** Provides technical support to members and governmental agencies.

**Fees:** Materials are distributed to members who pay annual subscriptions.

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

### **L30. Korea Advanced Institute of Science and Technology (KAIST)**

207-43 Cheongryangri-dong, Dongdaemun-gu  
Seoul 130-012  
Korea

**Telephone:** +82 2 958-3114

**Fax:** +82 2 958-3230

**Email:**

**Contact:** Dr. Kyu-Hong Ann, Head, Environment System Group

Also: Dr. Hang-Sik Shin, Chairman, Civil Engineering, Tel: +82 2 967 0121 /  
966 1931/7

**Topics covered:** a c d e f h i

**Description:** KAIST is an academic and research institute. It carries out R&D projects in waste management and environmental pollution and conservation in general. The Institute undertakes contract research and consultancy for the industry and government agencies. It helps formulate plans, policy, and strategies on environmental management and initiates technology transfer, education, and training programs.

**Format of information:** Reports, books, technical papers, journals, newsletters, and manuals.

**Internet:** www.kaist.edu

**Language:** Materials are mainly in Korean with some in English and other languages

**Consulting or support services:** It undertakes contract R&D projects and provides technical support services to businesses and government agencies.

**Fees:** None or at very low cost. (US\$0 to 20)

### **L31. Ministry of Construction - China**

Department of Science and Technology  
9 San Li He Road  
Beijing 100835  
People's Republic of China

**Telephone:** +86-10-68355505

**Fax:** +86-10-68394530

**Email:** dostmoc@public2.bta.net.cn

**Contact:** Nie Meisheng

**Topics covered:** a b c d e f g

**Description:** The Department is a government body responsible for management of scientific research and technology development on urban solid waste and wastewater treatment.

TOPICS:

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**Format of information:** Technical reports and scientific/technical papers in local and international journals.

**Internet:** [www.cin.gov.cn](http://www.cin.gov.cn)

**Language:** Materials are available mainly in Chinese

**Consulting or support services:** The Department provides consulting and support services to municipalities and other government bodies.

**Fees:** Depend on project and are often very low.

### **L32. Ministry of Development - Brunei Darussalam**

Old Airport, Berakas  
Bandar Seri Begawan, BB3510  
Brunei Darussalam

**Telephone:** +673 2 381033

**Fax:** +673 2 381541

**Email:** [modcpru@brunet.bn](mailto:modcpru@brunet.bn)

**Contact:**

**Topics covered:** a b e f g h i j k

**Description:** The Ministry sets policies, develops laws and regulations, monitoring systems and frameworks for environmental control and conservation. It carries out day-to-day MSWM services and is responsible for building, operating, and maintaining waste management facilities.

**Format of information:** Laws and regulations, code of practice, reports, and guidebooks for environment management.

**Internet:** [www.mod.gov.bn/PBD2.htm](http://www.mod.gov.bn/PBD2.htm)

**Language:** Mainly are available mainly in Malay and some in English

**Consulting or support services:** Provides technical support services to government departments and communities.

**Fees:** None.

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### L33. Ministry of International Trade and Industry (MITI) - Japan

Agency of Industrial Science and Technology  
3-1 Kasumigaseki, 1-Chome  
Chyoda-ku  
Tokyo 100  
Japan

**Telephone:** +81 3 3501 1511  
**Fax:** +81 3 3501 7926  
**Email:** qtka@miti.go.jp  
**Contact:** Dr. Chihiro Watanabe, Deputy Director General  
Dr. Nobuaki Mori, Director for General Coordination of New Energy and  
Environmental Technologies, Tel: +813 3501-9271; Fax: +813 3501 7926

**Topics covered:** a b c d e f g h i j k

**Description:** The Agency of Industrial Science and Technology of MITI is responsible for energy and environmental policy planning and industrial technology. Since the 1960s, it has spearheaded the R&D effort on sustainable development to meet the challenge of energy and environment constraints. MITI is working closely with many government ministries to formulate basic environmental policies.

**Format of information:** The AIST, and MITI in general, have many publications.

**Internet:** [www.aist.go.jp](http://www.aist.go.jp)

**Language:** Mainly in Japanese but also available in other languages

**Consulting or support services:** Provides funds and technical support for R&D programs to national and international bodies.

**Fees:** Materials are distributed free or at very low cost.

### L34. Ministry of Public Works - Indonesia

JL. Patimura 20  
Keb Baru, Jakarta 12110  
Indonesia

**Telephone:** +62-21-7392-262  
**Fax:** +62-21-7220-219  
**Email:**  
**Contact:** Ir Dr. Darmawan Saleh, Director of Directorate of Environmental Sanitation  
and Director General of Directorate of Human Settlement

**Topics covered:** a b e f g h i j k

**Description:** The Department is a government body responsible for the planning, development, and administration of infrastructure and public amenities. The Directorates of Environmental

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Sanitation and General Human Settlement (a) study and assess development projects subject to environmental impact assessment, (b) evaluate the site suitability and effectiveness of pollution control systems for projects, (c) provide environmental input to development agencies, and (d) carry out enforcement on pollution sources and review the existing regulations and recommend new ones where necessary. The Directorates also disseminate environmental information to the public to enhance environmental awareness.

**Format of information:** Reports, pamphlets, code of practice, regulations, and human resource development guidebooks and manuals.

**Internet:** [www.pu.go.id/lpi-pu/eng/imp/swdna-e.htm](http://www.pu.go.id/lpi-pu/eng/imp/swdna-e.htm)

**Language:** Materials are mainly in Indonesian with some in English and other languages

**Consulting or support services:** They give technical advice and expertise to local authorities and other government agencies.

**Fees:** Materials are distributed free to government bodies and libraries in Indonesia and some are available to the public at low cost.

### L35. Ministry of Science, Technology and Environment - Thailand

60/1 Soi Phibun Wattana 7  
Rama VI Road  
Bangkok 10400  
Thailand

**Telephone:** +66 2 279 0129

**Fax:** +66 2 279 0672  
+66 2 246 8016

**Email:** [webmaster@most.go.th](mailto:webmaster@most.go.th)

**Contact:** Dr. Pakit Kisaranit, Director General of Pollution Control Department

**Topics covered:** a c d e f h i j

**Description:** The Ministry proposes and enforces environmental laws and regulations, develops national networks of monitoring systems, and disseminates environmental information to the public to enhance environmental awareness and education. It provides funds and trainers for various projects and educational activities.

**Format of information:** Reports, code of practice, laws and regulations, pamphlets, manuals and guidebooks for training and public education.

**Internet:** [www.moste.go.th/moste\\_eng/index.htm](http://www.moste.go.th/moste_eng/index.htm)

**Language:** Materials are mainly in Thai; editions in English and other languages may be available

**Consulting or support services:** The Ministry provides technical support services to local authorities and other government agencies.

**Fees:** None.

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### **L36. National Institute of Environmental Research - Korea**

Domestic Waste Division  
Waste Management Research Department  
Environmental Research Complex  
Kyungseo-Dong, Seo-Gu  
Incheon  
Korea 404-170

**Telephone:** +82-32-560-7114  
**Fax:** +82-32-568-2031  
**Email:** mkang@me.go.kr  
**Contact:** Dr. Yoo-Won Lee, Director

**Topics covered:** a b e f g

**Description:** NIER is a research organisation involved in all aspects of environmental studies. Its Waste Management Research Department initiates programs, in-house and with other organisations, of basic and applied research and development into relevant areas of waste management, environmental monitoring, and assessment. The Department carries out R&D projects on domestic waste management covering waste minimisation, recycling, reuse, collection and transfer, landfill, and special wastes.

**Format of information:** Results are published in book form. The Department also publishes training guides and manuals for technology transfer and pamphlets on wastes management for public education.

**Internet:** [nier.go.kr/nierdepart/e\\_nier](http://nier.go.kr/nierdepart/e_nier)

**Language:** Materials are mainly in Korean with some in other languages

**Consulting or support services:** The Department undertakes contracts R&D and consultancy projects.

**Fees:** Materials are available at a low cost.

### **L37. National Solid Waste Management Commission**

Environmental Management Bureau - DENR  
Visayas Ave., Diliman  
1100 Quezon City  
Philippines

**Telephone:** +63 2 9296626  
**Fax:** +63 2 975698  
**Email:** webmaster@denr.gov.ph  
**Contact:** Mr. Albert A Magalang, Executive Director

**Topics covered:** a b c d e f g h i j

**TOPICS:**

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**Description:** The NSWMC was established from the Presidential Task Force on Solid Waste Management (PTFSWM), which was created in November 1987 under the Aquino administration to formulate immediate plans of action in solving the worsening garbage problem in the country. It's earlier functions include providing developing standards for solid waste management, providing technical assistance to Local Government Units (LGUs), networking with Non-Governmental Organisations (NGOs) and private sectors concerned and public information dissemination.

Since the functions of the task force fall within the mandate of national environmental protection and conservation, the Project Management Office (PMO) of the task force was transferred from the Presidential Management Staff (PMS) to the Environmental Management Bureau (EMB) of the Department of Environment and Natural Resources (DENR).

The National Solid Waste Management Commission (NSWMC) is the major agency tasked to implement Republic Act 9003, the Ecological Solid Waste Management Act of 2000. The law, signed in January 26, 2001, calls for the institutionalisation of a national program that will manage the control, transfer, transport, processing and disposal of solid waste in the country.

The Commission, Chaired by the Department of Environment and Natural Resources (DENR), will prescribe policies to effectively achieve the objectives of RA 9003. It will also oversee the implementation of appropriate solid waste management plans by end-users and local governments as mandated by law.

The Commission is also ordered to establish the National Ecology Center, which will serve as the depot of information, research, database, training, and networking services for the implementation of the provisions of the solid waste management act.

**Format of information:** Reports, technical papers, rules and regulations, and materials for human resources development.

**Internet:** [www.emb.gov.ph](http://www.emb.gov.ph)

Language: Materials are mainly in English and the national language

**Consulting or support services:** Provides technical support services to municipalities and government agencies and NGOs.

**Fees:** None, except mailing cost.

### **L38. Policy and Planning Department Thailand**

Division of Infrastructure and Environment  
Bangkok Metropolitan City Hall  
Bangkok 10200  
Thailand

**Telephone:** +66 2 225 7947

**Fax:** +66 2 225 7947

**Email:**

**Contact:** Dr-Ing Ksemsan Suwarnarat, Mr. Chanchai Pavasuthikam

**TOPICS:**

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**Topics covered:** a b c d e f h i

**Description:** The Department formulates policies, plans, and strategies for waste management. It evaluates and carries out R&D in relevant areas of environmental management, monitoring, and control. It plans waste disposal facilities, code of practice, and programs for human resource development.

**Format of information:** Reports, handbooks, manuals, and code of practice on- specific issues.

**Internet:**

**Language:** Materials are mainly in Thai with a few in other languages

**Consulting or support services:** Provides technical supporting service to municipalities and government bodies.

**Fees:** None or at very low cost.

### **L39. Pollution Control Department - Singapore**

40 Scotts Road  
Environment Building  
Singapore 228231

**Telephone:** +67 319667

**Fax:**

**Email:** YAU\_Tai\_Yin@NEA.gov.sg

**Contact:** Mr. Loh Ah Tuan, Head

**Topics covered:** a f g h

**Description:** The Department is responsible for air and water pollution control, control of environmental hazardous chemicals, planning consultation and building plan clearance, and CFC and TOP clearance for the Ministry of the Environment.

**Format of information:** An annual report, code of practices, and planning guides.

**Internet:** www.env.gov.sg

**Language:** Most of the materials are in English, Chinese, Malay, and Tamil

**Consulting or support services:** Consulting services are provided through Semac.

**Fees:** Annual reports are distributed free to government bodies and libraries in Singapore and to others on request. Planning guides and code of practices are sold at the Ministry of the Environment for less than US\$20.

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#### **L40. Regional Institute of Environmental Technology (RIET)**

3 Science Park Drive #04-09  
Singapore 118223

**Telephone:** +65 6777-2685  
**Fax:** +65 6773-2800  
**Email:** riet@riet.ogr.sg  
**Contact:** Dr. Philippe Bergeron, Director

**Topics covered:** a b c f h i j

**Description:** The Institute was established with the joint funding of Singapore and the European Union. Its role is to serve as an environmental business facilitator. It acts as a broker of value-added environment services in partnership with private suppliers of environmental goods and services in Asian countries, including China and most of Southeast Asia. RIET provides a simple matchmaking service for its members who are interested in identifying a business or partner. RIET also conducts short courses, seminars, workshops, and conferences on an ad hoc basis. These activities are open to the public.

**Format of information:** A quarterly newsletter, *RIET in Focus*, which is distributed free to its members, government bodies, and libraries in Singapore.

**Internet:** www.RIET.org

**Language:** Materials are available in English, but translations to Chinese, Malay, and Tamil are available on request

**Consulting or support services:** RIET provides matchmaking services for its members on environmental business and services. Industry members receive free, impartial advice on environmental technology and issues via a telephone help line.

**Fees:** For simple matchmaking services no fee is charged. However, a more comprehensive search that may entail extensive investigation into the capabilities of potential partners carries a fee. There are two categories of members: technology member and industry member. Fees for materials can be as high as US\$400. The annual subscription rates for a technology member are based on the company's business turnover and ranges from US\$200-600.

#### **L41. Regional Network for Management and Utilisation of Wastes**

IPB Darmaga Campus  
PO Box 69  
Bogor 166001  
Indonesia

**Telephone:** +62-251-622-640  
**Fax:** +62-215 83 127  
**Email:**  
**Contact:** Prof. Dr. F. Gunarwan Suratmo, Executive Secretary, UNESCO

**TOPICS:**

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**Topics covered:** a c f g i j

**Description:** This is a UNESCO network whose objective is to facilitate exchanges of information and technology transfer among member countries in the Asia/Pacific region. The network aims to create an awareness of the dangers of mismanagement of municipal and industrial wastes through seminars, workshops, and newsletters. These provide a forum for exchange of ideas and experiences among people involved in environment, waste disposal, and waste control technology.

**Format of information:** The network has produced newsletters, proceedings of workshops and conferences, and books on waste management and environmental education.

**Internet:**

**Language:** Materials are available in English and Indonesian

**Consulting or support services:** UNESCO provides funds for travel and R&D projects.

**Fees:** Materials are distributed free.

#### **L42. Shanghai Environmental Protection Bureau**

193 Hankou Road 200002  
Shanghai  
People's Republic of China

**Telephone:** +86 21 622-681-10

**Fax:** +86 21 622-666-89

**Email:** honghau@sepb.gov.cn

**Contact:** Mr. Lu Fukuan, Director, Senior Engineer

**Topics covered:** a b c d e f g h i j k

**Description:** The Shanghai Municipal Bureau of Environmental Protection is a government body responsible for protecting the quality of the environment, maintaining public health, and administering and enforcing environmental rules, regulations, and standards. The Bureau performs environmental impact assessments and disseminates environmental information to the public to enhance environmental awareness.

**Format of information:** Project reports, pamphlets, code of practice, manuals, and guidelines on specific subjects.

**Internet:** www.sepb.gov.cn

**Language:** Materials are available mainly in Chinese

**Consulting or support services:** Provides technical support to municipalities on urban environmental management services.

**Fees:** None or at very low cost.

#### **L43. South China Agricultural University**

Department of Land Resources and Environmental Sciences

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510642 Guangzhou  
People's Republic of China

**Telephone:** +86 20 85280021  
**Fax:** +86 20 85282693  
**Email:** hometown@scau.edu.cn  
**Contact:** Prof. Wu Qi-tang

**Topics covered:** a b c e f g h i j

**Description:** This University focuses on agriculture and other related disciplines. It also undertakes contract R&D projects in addition to academic research. It has considerable experience in solid waste and agricultural waste management, especially in the area of composting/anaerobic digestion, land application of compost and anaerobic-digested residuals, and the recovery of biogas for fuel in rural areas.

**Format of information:** The University has many research publications, books, and manuals.

**Internet:** [ww1.scau.edu/English/index.asp](http://ww1.scau.edu/English/index.asp)

**Language:** Materials are mainly in Chinese with some editions in other languages

**Consulting or support services:** The University undertakes contract R&D projects and provides technical support services to government bodies.

**Fees:** Materials are available free or at very low cost.

#### **L44. South Pacific Regional Environment Programme (SPREP)**

PO Box 240 Apia  
Samoa

**Telephone:** +68 521929  
**Fax:** +68 520231  
**Email:** sprep@pactok.peg.apc.org  
**Contact:** Waste Management & Pollution Prevention Officer

**Topics covered:** a b c d e f g h i j

**Description:** SPREP is a regional organisation established by the governments and administrations of the Pacific region to look after its environment. It has grown from a small program attached to the South Pacific Commission (SPC) in the 1980s into the Pacific region's major intergovernmental organisation charged with protecting and managing the environment and natural resources. It is based in Apia, Samoa, with over 70 staff.

The Pacific island governments and administrations saw the need for SPREP to serve as the conduit for concerted environmental action at the regional level. The establishment of SPREP also sends a clear signal to the global community of the deep commitment of the Pacific island governments and administrations towards sustainable development, especially in light of the outcomes of the World Summit on Sustainable Development in the form of the Plan of

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Implementation, the Millennium Development Goals and Declaration, the Barbados Plan of Action and Agenda 21.

**Format of information:** Publications can be provided in both paper and disk format.

**Internet:** [www.sprep.org.ws](http://www.sprep.org.ws)

**Language:** English and French

**Consulting or support services:** Provides technical assistance directly to its member governments.

**Fees:** Publications are usually distributed free of charge.

#### **L45. State Environmental Protection Administration - China**

Department of Pollution Control  
115 Xizhimennei Nanxiaojie  
Beijing 100035  
People's Republic of China

**Telephone:** +86 10 661 53366

**Fax:** +86 10 661 51768

**Email:**

**Contact:** Mr. Hu Shouren, Division Chief of Solid Waste Management Also: Zhang Kunmin, Deputy Administrator Tel: +86 10 610 1186; Fax: +86 10 6015641

**Topics covered:** a b c d e f g h i j k

**Description:** The Department of Pollution of the National Environmental Protection Agency is involved in all aspects of pollution control including solid waste management. The agency is responsible for strategic planning, development of legislation for specific environmental issues, applied research for application in relevant areas of environmental management, and environmental monitoring and planning. It is also involved in the development of waste disposal facilities. The department carries out enforcement on pollution sources to ensure that emissions/discharge meet standards and criteria. The agency publishes reports, laws and regulations on pollution control, code of practice, and manuals and materials for training and human resources development and public education.

**Format of information:** Reports, handbooks, manuals, code of practice on specific topics.

**Internet:** [www.zhb.gov.cn/english](http://www.zhb.gov.cn/english)

**Language:** All materials are in Chinese, but there are editions in other languages

**Consulting or support services:** Provides technical support services to various government bodies.

**Fees:** Materials are free or available at very low cost.

#### **L46. UNEP International Environmental Technology Centre (IETC)**

Osaka Office  
2-110 Ryokuchi-koen

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Tsurumi-ku  
Osaka 538  
Japan

**Telephone:** +81-6-915-4581  
**Fax:** +81-6-915-0304  
**Email:** ietc@unep.or.jp  
**Contact:** Ms. Lilia Casanova, Deputy Director

**Topics covered:** h i

**Description:** UNEP's International Environmental Technology Centre (IETC), the co-publisher of this document, was inaugurated in April 1994 to provide a unique contribution in promoting environmentally sound technologies (ESTs), including their transfer and utilisation. The Centre is now constructing its own database covering ESTs with the assistance of the Global Environment Centre Foundation (GEC) and the International Lake Environment Committee (ILEC), both Japanese supporting organisations to IETC.

In 1995, UNEP-IETC, in collaboration with UNEP Industry and Environment/PAC (Paris) and INFOTERRA (Nairobi), undertook a survey of 400 organisations involved in EST information dissemination. A report to the Commission on Sustainable Development (CSD) on this survey has recently been prepared that identifies 84 EST-related information systems. IETC's site on the World Wide Web provides an extensive list of EST information sources, which covers institutions Worldwide.

**Format of information:** Reports, newsletters, training materials

**Internet:** www.unep.or.jp

**Language:** English

**Consulting or support services:** Provides advisory services to selected locations through joint activities known as the "Sustainable Cities Programme" with UNCHS (Habitat).

**Fees:** None.

#### **L47. United Nations Centre for Regional Development (UNCRD)**

1-47-1 Nagono, Nakamura-ku  
Nagoya 450-0001  
Japan

**Telephone:** +81-52-5619377  
**Fax:** +81-52-5619375  
**Email:** rep@uncrd.or.jp  
**Contact:** Kazunobu Onogawa, Director

**Topics covered:** a h i

**TOPICS:**

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**Description:** The United Nations Centre for Regional Development (UNCRD), the only United Nations institution in the Chubu Region of Japan, was established in Nagoya in 1971 with a mandate to support capacity building for regional development planning and implementation in developing countries. The Chubu Region was chosen as an ideal location for UNCRD because the area had undergone a quarter century of rapid development across many sectors, including industrial and agricultural, to recover from the devastation of the Second World War. UNCRD is a research and training institution dealing with regional (subnational) and urban development planning. Beginning in 1987, it conducted a research project on the “Improvement of Solid Waste Management in the Context of Metropolitan Management in the Asian Countries”. UNCRD has held meetings on different aspects of MSWM - financial, institutional, citizen participation, recycling, partnerships - in cooperation with government institutions in China, Indonesia, Japan, Malaysia, and the Philippines.

On the basis of collaborative research with local officials and universities, UNCRD has published papers in its journal, *Regional Development Studies*. The Centre also disseminates MSWM information in developing countries via its newsletter, *SWM Info*, and includes MSWM topics in its International Training Course in Regional Development Planning, held April-May each year.

**Format of information:** Publications are in paper format.

**Internet:** [www.uncrd.or.jp](http://www.uncrd.or.jp)

**Language:** English and Japanese

**Consulting or support services:** Requests for training and collaborative research from public institutions and technical cooperation agencies may be addressed to the Director.

**Fees:** Most publications are distributed free, although some must be purchased. The *Research Report Series* is also available. UNCRD also exchanges publications with others.

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## **M. Information sources located in South and West Asia**

Note: There are information sources about MSW issues in South and West Asia that are located in other regions. These sources often cover several areas of the world, so they are listed in this publication under the region where they are located. Notable out-of-region institutions that offer information on MSW in South and West Asia include:

### **Institutions located in Africa**

UNEP-INFOTERRA

### **Institutions located in East Asia/Pacific**

Asian Development Bank

Asian Productivity Organisation (APO)

ENSIC (Environmental Systems Information Center)

United Nations Centre for Regional Development (UNCRD)

### **Institutions located in Europe**

ISWA (International Solid Wastes and Municipal Cleansing Association)

SANDEC/EAWAG

WASTE, Advisers on Urban Environment and Development

Water, Engineering and Development Centre (WEDC)

WHO Nancy Project Office

World Resource Foundation /*Warmer Bulletin*

### **Institutions located in North America**

Canadian International Development Agency

US Agency for International Development (AID)

US Environmental Protection Agency (EPA)

The World Bank

Note: In the following listings “Email” refers to an organisation’s electronic mail address. “Internet” refers most often to an organisation’s site on the World Wide Web, although it can also refer to gopher, ftp, or direct dial-in sites.

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## **M1. All India Institute of Hygiene and Public Health (AIHP)**

110 Chittaranjan Avenue  
Calcutta 700 073  
India

**Telephone:** +91 033315286  
**Fax:** +91 33 2412539  
**Email:**  
**Contact:** Prof. K.J. Nath, Director

**Topics covered:** a b e g h i

**Description:** AIHP is a leading environmental engineering institution in India, established nearly 40 years ago. It is supported by the Ministry of Health and is involved in education, research, and consulting services in India. It has conducted research on the health of waste pickers and changes in solid waste collection methods in Calcutta.

**Format of information:** Most of AIHP's research is available in the form of reports.

**Internet:** www.itrcindia.org

**Language:** English and Hindi

**Consulting or support services:** Not known.

**Fees:** Based on type of service.

## **M2. All India Institute of Local Self Government (AIILSG)**

Nehru Bhavan,  
Rajmahal Road,  
Baroda, Gujarat 390001  
India

**Telephone:** +91-265/433-987  
**Fax:** +91-265/430-729  
**Email:**  
**Contact:**

**Topics covered:** a b e f h i j k

**Description:** AIILSG is an autonomous, non-government institution that has been involved in training and research for municipal bodies and development authorities in India for nearly 80 years. The main office is in Bombay, with regional centres in Ahmedabad, Baroda, Belgaum, Bhopal, Bhuvaneshwar, and New Delhi. AIILSG has also published a number of booklets and audio-visual aids on MSWM.

**Format of information:** AIILSG has a large collection of MSWM literature in its head office in Bombay. It has produced a number of training manuals, books, and audio-visual aids on MSW.

### TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

Most are written in the context of the Indian situation but may be relevant for other South Asian countries.

**Internet:** [www.iclei.org/LA21/map/Aiilsg.htm](http://www.iclei.org/LA21/map/Aiilsg.htm)

**Language:** A number of publications are available in English; some material is also available in Hindi, Mahrati, and Gujarati

**Consulting or support services:** Training, research, consulting services, and computer software development.

**Fees:** Most of the publications are individually priced, ranging from US\$10-50, including postage.

### **M3. Applied Research Institute - Jerusalem**

Environmental Research Unit  
PO Box 860  
Caritas Street  
Bethlehem, West Bank  
Palestine

**Telephone:** +972 2 741889

**Fax:** +972 2 277-6966

**Email:** [postmaster@arij.org](mailto:postmaster@arij.org)

**Contact:** Dr. Jad Isaac, Director

Also: Violet Qumsieh, Director of the Environment Unit

**Topics covered:** b d e f g h j k

**Description:** The Applied Research Institute-Jerusalem (ARIJ) is an NGO dedicated to promoting sustainable development in the Palestinian Territories. To disseminate information to the public and the administration, the institute has produced environmental profiles for the West Bank. All activities, information, and publications of the institute are on the World Wide Web.

The institute is interested in starting a medical waste management program.

**Format of information:** Computer printouts, maps produced from the GIS system, reports, and newsletters.

**Internet:** [www.arij.org](http://www.arij.org)

**Language:** English and Arabic

**Consulting or support services:** ARU's Resource Centre has data, literature, and periodicals on a wide range of subjects.

**Fees:** All publications and printouts are distributed free of charge. Research services are at cost depending on technical and administrative requirements.

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

#### **M4. Asian Health, Environmental and Allied Databases (AHEAD)**

Publications and Information Directorate (PID), CSIR  
Dr. K S Krishnan Marg  
New Delhi 110-012  
India

**Telephone:** +91-11-572-8385  
**Fax:** +91-11-578-7062  
**Email:** pid@sirnetd.ernet.in  
**Contact:** Executive Director

**Topics covered:** a b c d e f g h i j k

**Description:** AHEAD is an international consortium sponsored and supported by the International Development Research Centre (IDRC), Canada, to catalyse information dissemination in the Asian region. The consortium generates and markets CD-ROMs containing information contributed by leading Asian organisations on health, environment, and natural resources. Among the contributors is ENSIC, based at the Asian Institute of Technology in Bangkok.

The AHEAD CD-ROM series comprises three disks: Environment Asia (that covers MSWM), Wealth Asia, and Health Asia. Each is updated every six months.

**Format of information:** Databases on three CD-ROMs, all of which are both full-text and bibliographical databases in Windows and DOS formats.

**Internet:**

**Language:** English

**Consulting or support services:** Negotiable upon request.

**Fees:** On an annual subscription basis, one disk costs US\$400; two cost US\$700; all three cost US\$1000. There is a 50% discount for subscribers from developing countries.

#### **M5. Centre for Environment Education (South) (CEE)**

Nehru Foundation for Development  
Thaltej Tekra  
Ahmedabad - 380 054  
India

**Telephone:** +91-79-685-8002  
**Fax:** +91-79-685-8010  
**Email:** cee@ceeindia.org  
**Contact:** Coordinator

**Topics covered:** a c f g h i j

**TOPICS:**

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

**Description:** CEE is a national institution established 1984 and supported by the Ministry of the Environment and Forests. CEE addresses urban environmental issues through community education. One particular focus of CEE activities is education in MSWM.

**Format of information:** CEE produces MSWM training materials and conducts training. A number of videos and booklets are available.

**Internet:** [www.CEEindia.org](http://www.CEEindia.org)

**Language:** English

**Consulting or support services:** Training.

**Fees:** Fees are charged for all materials and services.

## **M6. Centre for Environmental Health Activities (CEHA)**

PO Box 926967

Amman 11110

Jordan

**Telephone:** +962 55 24655-5531657

**Fax:** +962 55 16591

**Email:** [ceha@who-ceha.org.jo](mailto:ceha@who-ceha.org.jo)

**Contact:** Dr. M.Z. Ali Khan, Coordinator

**Topics covered:** a b c d e f g h i j (all with emphasis on public health aspects)

**Description:** CEHA is the WHO Regional Centre for Environmental Health Activities, a specialised centre established in Amman, Jordan by the World Health Organisation's Regional Office for the Eastern Mediterranean (EMRO). CEHA started executing its programs utilising a grant from the Arab Gulf Programme for the UN Development Organisations (AGFUND) and the kind hospitality of the Government of Jordan.

CEHA's performance and plans are guided by a Technical Advisory Committee (TAC), which meets once every two years. TAC consists of representatives from the 23 Member Countries, as well as international environmental health experts.

CEHA's mandate is to promote Environmental Health through technical support for national capabilities and programs in the Member Countries of the Region. CEHA carries out the following activities: human resource development, information exchange (CEHANET), technical cooperation, special studies, and applied research. CEHANET provides access to its regional bibliographic databases of technical information. Solid waste management is dealt with under CEHA's Rural and Urban Development and Housing Programme.

**Format of information:** Training materials, including *Reuse of Treated Effluents*, bibliographic database, reports, books, audio-visual materials, and a newsletter, *CEHA News*.

**Internet:** [intranet.emro.who.int/ceha](http://intranet.emro.who.int/ceha)

**Language:** English, French, and Arabic

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

**Consulting or support services:** Human resources development, information exchange, technical cooperation, special studies, and applied research. National agencies, research and educational institutions, and local governments within Member States of the WHO Eastern Mediterranean Region should contact the WHO representative of the requesting country.

**Fees:** The newsletter and other information exchange activities are free. For other activities, contact the Coordinator.

### **M7. Development Alternatives**

B-32, Tara Crescent  
Qutub Institutional Area  
New Delhi - 110 016  
India

**Telephone:** +91 11696 7938

+91 11685 1158

**Fax:** +91 11686 6031

**Email:** tara@sdalt.ernet.in

**Contact:** Dr. Ashok Khosla, George Varughese, and Dr. Vijay Lakshmi

**Topics covered:** a c j

**Description:** Development Alternatives is a firm involved in a number of research projects in MSWM. Its work focuses on source reduction and industrial waste minimisation, vermicomposting, recycling of waste cloth and waste paper to produce handmade paper, and generating awareness among school children about these issues.

**Format of information:** Hard copies of the reports on its research projects.

**Internet:** www.devalt.org

**Language:** English and Hindi

**Consulting or support services:** Research and consulting services.

**Fees:** Research and consulting services have fees. Documents are available for sale.

### **M8. Institute of Environmental Engineering and Research (IEER)**

NED University  
University Road  
Karachi - 75270  
Pakistan

**Telephone:** +92 21 496-9263-8

**Fax:** +92 214961934

**Email:**

**Contact:** Dr. Iqbal Ali, Director

**Topics covered:** e f g

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

**Description:** IEER is an educational institution, which offers education, training, research, and consulting services. It offers postgraduate degrees in environmental engineering and a number of short courses on the subject.

**Format of information:** IEER publishes a semi-annual journal, *Environmental News*, and can provide information on environmental issues including solid waste management.

**Internet:**

**Language:** English

**Consulting or support services:** Consulting services.

**Fees:** No formal system of fees. *Environmental News* costs US\$50 per year.

### **M9. International Centre for Diarrhoeal Diseases Research (ICDDR)**

Environmental Health Programme  
GPO Box 128  
Dhaka 1000  
Bangladesh

**Telephone:** +880 2 871751

**Fax:** +880 2 883116

**Email:** info@icddrb.org

**Contact:** Bilqis A Haque, Coordinator

**Topics covered:** a b c j

**Description:** Since 1978, the Centre has shared its knowledge and techniques by training more than 20,000 health professionals from over 78 countries of the world. ICDDR conducts basic and applied research on environmental health issues. In conjunction with the Global Applied Research Network, it focuses particularly on water, hygiene, and solid waste. Topics of study include recovery, collection, transfer, and treatment (using biogas digesters) of domestic wastes. Various courses provide practical training in hospital management of diarrhoeal diseases, epidemiology, biostatistics, family planning, demographic surveillance, child survival strategies, etc.

**Format of information:** Reports, articles, community education material.

**Internet:** www.ICDDR.org

**Language:** Most of the research reports are in English; community education material is in Bengali

**Consulting or support services:** Research, consulting, laboratory services, training, workshops.

**Fees:** Fees are charged for services.

TOPICS:

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

## **M10. Karachi Administration Women Welfare Society (KAWWS)**

C-32 Block-2  
Karachi Administration Employees Cooperative  
Housing Society (KAECHS)  
Karachi - 75350  
Pakistan

**Telephone:** +92 21452-8884  
**Fax:** +92 21 777-2752  
**Email:** sarahsiddiqi@kawws.paknet.com.pk  
**Contact:** Ms. Sarah Siddiqi, Executive Member

**Topics covered:** a b j

**Description:** KAWWS is a non-governmental women's pressure group oriented toward civic agencies involved in urban development. It has a special emphasis on the creation and maintenance of an unpolluted environment, with particular reference to women and children. MSWM is one of KAWWS' major activities.

**Format of information:** KAWWS publishes a newsletter and various publications from time to time.

**Internet:**

**Language:** English and Urdu

**Consulting or support services:** Research and advice.

**Fees:** None.

## **M11. Ministry of the Environment - Israel**

5 Kanfei Nesharim St.  
Givat Shaul  
PO Box 34033  
Jerusalem 95464  
Israel

**Telephone:** +972 2 655 3777  
**Fax:** +972 2 653 5934  
**Email:** ask@israel-info.gov.il, enviroby@vm.tau.ac.il  
**Contact:** Mr. Ilan Nissim, Division Head, Solid Waste Management

**Topics covered:** c d e f g h i j k

**Description:** The Ministry of the Environment provides comprehensive and up-to-date information on solid and hazardous waste management in Israel. Experiences within Israel may be extremely useful for other countries in the West Asian region.

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.



**Format of information:** An annual report on the state of the environment, a newsletter in Hebrew, a quarterly in English, professional publications, research reports, and surveys.

**Internet:** [www.environment.gov.il](http://www.environment.gov.il)

**Language:** English and Hebrew

**Consulting or support services:**

**Fees:** There is no fee system. Some publications are free.

## **M12. Mythri Foundation Waste Wise Project**

Muthri Sarva Seva Samithi  
373 Hal 2nd Stage  
Indranagar  
Bangalore 560 08  
India

**Telephone:** +91 81-221-7890

**Fax:** +91 80-525-5543

**Email:** [mythri@giasbg01.vsnl.net.in](mailto:mythri@giasbg01.vsnl.net.in)

**Contact:** Mr. Anselm Rosario, Project Director

**Topics covered:** a b c h j

**Description:** Waste Wise supports decentralised approaches to solid waste management. It has developed a primary waste collection system, advocated a source separation system of dry and wet waste, and experimented with composting systems.

**Format of information:** Occasional papers and reports

**Internet:**

**Language:** English

**Consulting or support services:** Research.

**Fees:** Most material is free on request.

## **M13. National Environmental Engineering Research Institute (NEERI)**

Nehru Marg, Nagpur 440 020  
Maharashtra  
India

**Telephone:** +91 712 526071

**Fax:** +91 712 523893

**Email:** [root%neeri@sirnetd.ernet.in](mailto:root%neeri@sirnetd.ernet.in)

**Contact:** Mr. A.D. Bhide, Director, Solid Waste Management Division  
Also: Prof. K.B. Misra, Head, Information Division

**Topics covered:** b c d e f g h i j k

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
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**Description:** NEERI is involved in environmental monitoring, environmental impact and risk assessment, air and water quality monitoring, pollution control, water treatment, water supply and sewerage, rural water supply, and low-cost sanitation. It also provides training and consulting services. It has conducted a number of solid waste management studies in various Indian cities.

**Format of information:** NEERI publishes a technical digest, training manuals, and a newsletter. Its well-known journal, *Indian Journal of Public Health*, is published quarterly.

**Internet:** [sunsite.sut.ac.jp/asia/india/jitnet/india/csir/neeri.html](http://sunsite.sut.ac.jp/asia/india/jitnet/india/csir/neeri.html)

**Language:** English

**Consulting or support services:** Research and consulting.

**Fees:** NEERI charges for consulting services, research, and training. Most of its publications are in the range of US\$10-50 including postage.

#### **M14. National Housing Development Authority (NHDA) - Sri Lanka**

PO Box 1826  
3rd Floor, NHDA Building  
Sir Chittampalam Gardiner Mawatha  
Colombo 02  
Sri Lanka

**Telephone:** +94 1422394 (General Manager)  
+94 1433778 (Deputy General Manager, Engineering Services)

**Fax:** +94 1 862583

**Email:**

**Contact:** S Vadugaiyahpillai, General Manager

**Topics covered:** b d h j

**Description:** NHDA has been involved in infrastructure development in many urban, low-income settlements. One focus has been the incorporation of community-based approaches to MSWM. The organisation prepared guidelines for the safe disposal of solid waste in low-income areas and, in conjunction with UNDP and UNCHS, demonstrated a low-cost incinerator.

**Format of information:** Reports

**Internet:**

**Language:** English

**Consulting or support services:** Functions as a development authority, providing guidance to local authorities. Provides consultancy services on infrastructure issues.

**Fees:** Literature is available at printing cost.

TOPICS:

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

### **M15. National Institute of Urban Affairs**

1 Floor, Core 4 B, Indian Habitat Centre,  
Lodhi Road  
New Delhi 110 003  
India

**Telephone:** +91-11-3011510  
+91-11-3010489  
**Fax:** +91-11-3792961  
**Email:** niua@vsnl.com  
**Contact:** Dinesh Mehta, Also: Usha Raghupati

**Topics covered:** h i j k

**Description:** The National Institute of Urban Affairs is a research and training institute. The institute has a large number of state and municipal governments as its members and receives partial financial support from the Government of India. The institute's work involves policy research, advocacy, training, and dissemination of information in a number of fields including MSWM. The NIUA collaborates with or undertakes work for various international agencies, such as the Asian Development Bank, US Agency for International Development, ODA of the UK, IDRC-Canada, UN Centre for Human Settlements, and The World Bank.

**Format of information:** Research study series (monographs), the biannual journal, *Urban India*, and newsletters on urban finance and urban poverty.

**Internet:** www.niua.org

**Language:** English

**Consulting or support services:** The NIUA provides consulting service and technical assistance to municipalities under its various ongoing programs.

**Fees:** Consulting services are charged at cost. Technical assistance, if it forms a part of a bilateral or multilateral program, is covered under the program. All publications are moderately priced. Newsletters are distributed free to interested organisations and individuals.

### **M16. Orangi Pilot Project (OPP)**

1-D, 26 Daulat House  
Orangi Town  
Karachi - 75800  
Pakistan

**Telephone:** +92 21 665 2297  
**Fax:** +92 21 435704  
**Email:**  
**Contact:** Mr. Anwar Rashid, Director

**Topics covered:** a b i j

**TOPICS:**

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

**Description:** OPP is an NGO that analyses problems in Orangi and then seeks to solve them through action and education. It promotes community organisations and provides technical support to development initiatives.

**Format of information:** A large collection of information in its library, a quarterly progress report, and a few other publications based on their experiences.

**Internet:**

**Language:** Most of the material is in English; some publicity material and reports are also available in Urdu

**Consulting or support services:** Consulting and training.

**Fees:** OPP's progress reports are free on request. Most of the books are priced.

### **M17. Rajkot Municipal Corporation (RMC)**

Dhebarbhai Road  
Rajkot - 360 002  
India

**Telephone:** +91 281-224-133

**Fax:** +91 281-224-258

**Email:**

**Contact:** Mr. J.B. Kagathara, City Engineer

**Topics covered:** b e h j k

**Description:** RMC has experimented with the privatisation of MSW services. It has also involved the community in the decentralisation of waste collection service.

**Format of information:** Official reports

**Internet:**

**Language:** English

**Consulting or support services:**

**Fees:** None.

### **M18. Tata Energy Research Institute (TERI)**

Darbari Seth Block, Lodhi Road  
New Delhi 110 003  
India

**Telephone:** +91-11-4622246

**Fax:** +91-11-4621770

**Email:** kmohan@teri.ernet.in

**Contact:** M Krishna Mohan

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

**Topics covered:** c d g h

**Description:** The Tata Energy Research Institute (TERI) has conducted research on bioconversion systems for MSW to generate renewable energy and to effect stabilisation of solid wastes. The work focused on anaerobic digestion of solid wastes in optimised, separate phases to generate methane. TERI also studies the collection, characterisation, and disposal of MSW in Delhi and other major Indian cities. The aim of the project was to design, install, and operate a pilot-scale bioconversion system.

**Format of information:** Reports.

**Internet:**

**Language:** English

**Consulting or support services:** Yes, on small-scale community-based projects.

**Fees:** Vary according to time required.

### **M19. Urban Resource Centre (URC)**

3/48 Mualimabad Jamaluddin Afghani Road  
Karachi 74800  
Pakistan

**Telephone:** +92 21 455-9275

**Fax:** +92 21 438-4288

**Email:** URC@cyber.net.pk

**Contact:** Muhammad Younus, Coordinator

**Topics covered:** h i j k

**Description:** URC is a small group of urban activists in Karachi, Pakistan. One of their main activities is the collection and dissemination of information on urban issues, including MSWM. URC is actively involved in information exchange.

**Format of information:** URC has a small library and publishes a quarterly report.

**Internet:** www.URCKarachi.org

**Language:** English and Urdu

**Consulting or support services:** Training and support to grassroots organisations.

**Fees:** Fees depend on type of request. Photocopying is 10 US cents/page.

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.



## SECTION C. EUROPE

Europe, including the countries of Eastern Europe and the more western independent republics of the former Soviet Union, is one of the more diverse regions in the world. The range of development is considerable, from wealthy and highly industrialised countries like France, Germany, and the Netherlands, to less economically developed nations such as Albania, Greece, Portugal, and Turkey, to countries like Hungary and Poland, which are essentially re-industrializing into a different economic system. This variation finds expression in the range and diversity of solid waste systems, as well.

In terms of modern development of solid waste management systems, these nations are arrayed in a continuum, from those with extremely informal or rudimentary waste management systems to those with high levels of service, control, technology, and financial support. At one end of the continuum, solid waste is at times beneath the notice of either the public or the relevant local, regional, or national governments. This “lower end” of the continuum is generally characterised by the following features:

- transitional or less-industrialised economic status, or dispersed rural population with relatively low population densities (Finland is a good example of this second type);
- low to moderate per capita waste generation rates, with high levels of compostables and low levels of packaging;
- projected increase in waste generation rates and complexity of waste composition due to expanding consumer and household product mix;
- door-to-door (kerbside) collection of household waste in only the more affluent urban settings, and often only neighbourhood or apartment building container service in the less affluent settings;
- most collection performed by government employees;
- extensive use of open dumping, with daily or frequent open burning of the trash;
- waste disposed in dispersed, local, unmonitored dumps, sited informally and expediently, and generally located on cliff sides, wetlands, old quarries, or the like; multiple sites in use in the same area, with many people dumping on their own or their neighbour’s property;
- substantial levels of surface and groundwater contamination in the absence of point and non-point pollution control mechanisms and emissions controls;
- disposal fees limited to collection service fees; no dumping fees;
- little or no awareness of the hazardous materials in the waste stream, evidenced by casual reuse of containers and bulk packages (such as drums) that have contained detergents, household chemicals, pesticides, herbicides, and the like; and
- recycling of metals, plastics, and paper at levels of throughput that fluctuate with the economy, motivated by the economic value of the recovered materials.

The “upper end” of the continuum has some or all of the following features:

- highly industrialised status, combined with relatively high population density;
- moderate to high per capita waste generation rates, with relatively high levels of packaging;
- mature, complex, consumer and household products markets;
- flat or slightly increasing waste generation rates projected;
- door-to-door collection of household waste in most areas, regardless of socioeconomic or political status;
- waste disposed in larger, regional landfills with pollution control features, or incinerated in mass burn incinerators or refuse-derived fuel furnaces;
- significant attempts to improve pollution and emissions controls;
- collection performed by a mix of government employees, private firms franchised or contracted by the government, and waste entrepreneurs;
- use of tipping fees at disposal facilities;
- in some cases, a per-bag or per-can fee is also charged for waste collection service;
- programs to prevent, reduce, or mitigate the effects of disposal of household hazardous wastes in the waste stream; and
- organised recycling programs bringing recycling collection to households or siting recycling bins in neighbourhoods.

In issue after issue, it is possible to identify a progressive European solid waste “club”: four or five Northern European nations whose solid waste and recycling practices give a high priority to waste prevention and the hierarchical approach to environmentally sound waste management (giving priority to waste reduction, reuse, and recycling), and whose policies and programs are usually on the cutting edge of solid waste developments. These “progressives” usually always include Denmark, Germany, and the Netherlands; these three are variously joined by Sweden or Switzerland, depending on the issue. In certain parts of Europe, and also in much of Eastern Europe, there is an intermediate situation where the large urban centres have nearly universal collection and one or two regional landfills with pollution control systems and, in some cases a massburn incinerator, but where the situation in the rest of the country, and as concerns other topics, has more common ground with the “lower” end of the continuum.

### **A. Topic a: Waste Reduction**

European governments, some of which come out of a social democratic political tradition, do not ordinarily question their direct and ultimate responsibility for public health, and thus for solid waste management. In the progressive countries and many other European Union (EU) nations, materials recovery and recycling have been accepted as a necessary and indeed essential aspect of government-sponsored integrated solid waste management systems. This is reflected in official policy documents at both the national and EU levels, and is widely evident in practice. Nevertheless, there are considerable variations in European practices in source reduction,



materials recovery, and recycling. These variations occur in substantive approach, methods employed, degree of political and fiscal commitment, and the markets that are available.

#### A1. COLLECTION of Recyclables

Unlike North America, European countries often have completely unrelated systems for collecting different recyclable materials. Paper is often collected kerbside from row- or single-family houses, and in ½- or 1-m<sup>3</sup> collection containers from apartments. Paper, usually consisting of all grades of residential mixed paper and cardboard, is usually collected in compactor trucks.

*Prominent containers for the collection of recyclables are common in some Western European countries.*

Glass collection, on the other hand, is more likely to be performed using closed recycling collection containers, sometimes called igloos. Enclosed dropoff systems play a critical role in high European levels of recovery.

Igloos are usually placed so as to have small clusters of containers for depositing different materials, including variously glass, plastics, and, rarely, paper or metal cans. The igloo-type containers are bottom-dumping, and are emptied by automated equipment into trucks. Northern European citizens generally use the containers as they are intended. Collection is performed by municipal governments, regional solid waste authorities, companies in the materials markets themselves, service companies, or NGOs or semi-public corporations with an environmental, human service, or charitable mission. NGO or service organizations may perform collection services under contract to the municipal government; or they may receive a fee per ton collected based on the avoided cost of disposal for the materials collected; generally they also get to keep some or all of the marketing revenues. Although some of these organizations must live from market income from the materials, their status as recognised elements of a public recycling infrastructure increasingly means that they receive government compensation in one form or another, often in the form of diversion credits.

More intensive recycling collection efforts, particularly under aggressive recycling policy regimes in Germany and Denmark, began with attempts at wet/dry separation in the mid-1980s. These efforts have now progressed to separate collection of biodegradables on the one hand (formerly the “wet” fraction) and to separate collection of paper and recyclables on the other. Recyclables (occasionally but not commonly commingled) are usually set out either in 120-L containers or 240-L divided containers, sometimes called “duo-baks”, and are collected in divided compactor trucks (see the overview on “Collection and Transfer”). This allows for a single pass to collect two streams. These kerbside collection programs often target paper, but seldom include glass. Under the influence of producer responsibility requirements, there are increasing experiments with commingled collection of drink boxes and plastic containers, sometimes compacted. The approach to processing these commingled materials is still under development.

#### A2. PRODUCER Responsibility

Perhaps the most unique aspect of Western European materials recovery is the widespread acceptance of the idea of “producer responsibility” for the environmentally sound disposal of packaging and products. Within the framework of this idea, Western European nations have crafted agreements and legal frameworks that gave industry responsibility for achieving packaging reduction goals of 75% or more by 2002. Some countries, such as Austria and

Germany, treat this as a mandate; others, like Britain and France, call their agreements voluntary but have stringent reporting and documentation requirements.

The general structure of producer responsibility programs is to place financial responsibility for recycling and disposal on the product and/or package manufacturer, and to internalise incentives for recovery, reuse, and recycling through taxes, fees, and deposits. Most systems encourage industry to form one or more recycling corporations that guarantee a market for the collected materials. Some systems, allow industry to make use of public sector waste management infrastructure, usually for a fee, with the goal of funnelling private funds to build or enhance public recycling infrastructures.

Industry has a high stake in the success of these programs, since various European governments have at times banned the use of specific types of packaging entirely. Because of this, objective reporting about their effectiveness is difficult to find. A complicating circumstance is the fact that many such programs have ambitious recovery goals that went into effect in the year 2000 or later.

The highest profile of these producer responsibility efforts, the German DSD (Duales) system, nearly failed financially in 1993, and ended up dumping large quantities of low-quality recyclables into the European (and Asian) secondary materials marketplace. It only survived through heavy government intervention, including the conversion of substantial debt (in the form of fees owed to municipalities for collection services and collected materials) into long-term loans owed to the local and regional governments by the recovery company.

Other countries have instituted some level of producer responsibility that require the relevant industry to make a contract or “covenant” with the environment ministry and to develop their own program for capturing their products. Even before full implementation, these requirements have been successful in stimulating waste reduction, in slowing the growth of packaging waste generation, and in general in causing substantial shifts in packaging policy and practice among certain industrial sectors, among them food retail, electronics, and appliances. The ultimate success of these is still open to question.

### A3. MATERIALS Recovery in Southern and Eastern Europe

In Southern and Eastern Europe (and also in France and the United Kingdom), the presence of recycling containers or collection programs is more sporadic. An exception is Italy, which has made considerable progress in materials recovery during the last few years. Urban centres may have some igloo containers and may be developing residential recycling collection, but these are not widespread. Certain cities with a strong grassroots environmental constituency and/or progressive public officials have developed kerbside collection of one or more materials. Depending in part on beverage or packaging industry price supports and buyback programs, scavengers may salvage and sell metals, paper, and other materials. When market prices are low, these informal collectors generally disappear, to return when prices are higher.

### A4. INFORMATION Sources in Europe on Topic a, Waste Reduction:

- ADEME (French Association for Waste Management)
- APESB (Portuguese Association for Basic Sanitation Studies)
- APME (The Association of Plastics Manufacturers in Europe)
- ATEGRUS (Technical Association for Municipal Solid Waste & Environment)
- AVR (Association of Cities for Recycling)
- The Chartered Institution of Wastes Management (CIWM)
- CIPA (Italian Center for Engineering to Protect the Environment)

- DAKOFA (Danish Association for Waste Management)
- Das Bessere Müllkonzept (The Better Waste Group)
- DEMEX
- Duales System Deutschland
- Ecocycle Commission
- Finnish Environment Agency (SYKE)
- Institute for Environmental Studies (IVM)
- International Development Department (IDD)
- International Institute for Industrial Environmental Economics (IIIEE)
- ISWA (International Solid Waste Association)
- Öeko-Institute, Chemistry Division
- REC (Regional Environmental Center for Central & Eastern Europe)
- RENDAN
- Research & Engineering Institute for the Environment
- RIVM (National Institute of Public Health & Environmental Protection)
- SKAT Consulting
- SLL (Finnish Association for Nature Protection)
- St. Petersburg Scientific Center
- Tool, Transfer of Technology for Development
- TU-Vienna, Technical University of Vienna
- UNEP Industry & Environment
- WASTE, Advisers on Urban Environment & Development
- Waste Prevention Association “3R”
- Water, Engineering & Development Centre (WEDC)
- World Resource Foundation/*Warmer Bulletin*
- Wuppertal Institute for Climate, Environment, & Energy
- YTV (Helsinki Metropolitan Area Council)

## **B. Topic b: Collection and Transfer**

Waste collection in Europe differs considerably among regions and countries, based on population densities and degree of economic development, but it is possible to speak of a common model or approach. Most Western European countries organise waste collection in twice-weekly, weekly, or biweekly routes using 120- or 140-L rolling carts, which are collected with semi-automated compactor trucks, usually having dual self-dumping lifts. In more southern European nations, these compactor trucks may be loaded from ordinary garbage cans and/or bags. Scandinavian countries have a tradition of setting out and collecting household waste in tall 120-L Kraft paper bags in a stationary metal frame. In Eastern Europe and in areas with a preponderance of multi-family dwellings, such as Southern Finland, residents may be offered 1 to 2 yd<sup>3</sup> containers for depositing their household waste. These are emptied, usually by rear-loading compactors, once or twice a week. In certain housing complexes in Eastern Europe, kitchen wastes are still collected in open containers and hauled away to be used as animal feed.

Waste collection vehicles may go directly to disposal facilities (landfills or incinerators), or they may go to a transfer facility, where the waste is compacted into larger vehicles for longer haul distances. Transfer in most cases consists of the compactor truck or other type of collection vehicle (such as an open truck, pickup truck, or wagon) arriving at the transfer facility and dumping its load of waste into a pit or onto a tipping floor. A front-end loader or bulldozer usually loads the waste onto a conveyor or a chute, from which it goes into a special compacting container. These are usually of large capacity and have high compaction ratios, and are used to

densify the waste for more efficient long-haul transportation. In some cases, bulky waste and/or recyclables, especially corrugated cardboard, are separated on the tipping floor, both for their market value and to make the compaction more efficient. The compaction of waste for long-distance hauling is not well developed in Europe.

In general, transfer stations dealing in residential waste are run by some public entity, but private operators have entered this phase of MSWM as well.

#### B1. INFORMATION Sources in Europe on Topic b, Collection and Transfer:

- ADEME (French Association for Waste Management)
- APESB (Portuguese Association for Basic Sanitation Studies)
- ATEGRUS (Technical Association for Municipal Solid Waste & Environment)
- AVR (Association of Cities for Recycling)
- The Chartered Institution of Wastes Management (CIWM)
- CIPA (Italian Center for Engineering to Protect the Environment)
- DAKOFA (Danish Association for Waste Management)
- Duales System Deutschland
- Finnish Environment Agency (SYKE)
- GTZ-GATE (German Appropriate Technology & Ecoefficiency)
- Institute for Environmental Studies (IVM)
- Institute of Environmental Sciences (IES)
- International Development Department (IDD)
- INTRADEL
- ISWA (International Solid Waste Association)
- REC (Regional Environmental Center for Central & Eastern Europe)
- RENDAN
- Research & Engineering Institute for the Environment
- RIVM (National Institute of Public Health & Environmental Protection)
- SANDEC/EAWAG
- SKAT Consulting
- St. Petersburg Scientific Center
- WASTE, Advisers on Urban Environment & Development
- Water, Engineering & Development Centre (WEDC)
- World Resource Foundation/*Warmer Bulletin*
- YTV (Helsinki Metropolitan Area Council)

#### C. Topic c: Composting

##### C1. SEPARATION and Handling of Compostables

Unlike in North America, collection of compostable materials for transport to centralised composting facilities is a central feature of most Northern European waste management and source separation programs. Collection of the so-called “biowaste” (garden and kitchen organics) from households is generally performed using 120-L green rolling carts; in some urban areas, collection from smaller, 35-L pails or from paper bags is also common. In the literature, the compostable stream is referred to as “green waste”, “biowaste”, or similar terms. This is contrasted with the remaining stream of non-compostable mixed waste, which is usually referred to as the “rest-fraction”, “rest-waste”, or “remainder fraction”, to indicate that it represents what is left over after the recyclable materials (including the organic fraction) has been removed.

The most frequent model for this collection is to alternate biowaste collection one week with the rest-fraction the next. In some places, both waste streams are collected weekly during the summer months, when the chance of unpleasant odors is higher. Alternating collection weeks brings the cost and energy usage of separate collection to within what appears to be acceptable budgetary and environmental levels in many Northern European countries. Because organic materials represent such a relatively high concentration of MSW in Europe, even the modest 35% to 50% capture rates for this stream result in sufficient reduction in quantity and in the degree of degradation of the remainder fraction as to make biweekly collection acceptable to most residents. Centralised composting has a long tradition in Western Europe in particular, where some plants still in operation came online as early as the 1960s. All European compost installations are now aerobic systems, with the compost having a short residence time in a reactor or pre-composter and a longer time in aerated static piles. Windrow composting is less common, but does exist.

## C2. EVOLUTION of Centralised Composting in Europe

All of the earliest approaches to centralised composting involved attempts to compost mixed solid waste. Installations were designed with complex pre-processing and segregation equipment intended to remove the non-compostable materials before mixing and composting. In theory, these non-compostables could then be recovered for recycling. Plants like these are still operating, and still being built, in countries like Greece, where early experiments with source separation of the organic fraction have shown a relatively low participation and capture rate.

Such mixed waste composting is possible, but its key problem has been that the waste arrives at the facility not only mixed, but compacted, with the result that both compostables and recyclables are contaminated. High metals content of the compost, and poor quality, marginally marketable recyclables, have led to a number of modification steps. Furthermore, EU regulations do not allow the production of compost from mixed municipal solid waste.

The second stage evolution for centralised composting was based on a “green bin” or wet/dry separation approach, tried and largely rejected in Germany and the Netherlands in the early 1980s. Residents were asked to put their dry recyclables and paper in one bin, and the wet waste in the other, which went to composting. This approach produced an improvement in compost quality over the attempts to compost mixed waste, but had some problems. The first was that there was an ambiguity in the distinction between “wet” and “dry”. For example, residents included household chemicals and detergents in the wet waste, while considering soil from potted plants to be dry.

*Composting, which has been important and successful in Europe, has gone through several stages of development. A highly source-separated stream is now considered the most desirable.*

Although wet/dry separation produced an improved quality of recyclables, the compost was not much improved over compost derived from mixed waste, a result that ultimately led to the approach of collecting source-separated compostables as a separate stream. This biowaste stream usually includes only yard, garden, and kitchen waste, and is collected for transfer to centralised composting facilities. Source separation of organics on this model in Denmark, Germany, and the Netherlands, in particular, and increasingly in other European countries, has proven to be a method that has been widely adopted throughout Western Europe. It produces a clean compost that meets increasingly strict European standards; and, by limiting, in most cases, the compostable fraction to kitchen and garden waste, it presents a clear separation protocol for residents.

Although a number of the early installations designed either for mixed waste or wet/dry separation are still in use, and a few are still being built and installed in France, Spain, and in the United Kingdom, where composting is less developed, the approach has gradually been abandoned and the facilities redesigned or modified to accommodate separate collection of compostables, with the result that more and more of the front-end separation steps have been bypassed.

### C3. CURRENT Composting Technology

Technically, centralised composting facilities can be divided into pre-processing stages, including removal of non-compostables by magnets, eddy currents, ballistics separators, and/or vibrating screens; size reduction; mixing and/or pre-composting; composting; curing; post-processing (usually consisting primarily of screening); packaging; and marketing. For the mixing and composting stages, the use of a vessel, usually a large horizontal drum or tunnel reactor, is common in Europe. The earliest and at one time the most common of these types of composting units, the Dano drum, has been in use for so long that the patent has expired, with the result that this is no longer a proprietary technology. Other technical approaches are proprietary, and cannot be built without a purchase or licensing agreement from the inventor or an authorised vendor.

Centralised composting facilities typically have a design capacity of 50 to 200 tons per day. Because of removal of contamination through pre-processing, as well as moisture and mass losses during the process of composting, a 100-ton per day facility will produce on the order of 30 to 50 tons of compost per day.

### C4. MARKETING Considerations

The marketability of the finished compost will vary according to the chemical constituency of the input material; for source-separated organics, the resulting compost is accepted for repeated application on agricultural land in most of Europe, and under the rules of the European Union. Efforts to market compost in Europe must take into account that even high quality compost is not usually considered to be a fertiliser; rather, it is a soil conditioner, useful for its water-holding capacity (it limits evaporation and erosion, and functions as a mulch), its slow release of the nutrients nitrogen, phosphorus, and potassium, and its ability to return organic matter to depleted, excessively mineralised soils. It is especially useful on slopes, or for reclaiming land degraded by erosion or through mining, quarrying, or rapid construction and development.

### C5. ANAEROBIC Digestion

In the last ten years, the predominantly aerobic in-vessel composting systems have been joined on the market by several, small- to medium-scale anaerobic digestion systems made in Belgium, Germany, and France.

Anaerobic digestion or methanization, occurs in the absence of oxygen, and is conducted in a completely enclosed silo or vessel. The processing temperatures seldom reach those of aerobic composting. Unlike aerobic composting, anaerobic digestion is an endothermic process (requires external sources of heat to reach optimum temperatures). Anaerobic digestion produces a gas that consists primarily of methane and carbon dioxide. The gas can be captured and used for power or steam generation, or purified and used as a fuel.

## C6. INFORMATION Sources in Europe on Topic c, Composting:

- ADEME (French Association for Waste Management)
- APESB (Portuguese Association for Basic Sanitation Studies)
- ATEGRUS (Technical Association for Municipal Solid Waste & Environment)
- The Chartered Institution of Wastes Management (CIWM)
- CIPA (Italian Center for Engineering to Protect the Environment)
- DAKOFA (Danish Association for Waste Management)
- Das Bessere Müllkonzept (The Better Waste Group)
- GTZ-GATE (German Appropriate Technology & Ecoefficiency)
- Institute of Environmental Sciences (IES)
- INTRADEL
- ISWA (International Solid Waste Association)
- Öeko-Institute, Chemistry Division
- REC (Regional Environmental Center for Central & Eastern Europe)
- RENDAN
- RIVM (National Institute of Public Health & Environmental Protection)
- SKAT Consulting
- SLL (Finnish Association for Nature Protection)
- St. Petersburg Scientific Center
- Tool, Transfer of Technology for Development
- WASTE, Advisers on Urban Environment & Development
- Water, Engineering & Development Centre (WEDC)
- World Resource Foundation/*Warmer Bulletin*
- YTV (Helsinki Metropolitan Area Council)

### D. Topic d: Incineration

European countries vary widely in their reliance on incineration. Northern European countries, including all of the “progressive club” of countries and, in this case, Sweden, are highly reliant on massburn incineration, coupled with energy generation, which in these countries is accompanied by state of the art pollution control equipment. In some Western European countries, it is usually the case that at least 35% and in some cases as much as 80% of the residential waste stream is disposed of through incineration. Until relatively recently, this has consisted of reliance on massburn technology, but there is increasing interest in and growing positive experience with fluidised bed technologies.

Among other factors, the relative scarcity of land suitable for the establishment of waste treatment and disposal facilities has resulted in a broader social consensus that incineration is necessary than can be found, for example, in North America. At the same time this consensus has in general also extended to a strong commitment to pollution control, a commitment that is strengthened by the proximity of European nations to each other and by their awareness that they are all at risk for pollution from a neighbour.

*Although controversial in Europe, as it is elsewhere, incineration is widely used in the continent. The steam generated from incineration is used for district heating.*

Another factor underlying the acceptance of incineration in Europe is that the energy generated by European waste-to-energy plants goes to supply steam to district heating networks. The heavy reliance on district heating, and the ready market for steam that this reliance provides, is part of what makes incineration so attractive in some European cities. Steam production is more energy

efficient and more profitable than electricity generation, and contributes to the robustness of the European waste-to-energy sector. The coupling of incineration with electricity generation, which contributes substantially to the capital costs of incineration, is quite rare in Europe, in part because European countries do not, in general, have utility rate structures that allow non-utility-generated electricity to be sold to the grid.

Waste incineration is nevertheless often the subject of controversy, usually because of its air emissions. Waste is a complex combination of substances, and burning them at certain temperatures results in the production of a number of substances, which are then released from smokestacks to the surrounding air. The emissions of acid gases, including SO<sub>x</sub> and NO<sub>x</sub>, together with heavy metals, dioxins, furans and mercury, are some of the sources of concern. Pollution control equipment on modern incinerators includes, in most cases, flue gas cleaners in the form of gas scrubbers, together with baghouse filters and electrostatic precipitators. Acid gases, SO<sub>x</sub>, and NO<sub>x</sub> are removed in flue gas cleaning systems, which usually consist of either wet or dry scrubbers, or, as is the case in Sweden, a combination of the two. Heavy metals are more likely to be removed in post-scrubbing filters, or via the injection of sodium sulphate in an electrostatic precipitator. This type of pollution control equipment can also remove dioxins and furans. The European Union is enforcing severe emissions standards for all types of incinerators, along with rules for protecting the health and safety of the workers.

While accepting their long-term reliance on waste incineration as a treatment and energy recovery strategy, several European governments phased out an older generation of non-energy-generating incinerators, most of them small and serving only a single city, because they did not comply with emissions limitations in national and European Community law. In some cases, these older incinerators have been upgraded and retrofitted with modern air pollution control equipment.

European countries tend to be well advanced in the utilization of byproducts of incineration. Fly ash has been used in bonded asphalt and other road products. The use of bottom ash and slag as an aggregate in road construction or in the production of construction materials is more common in some countries like the Netherlands than in others, but has had some setbacks as awareness has grown of the presence and the leachability of toxic constituents of these materials. Where these materials cannot be used, they are generally permitted to be landfilled in Europe, and not, as in North America, considered to be hazardous wastes.

The production of refuse-derived fuel is a second type of energy recovery system in operation in Europe. A period of enthusiasm for mixed waste sorting in the early 1970s produced a number of installations for recycling and for producing RDF, mostly of German or Italian design. Several of these facilities were initially designed to also feed the wet and putrescible wastes into composting systems.

Incinerators in Eastern Europe are often old models that usually do not have adequate, or in some cases any, environmental controls. Eastern European cities, other than major ones, have wastes that cannot be incinerated without auxiliary fuel. In the context of economic changes that are moving these countries away from government subsidies of all types, incineration is no longer economically attractive in some places where it once was deemed to be reasonable.

This publication includes a description of the technologies used in European incinerators: incineration facilities, plants for the production of refuse-derived fuel, and fluidised bed incinerators.



## D1. INFORMATION Sources in Europe on Topic d, Incineration:

- ADEME (French Association for Waste Management)
- APESB (Portuguese Association for Basic Sanitation Studies)
- APME (The Association of Plastics Manufacturers in Europe)
- ATEGRUS (Technical Association for Municipal Solid Waste & Environment)
- The Chartered Institution of Wastes Management (CIWM)
- CIPA (Italian Center for Engineering to Protect the Environment)
- DAKOFA (Danish Association for Waste Management)
- Das Bessere Müllkonzept (The Better Waste Group)
- Institute of Environmental Sciences (IES)
- INTRADEL
- ISWA (International Solid Waste Association)
- Öeko-Institute, Chemistry Division
- REC (Regional Environmental Center for Central & Eastern Europe)
- RENDAN
- RIVM (National Institute of Public Health & Environmental Protection)
- SKAT Consulting
- St. Petersburg Scientific Center
- TU-Vienna, Technical University of Vienna
- WASTE, Advisers on Urban Environment & Development
- World Resource Foundation/*Warmer Bulletin*
- YTV (Helsinki Metropolitan Area Council)

## E. Topic e: Landfills

Landfilling is an unavoidable component of all European waste systems. In certain Northern European countries, less than half of the waste may be landfilled; while in southern countries like Greece, or Eastern European countries such as Hungary and Poland, virtually all waste finds its way to land burial. The European Union Landfill Directive identifies three kinds of landfills: for hazardous waste, for municipal waste, and for inert materials. Monofills, landfills for one particular material, are also recognised in the directive.

In virtually every European country, reliance on small, largely uncontrolled municipal landfills was the norm about twenty years ago. In most of the countries that are members of the EU, this situation has changed substantially. Substantial investments have been made to close and remediate old dumpsites and to design and operate new sanitary landfills. The new sanitary landfills include impermeable membranes as well as gas and leachate management systems.

*As in North America, the need to build environmental controls into new landfills has resulted in the development of regional landfills that can cost effectively serve a large area.*

Within certain countries, grassroots and/or political concern over groundwater, soil, and health have led to an emphasis on developing more environmentally sound landfills than before. Supranational policy initiatives at the European Community level have strengthened this trend, contributing to a gradual shift from small, relatively uncontrolled landfills, with largely unmonitored environmental and water quality effects and costs, to larger, generally regional systems with pollution control features. These “modern” landfills are carefully sited, and access and dumping are controlled and monitored. They typically require incoming waste to be weighed, and to be paid for on a per ton basis. The characteristics of such state-of-the-art landfills are described in this publication. The landfill directive adopted by the EU also requires that member

countries achieve certain levels of waste diversion and a reduction on the quantity of organic matter reaching the landfills. Thus, the general trend is to use landfills for the disposal of primarily inert materials.

Increased attention paid to environmental controls usually results in rising costs for landfill construction, operation, and closure; this in turn tends to force the economy of scale of newer, more environmentally sound landfills, upwards. The resulting regionalization of solid waste disposal is a significant factor in most European countries, and creates side effects ranging from the need to create regional solid waste authorities to the need to build transfer stations.

Design and construction of modern landfills is more expensive than simple dumping, and these facilities may also be difficult to site. Public resistance is less of a factor in Europe than in North America, but still plays a role in siting. The implementation of environmental controls increases construction, operation, and maintenance costs. This pressures developers to build larger landfills, which serve a region rather than a single municipality and are typically more cost effective. Regional landfills tend to be larger, more identifiable capital projects, and cost recovery usually requires a tipping fee. European governments do not always choose to recover the fully amortised costs of construction and operation of landfills through the tipping fee, and these fees tend to be set in part according to policy objectives, such as discouraging open dumping. In some cases, landfill fees are arbitrarily set higher than costs to discourage disposal or force costs onto producers or generators; in other cases, they are price-controlled to encourage legal disposal and discourage illegal dumping.

The decomposition of putrescible materials in landfills produces landfill gas, a combination of methane and carbon dioxide. This gas can be vented, flared, or recovered for use, as described elsewhere in this publication. Some gas recovered at landfills in Europe was simply flared, while in other cases the energy was recovered. The increase concern about the ozone layer and greenhouse gases has prompted the implementation of several gas management systems. A tragic landfill accident occurred in 1993 near Istanbul, when a series of events caused decomposing waste to slide, covering part of a settlement nearby and killing 39 people. In Izmir, Turkey, there is a landfill with newly installed gas capture capability.

There is also considerable experience in Europe with bioreactor landfills, in which moisture (in some cases leachate) is recirculated to maintain optimal moisture levels for biodegradation to occur. The general idea is to promote degradation of the organic matter so that the landfill can be stabilised in less time than that required under “dry” conditions.

#### E1. INFORMATION Sources in Europe on Topic e, Landfills:

- ADEME (French Association for Waste Management)
- APESB (Portuguese Association for Basic Sanitation Studies)
- ATEGRUS (Technical Association for Municipal Solid Waste & Environment)
- The Chartered Institution of Wastes Management (CIWM)
- CIPA (Italian Center for Engineering to Protect the Environment)
- DAKOFA (Danish Association for Waste Management)
- Das Bessere Müllkonzept (The Better Waste Group)
- Finnish Environment Agency (SYKE)
- Institute of Environmental Sciences (IES)
- INTRADEL
- ISWA (International Solid Waste Association)
- Öeko-Institute, Chemistry Division

- REC (Regional Environmental Center for Central & Eastern Europe)
- RENDAN
- Research & Engineering Institute for the Environment
- RIVM (National Institute of Public Health & Environmental Protection)
- SANDEC/EAWAG
- SKAT Consulting
- St. Petersburg Scientific Center
- TU-Vienna, Technical University of Vienna
- UNEP Industry & Environment
- WASTE, Advisers on Urban Environment & Development
- Water, Engineering & Development Centre (WEDC)
- World Resource Foundation/*Warmer Bulletin*
- YTV (Helsinki Metropolitan Area Council)

## **F. Topic f: Special Wastes**

### **F1. SEPARATION of Hazardous Waste from MSW**

There is a wide range of practice in the handling of household hazardous waste (HHW) in Europe, and in its separation from MSW. In Northern European countries, like Germany, the Netherlands, and Switzerland, the use of travelling chemocars, vans equipped to collect HHW, is widespread. A typical scheme for collection of HHW, which includes oil, is monthly collection in each neighbourhood, with the chemocar standing in a shopping centre for a few hours at the end of the route.

The overall trend in Europe seems to be to provide a convenient, frequent, and reliable opportunity for separation of HHW. Where there is dropoff of waste or recyclables, it is common to set up permanent acceptance sites for HHW, and most dropoff centres include such facilities.

The collection of batteries, sometimes considered to be a part of HHW, is usually handled separately. In several countries in Northern Europe, a purchaser will be asked at the time of battery purchase to turn in the batteries he or she is replacing. In the Netherlands and Germany, igloos often include a small container for batteries. Batteries in Europe are processed to recover metals. Also, the use of rechargeable batteries appears to be growing, together with the availability of simple, relatively low-cost rechargers.

### **F2. CONSTRUCTION and Demolition Debris (C&D)**

In general, European countries reclaim more construction and demolition waste than other regions. Europe's dense population and old urban infrastructure lend themselves well to intensive recovery. A second factor is the long experience in brick and stone construction. In Northern Europe, the combination of increasing reliance on incineration and the rapidly escalating weight-based landfill tipping fees for non-combustible C&D combine to discourage both waste haulers and contractors from disposing of materials that can be recovered. Furthermore, C&D waste has been the focus of a number of policy initiatives, and the concept of producer responsibility is an influence here as well.

Increasingly, European construction and demolition sites are served by a multi-container waste removal system, which allows the contractor to source separate recoverable and non-recoverable materials. In regions where this has not yet become accepted practice, waste hauling firms are likely to separate recoverable materials in a processing plant, using some combination of

mechanical and manual separation. The most common configuration involves a tipping floor for the materials, which are then partially separated by a loader or bulldozer to remove the oversized or clearly recoverable materials, such as wood and cardboard (generated in large quantities in C&D waste streams). The remaining materials are either pushed into a pit conveyor or loaded in to a hopper conveyor, where they are separated by hand, usually in conjunction with one or more shredding or milling steps. Magnetic separation is also common, especially at the end of the separation process, after size reduction. In locations where facilities for separation are not available, and economics are favourable (that is, disposal is expensive), it is common practice to undertake limited separation on the tipping floor of transfer stations.

Recoverable C&D materials in Europe include brick, concrete, stone, wood, and construction-related paper products. Except for wood and paper, most of these materials are crushed in sophisticated stone-crushing plants (similar to those associated with the quarrying of virgin stone), screened to standard sizes, and resold into the market for construction, paving, and other materials. Wood is frequently shredded for mulch, although there is a body of opinion that states that the most environmentally sound disposal strategy for wood, because of its relatively high heating value, is combustion in a waste-to-energy facility. Paper, consisting primarily of Kraft and corrugated cardboard, is often removed from the tipping floor, if it is not source separated, and baled for marketing to traditional paper markets. Recently, there have been some efforts to recover, bale, and market the polyethylene sheeting used in the packaging of pallets with construction material, together with the sheeting used to protect curing concrete from rain.

### F3. TIRES

Western Europe generates more than 100 million waste tires per year. The European Commission, although giving attention to waste tires, has not yet produced either a recommendation or a directive for its member nations.

Although Europeans are suffering from a theoretical tire disposal crisis, the sorts of tire piles sometimes seen in North America are not widely in evidence, except, to some degree, in the United Kingdom. Some countries, such as the Netherlands, have extremely high rates of retreading, even of passenger tires, and there is a small amount of reclaiming. Retreading rates of 25% to 30% are not uncommon in Europe, and in some countries, they are higher.

Where reclamation possibilities do not exist, the recognised tire disposal option in Europe is either burning in a waste-to-energy facility or burial, after shredding, in a landfill. European Union laws and regulations continue to restrict these options, due in part to concern over operational and environmental consequences of too many tires in the disposal stream.

In some more southern European countries, like Greece, Portugal, and Spain, fewer waste tires are generated, since there are fewer cars, and the tires are used for longer. In the Naples, Italy region, there are a large number of small-scale tire reclamation businesses, including several that re-groove bus and truck tires.

### F4. USED Oil

Used oil is considered neither a hazardous waste nor a “normal” solid waste in much of Europe. Many European dropoff centres offer used oil depots, and some countries have special containers placed near glass igloos and other dropoff facilities. In most countries, certain if not all gas stations and retail outlets take oil back in point-of-purchase collection programs. Waste oil is accepted in most household hazardous waste programs, but waste oil containers are not generally considered hazardous. Improperly disposed of oil is considered so dangerous in densely

populated Europe that at least one country, Austria, has prohibited do-it-yourself oil changes to force all used oil to be removed in gas stations, where it can be separately collected and recycled.

#### F5. MEDICAL and Hospital Waste

The overwhelming majority of hospital waste in Western Europe is incinerated, in incinerators meeting stringent air pollution control standards; this seems to be the ideal solution for Eastern European countries as well. In many Western European nations, air pollution control regulations are forcing a shift from smaller, onsite, hospital-based incinerators to larger, regional medical waste incinerators with acid gas scrubbers and electrostatic precipitators or baghouses. Some governments, like that of Switzerland, have a bias against onsite incineration, as pollution control equipment is seldom affordable at a small scale.

Both dedicated regional medical waste incinerators and waste-to-energy plants figure in the disposal of European medical waste. A German innovation co-locates smaller, dedicated medical waste incinerators on the sites of high-tech waste-to-energy facilities, and cycles their waste gases through the pollution control system of the larger installation. In Germany and Sweden, there is in some cases 100% redundancy, meaning that there is a fully capable backup incinerator that can burn all medical wastes. It is not usual for dedicated medical waste incinerators, which are designed in the same manner as hazardous waste incinerators, to recover energy. In rare cases, the older practice of sterilization or autoclaving before landfilling is used as an alternative. In the past, many hospitals had onsite incinerators, and in some places, this is still the case, although these smaller incinerators are increasingly being phased out as appropriate regional waste-to-energy capacity becomes available.

#### F6. SEWAGE Sludge

Sewage sludge is arguably not a waste stream, but a product of waste processing. Sewage sludge is a product of primary, secondary, or tertiary wastewater treatment, and is usually generated in the form of a moist, cake-like substance whose moisture content varies from 20% to 60% by weight.

There are six general options for sludge handling, four of which produce an intermediate substance or product, which must be further handled through processing or land application. These are: a) land application without treatment; b) neutralization, using lime or other substances; c) drying; d) composting or co-composting; e) incineration; and f) landfilling and/or use as a cover material in landfill management.

Europeans employ all of these methods. When mixed MSW composting was a more important waste processing strategy, the co-composting of sludge with this material was more common, since the moisture content and high nitrogen of the sludge was able to complement and offset the dryness and high carbon content of the paper in the waste stream. The decrease in co-composting, in part due to the implementation of high compost standards, means that more sludge must be handled in other ways.

Where incinerators are available, incineration of sludge is deemed helpful in reducing the combustibility of excessively combustible waste streams.

## F7. INFORMATION Sources in Europe on Topic f, Special Wastes:

### F7.1. General

- ADEME (French Association for Waste Management)
- APESB (Portuguese Association for Basic Sanitation Studies)
- APME (The Association of Plastics Manufacturers in Europe)
- The Chartered Institution of Wastes Management (CIWM)
- CIPA (Italian Center for Engineering to Protect the Environment)
- DAKOFA (Danish Association for Waste Management)
- DEMEX
- Finnish Environment Agency (SYKE)
- International Institute for Industrial Environmental Economics (IIIEE)
- ISWA (International Solid Waste Association)
- Öeko-Institute, Chemistry Division
- REC (Regional Environmental Center for Central & Eastern Europe)
- RENDAN
- RIVM (National Institute of Public Health & Environmental Protection)
- SANDEC/EAWAG
- SKAT Consulting
- SLL (Finnish Association for Nature Protection)
- St. Petersburg Scientific Center
- Tool, Transfer of Technology for Development
- TU-Vienna, Technical University of Vienna
- UNEP Industry & Environment
- WASTE, Advisers on Urban Environment & Development
- Water, Engineering & Development Centre (WEDC)
- World Resource Foundation/*Warmer Bulletin*
- YTV (Helsinki Metropolitan Area Council)

### F7.2. Household Hazardous Waste

- DAKOFA (Danish Association for Waste Management)
- WASTE, Advisers on Urban Environment & Development
- YTV (Helsinki Metropolitan Area Council)

### F7.3. Construction and Demolition Debris

- APME (The Association of Plastics Manufacturers in Europe)
- CIPA (Italian Center for Engineering to Protect the Environment)
- DAKOFA (Danish Association for Waste Management)
- DEMEX
- International Institute for Industrial Environmental Economics (IIIEE)
- SLL (Finnish Association for Nature Protection)
- Tool, Transfer of Technology for Development
- TU-Vienna, Technical University of Vienna
- WASTE, Advisers on Urban Environment & Development

#### **F7.4. Tires**

- Tool, Transfer of Technology for Development
- WASTE, Advisers on Urban Environment & Development

#### **F7.5. Oil**

- APESB (Portuguese Association for Basic Sanitation Studies)
- DAKOFA (Danish Association for Waste Management)
- REC (Regional Environmental Center for Central & Eastern Europe)

#### **F7.6. Medical Waste**

- SKAT Consulting

#### **F7.7. Septic Waste/Sewage Sludge**

- APESB (Portuguese Association for Basic Sanitation Studies)
- CIPA (Italian Center for Engineering to Protect the Environment)
- DAKOFA (Danish Association for Waste Management)
- Finnish Environment Agency (SYKE)
- REC (Regional Environmental Center for Central & Eastern Europe)
- SANDEC/EAWAG
- SKAT Consulting
- WASTE, Advisers on Urban Environment & Development

#### **F7.8. Other Special Wastes**

- APME (The Association of Plastics Manufacturers in Europe)
- DAKOFA (Danish Association for Waste Management)
- SANDEC/EAWAG

### **G. Topic g: Waste Characterization**

Western European countries are some of the most advanced in the world in terms of preparing and maintaining updated composition and characterization information. Solid waste programs routinely perform waste characterization studies in their development phase, and national statistics offices maintain yearly standard composition figures, which are used as the basis of system planning. Nevertheless, some European composition studies only take a waste sample from one season, instead of all four seasons. Furthermore, base line studies to define the quantity of waste that is either generated or disposed have shown that some of the data available are not reliable.

The results of the waste composition studies are generally used in national and regional projections and in planning for collection systems and disposal capacity. They are used sometimes to evaluate the success of separate collection programs, and sometimes also to indicate to producers what their responsibilities in relation to the waste stream are.

Given variations in economic development, climate, diet, and culture, it is hardly surprising that composition varies considerably from country to country in Europe. Composition of mixed waste also varies due to differences in source separation protocols. In spite of this, some generalizations about composition are possible.

- The two largest waste streams in Europe, by far, are organics and paper. Depending on climate and country, these two waste streams combined account for between 50% and 80% of residential waste. It differs by country that of these two waste streams is the largest, but in most cases organics account for more waste by weight, ranging from 25% to 65% of residential MSW, while paper values are more constant, hovering between 20% and 40% by weight in most cases.
- Depending on packaging mix, the relative quantities of glass, plastics, and metals may shift from country to country. These three materials together may account for as little as 10% and as much as 25% of residential waste by weight. When textiles, usually in the range of 2% to 5% by weight, are added, these materials plus paper and organics largely account for the waste stream.
- Household hazardous wastes, present in European waste streams at 1% to 4% of residential waste by weight, are far more important in terms of environmental implications than their quantity would indicate.
- The waste stream in Eastern European countries tends to be higher in putrescible matter and lower in glass, plastics, and metals than the Western European stream, consistent with the former countries' generally less advanced state of economic development.

#### G1. INFORMATION Sources in Europe on Topic g, Waste Characterization:

- ADEME (French Association for Waste Management)
- APESB (Portuguese Association for Basic Sanitation Studies)
- APME (The Association of Plastics Manufacturers in Europe)
- The Chartered Institution of Wastes Management (CIWM)
- DAKOFA (Danish Association for Waste Management)
- Finnish Environment Agency (SYKE)
- Institute of Environmental Sciences (IES)
- ISWA (International Solid Waste Association)
- Öeko-Institute, Chemistry Division
- REC (Regional Environmental Center for Central & Eastern Europe)
- RENDAN
- Research & Engineering Institute for the Environment
- RIVM (National Institute of Public Health & Environmental Protection)
- SANDEC/EAWAG
- St. Petersburg Scientific Center
- Tool, Transfer of Technology for Development
- TU-Vienna, Technical University of Vienna
- WASTE, Advisers on Urban Environment & Development
- Water, Engineering & Development Centre (WEDC)
- World Resource Foundation/*Warmer Bulletin*
- YTV (Helsinki Metropolitan Area Council)



## H. Topic h: Management and Planning

More than any other region in the world, Western Europe has endorsed, and largely implemented, integrated waste management. Western European governments are generally required to design their waste management systems around the proverbial waste management hierarchy, with waste prevention given the highest priority, followed by reuse, recycling, materials recovery, energy recovery, and disposal as the last resort. There is some variation, even within the European Union. For example, while most Northern European nations give materials recovery a higher priority than energy recovery, France does not distinguish between them, and assigns them equal weight in keeping materials out of landfills.

Western European governments support integrated waste management in another way as well. With some exceptions, the financing of waste management is usually arranged or supplemented at the national level, and this national financing ensures that the national policy priorities become incorporated into solid waste management systems. It also ensures that all aspects of the system are financed together, with mechanisms such as diversion credits providing incentives for recycling. As a consequence of this integrated approach to waste management, Europe has more experience with waste prevention than other regions, and recycling and materials recovery are well supported in Northern Europe. This is much less true in the southern EU countries and in the transition economies of Eastern Europe

*Both the public and the governments of most European countries have long assumed that waste management is a public function and responsibility. In both Western and Eastern Europe, however, governments are increasingly turning to the private sector to carry out some waste management tasks, usually with government oversight.*

Europe is, more the most part, a densely populated region with many old cities and mature settlements. In most cases, European countries have more than a thousand years, 2,000 in some cases, of experience with the public health and the consequences of inadequate urban sanitation. European governments, perhaps as a consequence, accept the role of the public sector at the local, regional, and in some cases national levels, in taking responsibility for waste management. This stance has been confirmed in recent court contests over European Commission solid waste directives. In addition, the generally social democratic cast of European national and regional governments tends to bolster both governmental and public expectations that the public sector is the prime mover in waste management. However, as described under “Financing”, below, governments are increasingly turning to the private sector to carry out waste management services. In Eastern Europe, formerly state-owned enterprises are undergoing a variety of transformations, generally in the direction of greater private sector involvement.

Waste management planning and policy decisions in Europe are generally done at the level of national ministries, which respond to political pressure for environmental protection and the need for clean air and water. The often lofty goals of these ministries sometimes conflict with the more mundane missions of local authorities, who have to manage the flow of waste on a daily basis.

Most European national environmental ministries, even those of countries that are not members of the European Community, are planning and making policy in response to current or anticipated European Union (EU) directives. However, these directives may be too expensive for Eastern European countries to follow fully. In recent years, the EU has issued directives on incineration, landfilling, solid waste and recycling, and packaging waste. The structure of these directives generally gives national governments a general mandate, numerical performance targets, and a certification or documentation procedure. A number of EU waste directives require planning processes in relation to waste management, as do some national waste laws and regulations.

In general, the impact of grassroots lobbying and activism in Europe can be felt more at the national level than at the level of local programs, although decision-making processes at the national, regional, and local levels vary so widely within Europe, and even within the European Union, as to make generalization impossible. Countries like France have highly centralised decision-making processes, while those like the United Kingdom leave most decisions to the local authorities. Specific local programming decisions may be broadly consultative, as they are in the Netherlands, responsive to adversarial citizen action, as in Great Britain, or less attentive to citizen input, as they are in Spain. In Northern Europe, implementation and monitoring tend to occur within the framework of a generally consensus-oriented culture, where noncompliance is the exception, rather than the rule.

The main research and scientifically oriented monitoring projects are performed by national institutes, such as RIVM in the Netherlands, or the Umweltbundesamt in Germany; these may also take place at technical universities or other academic institutions. These institutes both define research programs and respond to suggestions and proposals from consulting and independent research organizations to investigate particular problems or monitor the success of new programs.

#### H1. INFORMATION Sources in Europe on Topic h, Management and Planning:

- The Chartered Institution of Wastes Management (CIWM)
- DAKOFA (Danish Association for Waste Management)
- DEMEX
- Finnish Environment Agency (SYKE)
- Institute for Environmental Studies (IVM)
- Institute of Environmental Sciences (IES)
- International Development Department (IDD)
- International Institute for Industrial Environmental Economics (IIIEE)
- ISWA (International Solid Waste Association)
- REC (Regional Environmental Center for Central & Eastern Europe)
- RENDAN
- Research & Engineering Institute for the Environment
- RIVM (National Institute of Public Health & Environmental Protection)
- SANDEC/EAWAG
- SKAT Consulting
- SLL (Finnish Association for Nature Protection)
- St. Petersburg Scientific Center
- Tool, Transfer of Technology for Development
- TU-Vienna, Technical University of Vienna
- WASTE, Advisers on Urban Environment & Development
- Water, Engineering & Development Centre (WEDC)
- World Resource Foundation/*Warmer Bulletin*
- Wuppertal Institute for Climate, Environment, & Energy
- YTV (Helsinki Metropolitan Area Council)

## **I. Topic i: Training**

Solid waste and recycling are beginning to be recognised as standalone subdivisions of the environmental professions in Europe. A university degree in environmental science or engineering is becoming the accepted route to entering the profession.

A number of technical universities claim students in waste management, but there is not usually anything like a degree program. A number of Dutch professionals have been trained in environmental science at the Agricultural University of Wageningen in the Netherlands. Some universities perform research on solid waste issues such as the Technical University of Hamburg-Harburg, Bauhaus University-Weimar, and TU Braunschweig (Germany), the University of Padova (Italy), several universities in Sweden and in Austria.

Universities tend to have a relatively active role in Europe in relation to pilot programs and monitoring. To study some aspect of solid waste management at a university in Europe almost always means to get a masters degree. Current university programs include several environmental science or environmental economics programs, some specialised programs in clean technology, and environmental and waste programs that are part of agricultural or technical universities.

One of the main ways for professionals or would be professionals to learn about waste management in Europe is through internships. Many university technical and environmental programs require at least one internship, and many of the organizations mentioned in this publication will accept interns for specific projects or as general assistance. Internships in Europe tend to be of several months' duration, and require the intern to perform a piece of research, document the research, and have the resulting report approved. Quite a large percentage of waste professionals enter the field by way of these internships, and the contacts they make during this time serve as the beginning foundation of their professional networks.

For those already working in the field, conferences, seminars, and professional meetings and commissions are frequent forums for de facto training and human resource development. Professional and technical associations play an important role in organizing such meetings. In addition, the structure of European Union funding for environmental projects in general, and for solid waste projects in particular, creates an incentive for a large number of information exchange programs, particularly those targeting southern European countries like Greece and Portugal. These exchange programs serve as peer exchange and in-service training for those in solid waste management.

In some European countries that are less economically developed, there is a critical shortage of trained personnel. In Turkey, for example, a study reported that only about one percent of the municipalities have as director of the cleansing department a person who received formal education in this field.

### **II. INFORMATION Sources in Europe on Topic i, Training:**

- ADEME (French Association for Waste Management)
- APESB (Portuguese Association for Basic Sanitation Studies)
- ATEGRUS (Technical Association for Municipal Solid Waste & Environment)
- The Chartered Institution of Wastes Management (CIWM)
- DEMEX
- Institute of Environmental Sciences (IES)
- International Development Department (IDD)
- International Institute for Industrial Environmental Economics (IIIEE)

- ISWA (International Solid Waste Association)
- REC (Regional Environmental Center for Central & Eastern Europe)
- RENDAN
- Research & Engineering Institute for the Environment
- RIVM (National Institute of Public Health & Environmental Protection)
- SANDEC/EAWAG
- SKAT Consulting
- SLL (Finnish Association for Nature Protection)
- St. Petersburg Scientific Center
- Tool, Transfer of Technology for Development
- WASTE, Advisers on Urban Environment & Development
- Water, Engineering & Development Centre (WEDC)
- World Resource Foundation/*Warmer Bulletin*
- YTV (Helsinki Metropolitan Area Council)

### **J. Topic j: Public Education**

Most Europeans attach a high priority to good public education materials. Many solid waste agencies, especially those with source separation components, have a staff person assigned at least part-time, and, depending on the size and complexity of the jurisdiction, often full-time, to coordinate educational materials.

Calendars, newsletters, and flyers are the prime modes of communicating with the public, although television and radio advertising are not unknown. Clever public education campaigns often centre on a public figure, as was the case when Amsterdam was introducing separate organics collection, and the former mayor, a controversial but popular character, was assigned the job of promoting the new system on television and in advertisements.

A typical European public education strategy is to publicise special collections (for example, clothing collections or visits of the chemocar) by putting a flier in the mail slots of all residents in the service area in the week preceding the collection. The frequently high density of housing makes the use of door-to-door distributors for these fliers practical and cost effective.

When new systems are being considered, tested, and evaluated, there is extensive use of public opinion surveys, focus groups, and polling to gauge public acceptance. Surveys are also typical of early implementation, when public acceptance of new systems is evaluated. While such public participation in decision-making may not be required in European countries, public input into decision-making is far more institutionalised and far less combative than in North America.

The process of integration in Europe creates a number of channels for sharing of information and techniques of public education. Many EU member countries have an EU liaison office that collects and makes available materials used in other EU countries, particularly when those materials have been developed with EU financial assistance.

J1. INFORMATION Sources in Europe on Topic j, Public Education:

- The Chartered Institution of Wastes Management (CIWM)
- Finnish Environment Agency (SYKE)
- GTZ-GATE (German Appropriate Technology & Ecoefficiency)
- International Development Department (IDD)
- International Institute for Industrial Environmental Economics (IIIEE)

- ISWA (International Solid Waste Association)
- REC (Regional Environmental Center for Central & Eastern Europe)
- RENDAN
- RIVM (National Institute of Public Health & Environmental Protection)
- SKAT Consulting
- SLL (Finnish Association for Nature Protection)
- St. Petersburg Scientific Center
- Waste Prevention Association “3R”
- Water, Engineering & Development Centre (WEDC)
- World Resource Foundation/*Warmer Bulletin*
- YTV (Helsinki Metropolitan Area Council)

## **K. Topic k: Financing**

The financing of solid waste systems in Western Europe is widely accepted to be a government responsibility. In most cases, local jurisdictions, mostly at the municipal level, have a statutory responsibility for collection of residential waste. The extent to which this function is actually performed by the government varies, however, with some countries preferring public collection, and others, like Denmark, relying to a greater extent on contracting out of collection, processing, or disposal operations. There is now considerable private participation in France, and in the United Kingdom.

There is a general acceptance, among Western European governments, of the financial validity of the concept of diversion credits to internalise the avoided cost of disposal in reuse, recycling, and recovery operations. The cost of landfilling or incinerating a ton of waste is relatively simple to predict, and many jurisdictions credit avoided costs of disposal to waste diversion programs, including recycling and composting programs. In certain instances, this diversion credit is actually booked as income to the program and paid to the program operator. Where nonprofit or private-sector waste collection firms are collecting recyclables, the money from diversion credits may be specified in the contract as a part of their compensation.

In Eastern Europe, what was formerly a publicly run solid waste service sector has undergone many changes during the past decade. In some cases, cities have given the private sector very substantial control of waste management functions; in others, there is now a variety of public/private enterprises; and in still others there is considerable contracting of services to the private sector.

### **K1. FEES for Solid Waste Services**

Because European governments have generally accepted the idea that waste management is a public service and public health function, it is usually either a tax-based or a flat-fee function. Most Europeans pay for waste management services in their taxes, sometimes supplemented by utility payments. In the Netherlands, for example, residents get quarterly bills for water, wastewater, and solid waste collection; while water is metered, solid waste is a flat fee. Eastern European countries are finding it difficult to finance this centrally controlled model of MSW service delivery and are turning increasingly to the private sector to finance MSWM activities, including collection and disposal. In some cities, residents are paying fees directly to private collectors.

Capital costs are frequently paid for by grants or subsidies from the central government; in more southern EU countries, the EU itself is increasingly offering grants to local governments to develop infrastructure and environmentally sound facilities. Outside of the EU, especially in

Eastern Europe and the former Soviet Union, a very large amount of foreign aid from countries like Denmark, Germany, and the United States is currently being used for developing new or updated solid waste systems as part of development projects for urban infrastructure. Some of these aid monies are restricted to purchasing equipment from a vendor in the donor country; sometimes these monies are purely for planning and evaluation.

Collection costs for waste and recyclables are in most cases transparent to individual users. Some business customers, but far from all, do pay for collection and disposal based on the volume of their container, but this is not the case for most residences.

Tipping fees in Europe tend to reflect both policy considerations and “real” costs. Incinerators typically are financed and paid for out of tipping fees, so these systems are more likely to reflect the real costs of construction and operations. Landfills, on the other hand, are often relatively inexpensive to operate (particularly if they are unimproved, unlined, unmonitored, and older), and tipping fees are sometimes artificially inflated in order to achieve policy goals supporting recycling, to constrain or discourage disposal (particularly waste import), or improve the economics of other processing options.

There is some interest in Europe in volume-based fees, but this is still mostly in the discussion stage for residential waste. The closest to volume-based fees are residential systems that mimic the commercial ones, where residents pay a waste collection fee based on the capacity of their waste container, irrespective of the actual quantity of waste in it. These systems are extremely rare. Even businesses do not always pay for waste on a weight or volume basis. Where they do, the cost is frequently imputed based on the capacity of the container, rather than actually monitored.

## K2. INFORMATION Sources in Europe on Topic k, Financing:

- APESB (Portuguese Association for Basic Sanitation Studies)
- ATEGRUS (Technical Association for Municipal Solid Waste & Environment)
- The Chartered Institution of Wastes Management (CIWM)
- Duales System Deutschland
- Institute of Environmental Sciences (IES)
- International Development Department (IDD)
- International Institute for Industrial Environmental Economics (IIIEE)
- ISWA (International Solid Waste Association)
- REC (Regional Environmental Center for Central & Eastern Europe)
- RENDAN
- SANDEC/EAWAG
- SKAT Consulting
- SLL (Finnish Association for Nature Protection)
- St. Petersburg Scientific Center
- WASTE, Advisers on Urban Environment & Development
- Water, Engineering & Development Centre (WEDC)
- World Resource Foundation/*Warmer Bulletin*
- Wuppertal Institute for Climate, Environment, & Energy

## L. Information sources located in Europe

Note: Some of the listings refer to “Topic I”. This consists of miscellaneous (Misc.) topics covered by the institution.

Note: There are information sources about MSW issues in Europe that are located in other regions. These sources often cover several areas of the world, so they are listed in this publication under the region where they are located. Notable out-of-region institutions that offer information on MSW in Europe include:

### Institutions located in Africa:

UNEP-INFOTERRA

Note: In the following listings “Email” refers to an organisation’s electronic mail address. “Internet” refers most often to an organisation’s site on the World Wide Web, although it can also refer to gopher, ftp, or direct dial-in sites.

### L1. ADEME

(French Association for Waste Management)

27, rue Louis Vicat  
75737 Paris cedex 15  
France

**Telephone:** +33 16 4765-2000

**Fax:** +33 16 4645 5236

**Email:**

**Contact:** Mr. Jean-Jacques Thomas

**Topics covered:** a b c d e f g i

**Description:** ADEME is a state, industrial, and commercial body acting under the joint responsibility of the French ministries of the Environment, Industry, and Research. The Agency has special responsibility for waste minimisation, recovery and processing for economic value, and disposal.

**Format of information:** Reports, documents, books, brochures, videotapes, photos, journals, conference proceedings, membership lists, and databases. Those served include professionals, researchers, public inquiry, activists and environmental groups, community groups, and others.

**Internet:** [www.ademe.fr/anglais/vadefault.htm](http://www.ademe.fr/anglais/vadefault.htm)

**Language:** French, English, and Spanish

**Consulting or support services:** Library facilities, telephone advising.

**Fees:** None.

#### TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

## **L2. APESB (Associação Portuguesa Para Estudos de Saneamento Básico)**

(Portuguese Association for Basic Sanitation Studies)

A/c: LNEC-DH-NES

Av. do Brasil 101

1700-066 Lisbon Codex

Portugal

**Telephone:** +351 1 218443849

**Fax:** +351 1 218443048

**Email:** apesb@apesb.pt

**Contact:** Antonio Albuquerque

**Topics covered:** a b c d e f (used oil, septage, sewage sludge) g i k

**Description:** APESB is a non-governmental technical association representing Portuguese professionals working in the areas of sanitation, solid waste, and wastewater.

**Format of information:** Magazine, newsletter, reports, and brochures.

**Internet:** www.apesb.pt

**Language:** English, French, Spanish, and Portuguese

**Consulting or support services:** Advising, library facilities, research staff.

**Fees:** Annual membership and subscription fees for individual and organisational memberships.

## **L3. APME (The Association of Plastics Manufacturers in Europe)**

Avenue E van Nieuwenhuysse 4

Box 3

B-1160 Brussels

Belgium

**Telephone:** +32 2 676-1732

**Fax:** +32 2 675 3935

**Email:** info.apme@apme.org

**Contact:** Nancy Russotto

**Topics covered:** a d f (C&D, automotive wastes) g l (plastic waste and electric/electronic wastes)

**Description:** An industry trade association whose members are plastics producers and recyclers. Lobbies and supports the European Commission in its decision-making processes, Members consist of plastics manufacturers and distributors. APME is involved in pilot implementation of programs to comply with the EU Packaging Directive.

**Format of information:** Articles, conference proceedings, curricula and educational materials, videos, brochures, and reports

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.



**Internet:** www.apme.org

**Language:** English

**Consulting or support services:** Research and development of plastics collection systems, liaison to NGOs, telephone referrals.

**Fees:** Membership fees for industry members.

#### **L4. ATEGRUS (Technical Association for Municipal Solid Waste and Environment)**

48001 Bilbao

Spain

**Telephone:** +34 94 464-1990

**Fax:** +34 94 424 3854

**Email:** juriarte@ategrus.org

**Contact:** Sr. Julián Uriarte Jaureguizar

**Topics covered:** a b c d e i k

**Description:** ATEGRUS is a technically oriented non-profit private association, whose members consist of companies, municipalities, and individuals. ATEGRUS is the Spanish national member of ISWA.

**Format of information:** Annual conferences, conference proceedings; publications in the form of a bulletin series on solid waste topics, and technical and conference papers; databases containing articles and technical information; a quarterly journal, *Residuos*. ATEGRUS also has a normalisation committee that works on harmonisation of Spanish and EU environmental and waste management issues.

**Internet:** www.ategrus.org

**Language:**

**Consulting or support services:** Limited to information exchange via meetings, technical committees, etc.

**Fees:** Most services are free to members, who also get discounts in conference registration fees.

#### **L5. AVR (Association de Villes pour le Recyclage)**

(Association of Cities for Recycling)

Gulledelle, 100

B-1200 Brussels

Belgium

**Telephone:** +32 2 775 7701

**Fax:** +32 2 775 7611

**Email:**

**Contact:** Thomas Bernheim, Executive Secretary

Also: Jean-Pierre Hannequart, President of the Board of Directors

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

**Topics covered:** a b

**Description:** The AVR is an organisation for the exchange of information about urban recycling programs. Its membership is restricted to city/urban community or local waste authorities, international professional federations, and international NGOs. Goals include the exchange of information on recycling operations and markets for secondary materials; methods of communication, education, and public awareness; and legal, economic, or voluntary instruments relating to recycling.

**Format of information:** Initial publications include reprints of articles, a recycling survey, and conference proceedings.

**Internet:**

**Language:** French and English, on request in Dutch or Spanish

**Consulting or support services:** Not directly. Telephone referrals and information sent upon request.

**Fees:** Memberships for a city about 1,000 Euros per year; 500 Euros for NGOs; and 5,000 Euros for international. Reports are available for about US\$10 or less, plus postage.

## **L6. Both ENDS: Environment and Development Service for NGOs**

Nieuwe Keizersgracht 45  
1018 VC Amsterdam  
Netherlands

**Telephone:** +31 20 623-0823

**Fax:** +31 20 620-8049

**Email:** info@bothends.org

**Contact:** Huub Schele

**Topics covered:** 1 (depends upon the specific request)

**Description:** Both ENDS seeks to strengthen environmental development by promoting institutional cooperation between NGOs in industrialised and developing countries. Both ENDS, although not specifically focused on waste, offers four relevant services for those with a need for solid waste information. These are: (a) a service program for information on funds allocation and financial assistance; (b) an outreach and visitors' program promoting cooperation between NGOs and other social segments; (c) a capacity program, promoting international exchange on technical and strategic issues; and (d) an advocacy program enhancing the voice of NGOs in policy formulation. Both ENDS also coordinates a cities network consisting of NGOs involved with the UN Habitat Conference.

**Format of information:** Publications include guides and white papers on environment and development, and can be ordered by phone or email; research facilitation; and assistance with financing.

**Internet:** www.bothends.org

**Language:** English, Dutch, and some other languages

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

**Consulting or support services:** Telephone advice, facilitation, peer matching; tour and travel logistics; and assistance in identifying appropriate financing.

**Fees:** None.

## **L7. Central European Environmental Data Request Facility - CEDAR**

International Society for Environmental Protection (ISEP)

Marxergasse 3/20

A-1030 Vienna

Austria

**Telephone:** +43 1-715-28-280

**Fax:** +43 1-715-28-2819

**Email:** info@cedar.univie.ac.at, bernhard@pan.cedar.univie.ac.at

**Contact:** Bernhard Lorenz

**Topics covered:** l (a range of topics within MSWM is covered by CEDAR databases and mailing lists)

**Description:** Administered by the International Society for Environmental Protection, CEDAR supports international data exchange within the Central and Eastern European environmental community. CEDAR provides access to environmental databases worldwide and has set up email mailing lists to encourage communication among experts involved in environmental activities. CEDAR is designated as the Regional Service Centre for Europe and is working with the UNEP/INFOTERRA national focal points to support environmental information dissemination

CEDAR has created an EcoDirectory, which identifies environmentally oriented data and information specialists in Central and Eastern Europe. In conjunction with other organisations, CEDAR has also worked to establish CEED, the Central and Eastern European Environmental Expert Database, which highlights regional experts, their institutes, research, and publications (including gray literature).

**Format of information:** Databases and mailing list forums available via the Internet. Some information available via World Wide Web and gopher; some materials available in paper format.

**Internet:** www.CEDAR.at

**Language:** English and others

**Consulting or support services:**

**Fees:**

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

## **L8. The Chartered Institution of Wastes Management (CIWM)**

9 Saxon Court  
St. Peter's Gardens  
Marefair  
Northampton NN1 1SX  
United Kingdom

**Telephone:** +44 1604 620426  
**Fax:** +44 1604 621339  
**Email:** mike.philpott@ciwm.co.uk  
**Contact:** Mr. Mike Philpott, Chief Executive Officer

**Topics covered:** a b c d e f g h i j k l

**Description:** The Chartered Institution of Wastes Management identifies itself in brief as a professional institute.

**Format of information:** Library facilities, journal, and conference proceedings.

**Internet:** www.ciwm.co.uk

**Language:** English

**Consulting or support services:** Telephone assistance, field staff.

**Fees:** Case-by-case basis.

## **L9. CIPA (Centro di Ingegneria per la Protezione dell'Ambiente)**

(Italian Center for Engineering to Protect the Environment)  
Via Andrea Palladio 26  
20135 Milan  
Italy

**Telephone:** +39 2 5830 1501  
**Fax:** +39 2 5830 1550  
**Email:** defrajas@tin.it  
**Contact:** Professor Eugenio de Fraja Frangipane

**Topics covered:** a b c d e f (C&D, septage and sewage sludge)

**Description:** CIPA serves as editor of technical publications on environmental engineering; coordinates congresses, and offers courses on environmental engineering.

**Format of information:** Reports, books, brochures, journals, and library facilities.

**Internet:**

**Language:** English, French, and Italian

**Consulting or support services:** Consulting, field staff, research staff.

**Fees:** Depends on the case.

### TOPICS:

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## **L10. DAKOFA (Danish Association for Waste Management)**

Vesterbrogade 74, 3. sal  
DK-1620 Copenhagen V  
Denmark

**Telephone:** +45-32 96 90 22  
**Fax:** +45-32 96 90 19  
**Email:** dakofa@dakofa.dk  
**Contact:** Suzanne Arup Veltze

**Topics covered:** a b c d e f (HHW, special wastes, C&D, used oil, sewage sludge) g h

**Description:** DAKOFA is a professional membership organisation and ISWA affiliate for central and local authorities, private organisations, municipal waste companies, consultants, and suppliers within the field of waste. Activities include coordination and initiation of research, development, and pilot projects; communicating information and expertise, establishing cooperation with other bodies and institutions, including EU organisations; creating debate about national and international regulations and laws; creating dialogue between the public and private sectors; and supplying assistance in financing and exporting.

**Format of information:** Reports, documents, brochures, membership lists, and newsletter.

**Internet:** www.DAKOFA.dk

**Language:** Danish and English

**Consulting or support services:** Telephone advising; arranging of conferences, seminars, and meetings.

**Fees:** Fees are charged for literature, activities, and membership.

## **L11. Das Bessere Müllkonzept**

(The Better Waste Concept)

Landesgeschäftsstelle  
Feldstr. 6  
82282 Unterschweinbach  
Germany

**Telephone:** +49 08145 - 1053  
**Fax:** +49 08145 - 1058  
**Email:** galaske@t-online.de  
**Contact:** Waltraud Galaske

**Topics covered:** a c d e

### TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
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**Description:** Das Bessere Müllkonzept is a small, activist organisation promoting composting and recycling and resisting incineration projects. They have well-informed staff members and are a resource in incineration siting conflicts.

**Format of information:** Reports, documents, and brochures.

**Internet:** [www.muellkonzept-bayern.de](http://www.muellkonzept-bayern.de)

**Language:** German

**Consulting or support services:** Telephone advising and networking.

**Fees:** None known.

## L12. DEMEX A/S

Hejrevej 26  
DK-2400 Copenhagen NV  
Denmark

**Telephone:** +45-38 10 89 70

**Fax:** +45-38 33 13 17

**Email:** [info@demex.dk](mailto:info@demex.dk)

**Contact:**

**Topics covered:** a f (C&D) h i

**Description:** Demex is a private company involved in environmental technology and the recycling of construction and demolition waste. It is well known in Scandinavia for its willingness to give out information on this topic, and is therefore included here.

**Format of information:** Reports, books, brochures, videotapes, photos, and conference proceedings.

**Internet:** [www.DEMEX.dk](http://www.DEMEX.dk)

**Language:** English, French, Russian, Danish, and Swedish

**Consulting or support services:** Telephone advice, consulting, research staff. Services in planning, company and sector analysis, project assessment, lifecycle analysis.

**Fees:** Information is generally free; consulting fees per consulting or operations contract.

## L13. Duales System Deutschland AG

Frankfurter Straße 720-726  
51145 Köln  
Germany

**Telephone:** +49 22 03 - 9 37-0

**Fax:** +49 22 03 - 9 37-190

**Email:** [Pressestelle@gruener-punkt.de](mailto:Pressestelle@gruener-punkt.de)

**Contact:** Mrs. Edelgard Bially

### TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
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**Topics covered:** a b k

**Description:** This organisation is primarily a packaging industry consortium that provides public information about the DSD system in Germany. It focuses on the private sector approach to collection and recycling of packaging materials from households and small businesses. It serves as a clearinghouse for packaging-related recycling initiatives in other countries, including Spain, France, Austria, Belgium, and Luxembourg.

**Format of information:** Brochures, videotapes, photos in German and English. Generally informative booklet: Packaging Recycling Worldwide, summarises packaging initiatives in OECD countries; available in English upon request, Information serves members, mostly consisting of the packaging industry, professionals, researchers, and members of the public.

**Internet:** [www.gruener-punkt.de](http://www.gruener-punkt.de)

**Language:** German, limited English

**Consulting or support services:** Telephone assistance in German.

**Fees:** None.

#### **L14. Ecocycle Commission**

Ministry of the Environment  
Tegelbacken 2  
S-103 33 Stockholm  
Sweden

**Telephone:** +46 8 405 1000

**Fax:** +46 8 204 666

**Email:** [siv.naslund@environment.ministry.se](mailto:siv.naslund@environment.ministry.se)

**Contact:** Siv Nåslund

**Topics covered:** a

**Description:** The Ecocycle Commission was established by the Swedish government in 1993 to pursue and coordinate materials management: policies that result in ecological management of materials. It is now a division of the government agency promoting ecological and sustainable waste management in Sweden and Europe. The Commission compiles information, conducts research, and submits information and draft legislation consistent with its aims. Commission members come from government and industry.

**Format of information:** Brochures, reports, legislation, and articles.

**Internet:**

**Language:** English

**Consulting or support services:** Participates in the legislative and policy-making process. Can report on Swedish approaches and developments.

**Fees:** None.

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## L15. ENDS (Environmental Data Services)

Finsbury Business Centre  
40 Bowling Green Lane  
London EC1R ONE  
United Kingdom

**Telephone:** +44 (0)20 7814 5300  
**Fax:** +44 (0)20 7415 0106  
**Email:** post@ends.co.uk  
**Contact:** Ben Schneider, Information Resources

**Topics covered:** 1 (any upon request, no specialisation for waste management)

**Description:** ENDS collects and publishes environmental information, primarily for the business community. It publishes the monthly ENDS Report.

**Format of information:** journal, also available on CD-ROM.

**Internet:** www.ENDS.co.uk

**Language:** English

**Consulting or support services:** None.

**Fees:** Journal subscription, US\$380 per year; introductory subscriptions in EC countries only, US\$230 per year.

## L16. Finnish Environment Agency

(Suomen Ympariston Keskys, SYKE)  
PO Box 140  
00251 Helsinki  
Finland

**Telephone:** +358 403 000  
**Fax:** +358 4030 0190  
+358 4030 0890  
**Email:** neuronta.syke@ymparisto.fi  
**Contact:**

**Topics covered:** a b e f (sewage sludge) g h j l (decision-making processes, risk assessment, environmental impacts of waste, site remediation)

**Description:** The Finnish Environment Agency is the general coordinating body for Finnish environmental staff. In waste management, their activities have to do with public education for and implementation of the new Finnish waste law; with environmental impacts of waste, and with technical assistance to Finnish communities. Finland is also active in providing technical assistance to other Baltic countries, including Estonia, Latvia, Lithuania, Poland, and the St. Petersburg and Eastern Karelia regions of Russia.

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.



**Format of information:** Reports, audiovisual public education material.

**Internet:** [www.ymparisto.fi](http://www.ymparisto.fi)

**Language:** Finnish, Swedish, some English

**Consulting or support services:** Within Finland only.

**Fees:** None.

### **L17. GTZ-GATE (German Appropriate Technology and Ecoefficiency)**

Deutsche Gesellschaft für Technische  
Zusammenarbeit (GTZ) GmbH - Division 402  
Post Box 5180  
Dag-Hammarsköld-Weg 1-5  
D-65726 Eschborn  
Germany

**Telephone:** +49 6196 794213

**Fax:** +49 6196 797352

**Email:** [Carolin.Bothe@gtz.de](mailto:Carolin.Bothe@gtz.de)

**Contact:** Mrs. Carolin Bothe

**Topics covered:** b c j

**Description:** The GATE Information Service improves the technological knowledge of organisations and individuals involved in poverty alleviation projects in developing countries. The work of GATE Information Service is based on the experience that even entire programs are limited in their effectiveness. The knowledge gained and experience made in one region will not automatically be passed on to another region. If they are truly to be made accessible and usable for others, then active knowledge and information management is needed. This is what GATE Information Service does, with the aim of enabling the disadvantaged people of the South to take their fate into their own hands and improve their living conditions themselves. Depending on the complexity of the enquiry, the GATE Information Service provides advice on how to build up an information service, contacts to NGOs, experts and producers, and advice for the planning and realisation of technological projects in general. GATE Information Service is still free of charge for users who belong to the target group.

**Format of information:** Project reports, studies, manuals, scientific literature, bibliographies, databases, a question-and-answer service, and the quarterly magazine gate.

**Internet:** [www.gtz.de/gate](http://www.gtz.de/gate)

**Language:** German, English, and other languages

**Consulting or support services:** GTZ and GATE provide a wide range of development advisory and project services to developing countries.

**Fees:** The magazine gate is sold on per issue basis. The question-and-answer service is free to users from developing countries.

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## L18. Institute for Environmental Studies (IVM)

Vrije Universiteit  
De Boelelaan 1087  
1081 HV Amsterdam  
Netherlands

**Telephone:** +31 20 444 9520 (director)  
+31 20 444 9555 (secretary)  
**Fax:** +31 20 444 9553  
**Email:** harmen.verbruggen@ivm.falw.vu.nl  
**Contact:** Harmen Verbruggen, Director

**Topics covered:** a b h

**Description:** The Institute for Environmental Studies (IVM) is a research institute that covers a wide range of socio-economic as well as scientific issues. A substantial part of the collaborative research focuses on developing countries in which solid waste management plays an important role. Besides analysing the utilisation of waste in production processes, various projects concentrate on the formal and informal recovery sector in developing cities. Research tools used in these projects are integrated environmental-economic modelling and decision support systems.

**Format of information:** Reports, working papers, and publications in scientific journals.

**Internet:** [www.vu.nl/ivm](http://www.vu.nl/ivm)

**Language:** English

**Consulting or support services:** Economic and environmental research.

**Fees:** Depending on the type of publication, copies are distributed free or at limited charge.

## L19. Institute of Environmental Sciences (IES)

Bogazici University  
8081S Bebek  
Istanbul  
Turkey

**Telephone:** +90 212 358 1500  
**Fax:** +90 212 265-6357  
**Email:** kocasoy@boun.edu.tr  
**Contact:** Gunay Kocasoy

**Topics covered:** b c d e g h i k

**Description:** IES is an institute within Bogazici University. It offers postgraduate studies in the field of environmental sciences and environmental technology. The institute aims to emphasise the importance of appropriate environmental technologies and intends to act as a leading

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institution for developing countries. It is involved extensively in research, teaching, and training in MSWM.

**Format of information:** Research papers, reports, and other publications.

**Internet:**

[www.boun.edu.tr/graduate/sciences\\_and\\_engineering/institute\\_environmental\\_sciences.html](http://www.boun.edu.tr/graduate/sciences_and_engineering/institute_environmental_sciences.html)

**Language:** English and Turkish

**Consulting or support services:** Educational institute.

**Fees:** Not known.

## **L20. The International Development Department (IDD)**

School of Public Policy  
University of Birmingham  
Edgbaston  
Birmingham B15 2TT  
United Kingdom

**Telephone:** +44 121 414 5038

**Fax:** +44 121 414 5038

**Email:** [idd@bham.ac.uk](mailto:idd@bham.ac.uk)

**Contact:** Carol Solley

**Topics covered:** a b h i j k

**Description:** The International Development Department (IDD) is a self-financing University department within the School of Public Policy that provides training, consultancy, and research services to a range of government and non-government clients at national and sub-national levels throughout the world. IDD has undertaken a number of pieces of research on solid waste, involving environmental economics and public surveys to assess performance of waste collection and disposal services. IDD also runs a short course addressing the current issues of public-private partnerships and urban environmental services, and is involved in consultancies addressing wider environmental management issues.

**Format of information:** Publications are in paper form with some abstracts on the website.

**Internet:** [www.idd.bham.ac.uk](http://www.idd.bham.ac.uk)

**Language:** English

**Consulting or support services:** IDD provides consulting services to a wide range of public institutions, including donor agencies and national and sub-national governments.

**Fees:** Details of fees for publications and consultancy services can be provided on request.

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## L21. International Institute for Industrial Environmental Economics (IIIEE)

Lund University  
Box 196  
S-221 00 Lund  
Sweden

**Telephone:** +46 46 222 02 00  
**Fax:** +46 46 222 02 10  
**Email:** [iiiee@iiiee.lu.se](mailto:iiiee@iiiee.lu.se)  
**Contact:** Mr. Thomas B. Johansson, Director

**Topics covered:** a (reuse and prevention) f (construction and demolition waste; others) h i j k l (pollution prevention, waste minimisation, extended producer responsibility, ecoproducts, and green product development, environmental labelling)

**Description:** IIIEE is a research institute with ties to the University of Lund in Sweden. Its mission is to contribute to the international advancement of sustainable development by conducting research at the forefront of issues pertaining to cleaner production, and to train present and future policy and decision-makers within all sectors of society in the formulation and implementation of preventive environmental strategies. Most of IIIEE's waste-related reports and documents have to do with recycling and waste prevention. Its constituency includes professionals in primarily Swedish and Eastern European industry, researchers, public inquiry, and international organisations (such as UN and OECD).

The Institute offers a Masters Program in environmental management and policy, based on the UNEP Cleaner Production concept. For information on this, contact Ms. Karin Frydenlund, Tel: +46-46-222 0237; Fax: +46-46-222 0210 Email: [msc.program@envecon.lu.se](mailto:msc.program@envecon.lu.se)

**Format of information:** Reports, documents, and brochures.

**Internet:** [www.iiiee.lu.se](http://www.iiiee.lu.se)

**Language:** Materials are in English, and some Russian; staff can work in English, Swedish, Spanish, Russian, and French

**Consulting or support services:** Research staff, education, training courses, and field staff.

**Fees:** Documents and some services free to NGOs; others on a specific proposal basis.

Contact Mrs. Eva Kirsebom, Tel: +46-46-222 02; Fax: +46-46 222 0230;

Email: [eva.kirsebom@envecon.lu.se](mailto:eva.kirsebom@envecon.lu.se).

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## L22. INTRADEL

Port de Herstal, Pré Wigi  
B-4040, Herstal  
Belgium

**Telephone:** +32 42 40 7474  
**Fax:** +32 42 48 1142  
**Email:**  
**Contact:** Charles Rocmans, General Manager

**Topics covered:** b c d e

**Description:** INTRADEL is an association of Belgian communities. It provides reports, on request, usually to public inquiry.

**Format of information:** Reports  
**Internet:** [www.intradel.be](http://www.intradel.be)  
**Language:** French  
**Consulting or support services:** None.  
**Fees:** Free to members.

## L23. ISWA (International Solid Waste Association)

Vesterbrogade 74, 3. sal  
DK-1620 Copenhagen V  
Denmark

**Telephone:** +45-32-961-588  
**Fax:** +45-32-961-584  
**Email:** [iswa@iswa.dk](mailto:iswa@iswa.dk)  
**Contact:**

**Topics covered:** a b c d e f g h i j k l

**Description:** ISWA is an international trade association for waste professionals and the waste industry, with the objective of maximising exchange of information and experience worldwide on all aspects of solid waste management. Its membership consists of individuals, public and private companies, and authorities and solid waste associations in more than 75 countries and National Member organisations in 34 countries. ISWA prepares and distributes publications, organises conferences and specialised seminars, and establishes working groups on various topics. ISWA's focus is international, but the majority of its information concerns its European members.

ISWA publishes a monthly journal, *Waste Management World*; the bi-monthly scientific journal, *Waste Management & Research*; books; newsletters; proceedings from professional meetings; and a number of annual or semi-annual documents, including membership directories and a

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yearbook. Topical summaries are also produced with great regularity on important solid waste topics, such as composting or landfill technologies. Publications lists, schedules of events, and other informational documents can be ordered by calling or writing the secretariat, which is also the source for membership materials.

ISWA is governed by a general assembly, consisting of national representatives, managed by an executive and a strategic planning committee. ISWA maintains a secretariat in Copenhagen. Extensive specific or general information requests are usually referred to an individual who serves on one of ISWA's technical committees. The nature of each response, therefore, depends on the time available to and the background of the individual member to whom the inquirer is referred.

**Format of information:** Reports, documents, books, brochures, journals, conference proceedings, directories, membership lists, on-line listings, and databases.

**Internet:** [www.iswa.org](http://www.iswa.org)

**Language:** English; some documents available in other European languages

**Consulting or support services:** Telephone assistance.

**Fees:** Members receive services for free.

#### **L24. Öeko-Institute, Chemistry Division**

Postfach 6226  
D-79038 Freiburg  
Germany

**Telephone:** +49 (0)761-4 52 95-0

**Fax:** +49 (0)761-47 54 37

**Email:** [info@oeko.de](mailto:info@oeko.de)

**Contact:** Yash Tandel

**Topics covered:** a (waste prevention) c d e f g

**Description:** The Oeko-Institute (Institute for Applied Technology) was created in 1977 to do ecological and environmental research independent of industry and government. At present, more than 90 persons, 60% in research, work at the three offices in Berlin, Darmstadt, and Freiburg. The Chemistry Division deals with waste, and undertakes research, much of it under contract, in the fields of waste, plant engineering and safety, toxicology, substance and product assessment, and environmental law. The Institute offers advice based on this research to local, federal, state, and international authorities, firms, ministries, environmental associations, and concerned citizens, and has a special interest in practical implementation of its scientific results. The Chemistry Division also comments on draft legislation in areas relating to its expertise. Products and services include research and documentation on waste topics. Papers in the catalogue include conceptual and feasibility studies; energy and environmental evaluations; conceptual laws and ordinances; specific waste prevention and recycling studies and plans; technical assessment of waste management and incineration facilities; environmental and technical evaluation of waste management technologies; and white papers of various types.

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**Format of information:** Reports, books, documents, brochures, journal, and conference proceedings.

**Internet:** [www.oeko.de](http://www.oeko.de), or in English: [www.oeko.de/oeko\\_en/indexb\\_en.html](http://www.oeko.de/oeko_en/indexb_en.html)

**Language:** German and English

**Consulting or support services:** Research and documentation.

**Fees:** Documents provided at cost, including copying and postage costs.

## **L25. REC (Regional Environmental Center for Central and Eastern Europe)**

2000 Szentendre  
Ady Endre út 9-11  
Hungary

**Telephone:** +36 26 504-000

**Fax:** +36 26 311-294

**Email:** [rec-info@rec.hu](mailto:rec-info@rec.hu)

**Contact:** Winston Bowman, Team Leader, information Exchange

**Topics covered:** a b c d e f (used oil, sewage sludge) g h i j k l (plastic, electrical, and metal wastes)

**Description:** REC is an independent, non-profit organisation that promotes public participation in environmental decision-making, thereby assisting Central and Eastern European countries in their transition to a democratic, sustainable society. In this effort, the REC supports NGOs, governments, businesses, academic institutions, and the media. REC serves professionals, researchers, public inquiry, community groups, activists, and students. REC has 13 regional offices in Central and Eastern European nations, but inquiries are routed through the central program office. The REC's Information Exchange Program collects and disseminates information about the environment in Central and Eastern Europe, handling requests from around the world.

**Format of information:** Reports, documents, books, brochures, videotapes, journals, conference proceedings, directories, membership lists, databases, and on-line listings. To order REC publications, contact the Natural History Book Service Ltd (NHBS), 2-3 Wills Road, Totnes, Devon, TQ9 5XN, UK. Tel: +44 1803 865913; Fax: +44 1803 865280; Email: [nhbs@nhbs.co.uk](mailto:nhbs@nhbs.co.uk)

**Internet:** [www.rec.hu](http://www.rec.hu)

**Language:** English, Russian, Hungarian, Bulgarian, Polish, Czech, Slovak, Romanian, Croatian, and Albanian

**Consulting or support services:** Telephone assistance, advising, library, field, and research staff.

**Fees:** Information services and REC publications are offered free to Central and East European NGOs. There is a minimal copying charge (5 US cents per page) for library materials over 30 pages. Services to the business community are charged at US\$30 per hour, plus direct costs.

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## L26. RENDAN A/S

(Waste Management Information Centre in Denmark)  
Danish Environmental Management Centre  
Gladsaxevej 376  
DK-2860 Soborg  
Denmark

**Telephone:** +45-39 66 12 00  
**Fax:** +45-39 66 16 00  
**Email:**  
**Contact:** Susan Christensen

**Topics covered:** a b c d e f g h i j k

**Description:** RENDAN A/S is a non-profit information centre supported by the Danish Ministry of the Environment, which answers inquiries from within Denmark and abroad concerning all aspects of waste management.

**Format of information:** Library with more than 1000 publications and periodicals; databases on literature and articles, equipment suppliers, information centres, upcoming conferences, and waste quantity and composition statistics; *Ren Viden* Newsletter (readership, approximately 3000); yearbook on legislation, literature digest.

**Internet:**

**Language:** Danish and English

**Consulting or support services:** Telephone information service; logistics and guiding for foreign delegations researching Danish waste systems; database searches.

**Fees:** None.

## L27. Research and Engineering Institute for the Environment

Spl. Independentei 294, Sector 6  
77703, Bucharest 78  
Romania

**Telephone:** +40 1221 0990, 221-0888  
**Fax:** +40 1312 13 93  
**Email:**  
**Contact:** Luminita Stefanescu

**Topics covered:** a b e g h i

**Description:** The largest institute in Romania for environmental research. Information and research are provided on a contractual basis to government, official bodies, and state-owned and private companies.

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**Format of information:** Reports, documents, books, brochures, photos, others as needed.

**Internet:**

**Language:** English, French, and Russian

**Consulting or support services:** Research, consulting.

**Fees:** Per contractual agreements.

## **L28. RIVM (National Institute of Public Health and Environmental Protection)**

Antonie van Leeuwenhoeklaan 9, PO Box 1  
3720 BA Bilthoven  
Netherlands

**Telephone:** +31 30 274 9111

**Fax:** +31 30 274 2971

**Email:** info@rivm.nl

**Contact:** Ms. Leidsman, Also: Ms. Bruggeman

**Topics covered:** a b c d e f g h i j

**Description:** RIVM is the Netherlands' national environmental research organisation. It sponsors feasibility studies, research, and pilot projects in waste management and recycling. RIVM co-finances and commissions research, pilot programs, and monitoring and evaluation of waste management and recycling strategies.

**Format of information:** Reports, documents, and statistics.

**Internet:** www.rivm.nl

**Language:** Dutch and English

**Consulting or support services:** Limited.

**Fees:** Some documents cost up to US\$25.

## **L29. SANDEC/EAWAG**

(formerly, International Reference Center for Waste Disposal (IRCWD))

Water and Sanitation in Developing Countries (SANDEC)

Swiss Federal Institute for Environmental Science and Technology (EAWAG)

Überlandstrasse 133

CH-8600 Dübendorf

Switzerland

**Telephone:** +41-1-823 54 23

**Fax:** +41-1-823 53 99

**Email:** info@eawag.ch

**Contact:** Dr. Roland Schertenleib, Director

### TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

**Topics covered:** b e f (human waste, faecal waste, septage and sewage sludge); g h i k l (primary collection of domestic refuse: non-conventional approaches such as community-based, microenterprises; decentralised composting; sanitary landfill, and low-cost options)

**Description:** SANDEC is the acronym for Water and Sanitation in Developing Countries and is a Department within the Swiss Federal Institute for Environmental Science and Technology (EAWAG). SANDEC consists of a research group that aims to support and develop low-cost technical solutions in the field of water and sanitation. In the field of MSWM, SANDEC has concentrated its research on non-conventional collection of domestic refuse (community-based/small private enterprises) and decentralised composting; sanitary landfill is another topic of interest. SANDEC also focuses on treatment of sludges from onsite sanitation systems. Constituencies include professionals, researchers, public inquiry, community groups, and activists, primarily in developing countries.

**Format of information:** Reports, documents, brochures, journal, *SANDEC* newsletter. Documents are sent out, or assistance is provided in locating them, upon request.

**Internet:** [www.eawag.ch](http://www.eawag.ch)

**Language:** English, French, Spanish, and German

**Consulting or support services:** Advising, library, research staff; SANDEC organises trainings and workshops on solid waste topics in Switzerland and abroad.

**Fees:** Fees are charged for some services.

### L30. SKAT CONSULTING

Vadianstrasse 42  
CH-9000 St. Gallen  
Switzerland

**Telephone:** +41 71 2285454

**Fax:** +41 71 2285455

**Email:** [info@skat.ch](mailto:info@skat.ch)

**Contact:** Jürg Christen, Managing Director

**Topics covered:** a b c d e f (health care/medical waste management, human waste, septage, sewage and sludge) h i j k l (strategic MSWM planning and public/private partnerships in MSWM)

**Description:** SKAT is an entity focused on appropriate technology. SKAT's objective is to provide a forum for South-South contact and for North-South dialogue. It provides technical backup in a number of areas, including waste management and wastewater. Services are provided to the Swiss agency for Development Cooperation (SDC), other external support agencies, Urban Management Program/World Bank, WHO, NGOs, professionals, and public inquiry. The SKAT publications unit produces eight to ten manuals, monographs, and books annually; the mail order information service sells SKAT publications and a selection of books in the field.

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

**Format of information:** More than 6,000 reports, documents, books, photos, conference proceedings, directories, all available on database.

**Internet:** [www.SKAT.ch](http://www.SKAT.ch)

**Language:** German, English, French, and Spanish

**Consulting or support services:** Telephone assistance, advising, consulting, networking, library.

**Fees:** Research paid for by government agencies.

### **L31. SLL (Suomenluonnonsuojeluliitto)**

(Finnish Association for Nature Protection)

Kotkankatu 9  
00150 Helsinki  
Finland

**Telephone:** +358 9 228 081

**Fax:** +358 9 228 08200

**Email:** [ejja.koski@sll.fi](mailto:ejja.koski@sll.fi), [kierratys@sll.fi](mailto:kierratys@sll.fi), [leena.sjoblom@sll.fi](mailto:leena.sjoblom@sll.fi)

**Contact:** Eija Koski, Also: Leena Sjoblorn

**Topics covered:** a (with emphasis on reuse, waste prevention) c f (C&D) h i j k

**Description:** SLL is an association of local and topical Finnish environmental organisations. The head office in Helsinki is staffed with a number of technical experts. SLL was instrumental in promoting and setting up recycling and solid waste Public information in Finland, focusing more on waste avoidance and waste prevention. SLL staff do research, initiate and operate pilot projects and public events, and run public information campaigns. SLL is also the administrative home of Kierrdtysliike, the recycling league, a confederation of recycling activists and recycling-related companies and organisations. SLL staff are often aware of and/or networked with parallel organisations in Estonia, Russian Karelia, and the St. Petersburg region of Russia. SLL's international focus tends to be on circum-Baltic water and wastewater issues, but staff and associates are also involved in waste and recycling questions in the region.

**Format of information:** Reports, networking, library, and photos.

**Internet:** [www.SLL.fi](http://www.SLL.fi)

**Language:** Finnish; some English and German; specific project materials may be available in Estonian or Russian, and some staff speak Estonian

**Consulting or support services:** Projects for government or industry; monthly newsletter; reports; posters; expositions.

**Fees:** Fees for documents and other products; none for advice.

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

### **L32. Specialist Group on Water and Waste Technology and Management Strategies for Developing Countries**

c/o International Association on Water Quality (IAWQ)  
Alliance House  
12 Caxton Street London SW1H 0QS  
United Kingdom

**Telephone:** +44 0207654-5500  
**Fax:** +44 0207654-5555  
**Email:** water@iwahq.org.uk  
**Contact:**

**Topics covered:** l (all areas relating to waste management that are appropriate for application to developing countries)

**Description:** The Specialist Group promotes the concept of the appropriate technology approach to water and waste management; establishes a link between institutions, practitioners, and research groups with expertise in low-cost, onsite treatment and waste recycling systems; organises collaborative research and development; and works with multilateral agencies to identify and implement projects in developing countries.

**Format of information:**

**Internet:** IAWQ is at [www.iawq.org.uk](http://www.iawq.org.uk)

**Language:** English

**Consulting or support services:**

**Fees:**

### **L33. St. Petersburg Scientific Center, Russian Academy of Science United Council for Ecology and Natural Resources (SPb SCRAS, UCENR)**

Universitetskaya naberezhnaya 5  
St. Petersburg  
Russia

**Telephone:** +7-812 2133025  
+7-812 2188030  
**Fax:** +7-812 2133025  
**Email:** flora@ecol.spb.su  
**Contact:** Sergei G. Inge-Vechtomov, Chairman of the United Council

**Topics covered:** a b c d e f g h i j k

**Description:** The Scientific Center is a regional scientific and organisational body of the Russian Academy of Science that works in conjunction with universities and specialised research organisations specialising in ecology and environment protection. It establishes temporary groups

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consisting of leading specialists to solve specific scientific, applied, and legal problems; organises public hearings on significant problems; arranges scientific conferences; provides information to decision-makers; and participates in international ecology and environment protection programs.

**Format of information:** Reports, documents, books, brochures, photos, and conference proceedings.

**Internet:**

**Language:** English and Russian

**Consulting or support services:** Advising, consulting, library facilities.

**Fees:** Vary depending on type and scope of work.

### L34. Tool, Transfer of Technology for Development

Sarphatistraat 650  
1018 AV Amsterdam  
Netherlands

**Telephone:** +31 20 626 4409

**Fax:** +31 20 627 7489

**Email:** erik.baumann@tool.nl, tis@tool.nl

**Contact:** Ilse Suijkerbuijk, Also: Erik Baumann

**Topics covered:** a c f (tires, C&D) g h i

**Description:** Tool is a development organisation that specialises in appropriate and small-scale technology applications for development. Tool has its own publishing house, where it publishes books and consulting and project reports. Tool also maintains a network for the exchange of information on appropriate technology.

**Format of information:** Books, reports, brochures, journals, statistics, library, and database.

**Internet:** www.tool.nl

**Language:** English, Dutch, French, and Spanish

**Consulting or support services:** Consultants for projects in developing countries. The consulting arm is Toolconsult, which focuses specifically on small enterprise development in the recycling sector and the recycling industry in specific countries.

**Fees:** Most publications cost about US\$10-20; a catalogue is available from the above addresses; consulting is financed by international organisations; no fees for information.

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

### **L35. TU-Vienna, Technical University of Vienna**

Department of Waste Management  
Karlsplatz 13/226.4  
A-1040 Vienna  
Austria

**Telephone:** +43 158801-0  
**Fax:** +43 158801-41099  
**Email:** pbrunner@tuwien.ac.at  
**Contact:** Paul H. Brunner, Professor

**Topics covered:** a d e f (C&D) g h

**Description:** TU-Vienna is a University-based research institute. It deals with research, education, and publishing, and has a focus on international collaboration. TU serves professionals, researchers, and public inquiry

**Format of information:** Reposts, documents, books, brochures, consulting, and library facilities.

**Internet:** www.tuwein.ac.at

**Language:** English, French, and German

**Consulting or support services:** Consulting fees, where applicable, are charged in accordance with the fee structure of the Austrian Association of Civil Engineers.

**Fees:** None for materials.

### **L36. UNEP Industry and Environment**

Tour Mirabeau  
39-43 quai André Citroën  
75739 Paris, Cedex 15  
France

**Telephone:** +33 144 37 14 50  
**Fax:** +33 144 37 14 74  
**Email:** unep.tie@unep.fr  
**Contact:** Mr. Klaus Toepfer, Executive Director

**Topics covered:** a e f l (lifecycle assessment, hazardous waste identification)

**Description:** UNEP Industry and Environment (UNEP IE) encourages the development and implementation of industrial policies, strategies, technologies, and management practices that contribute to sustainable development by making efficient use of natural resources as well as by reducing industrial pollution and risk. UNEP IE's activities relate to MSWM only to a certain extent.

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In conjunction with UNEP INFOTERRA, UNEP IE published *Wastes and their Treatment*, a volume of over 1,100 pages documenting information sources on hazardous industrial waste management. With UNEP IETC and UNEP INFOTERRA, UNEP IE published *Survey of Information Systems Related to Environmentally Sound Technologies*.

**Format of information:** Books, reports, training materials, and journals.

**Internet:** [www.unepie.org/home.html](http://www.unepie.org/home.html)

**Language:** English, French, and Spanish

**Consulting or support services:** Documentation and query response.

**Fees:** Publications are available at a modest cost.

### **L37. WASTE, Advisers on Urban Environment and Development**

Nieuwehaven 201  
2801 AN Gouda  
Netherlands

**Telephone:** +31 182 52-2625

**Fax:** +31 182 55-6313

**Email:** [waste@waste.nl](mailto:waste@waste.nl)

**Contact:** Arnold van de Klundert

**Topics covered:** a b c (small-scale applications) d e f (HHW, tires, C&D, septage and sewage sludge) g h i j k l (small-scale recycling entrepreneurship and the informal sector)

**Description:** WASTE is a non-profit consulting agency active in the urban environment, with an emphasis on Africa, Latin America, and Asia. WASTE focuses on solid and liquid waste management and resource recovery, low-cost sanitation, and neighbourhood improvement. It works primarily in urban low-income areas and small enterprises, in the context of an integrated and sustainable municipal waste management system. WASTE operates the Urban Waste Expertise Program (UWEP), a program for facilitating research, documentation work, South-South information exchange, technical assistance, policy development, capacity-building, and pilot project implementation. WASTE also consults on projects in solid and liquid waste management, recycling, and resource recovery and maintains a network of consultants in developing and transition countries for collaboration on projects.

**Format of information:** Books, reports, articles, photos and slides, videotapes, library facilities, telephone and written advice, and commentary.

**Internet:** [www.waste.nl](http://www.waste.nl)

**Language:** English and Dutch; staff speak Spanish, Portuguese, French, German, and Swahili; some publications are available in some of these languages

**Consulting or support services:** Consulting is performed for and with NGOs and small entrepreneurs and is financed by international organisations and the Dutch government.

**Fees:** Charges for books are through TOOL Books; reports are charged at cost; where possible, information is provided for free or low cost in response to specific and limited requests.

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**L38. Waste Prevention Association “3R”**

**L39. (Ogólnopolskie Towarzystwo Zagospodarowania Odpadów “3R”)**

POB 54  
30-961 Krakow 5  
Poland

**Telephone:** +48 12 654-99-86  
**Fax:** +48-12-654-99-86  
**Email:** office@otzo.most.org.pl  
**Contact:** Pawel Gluszynski, Piotr Rynarowicz, Olaf Swolkien

**Topics covered:** a i

**Description:** The Waste Prevention Association “3R” (WPA), is an NGO that promotes waste reduction, the sound management of waste, cleaner production, and reusable packaging. It opposes international trade in waste and incineration. WPA collects information about waste practices in Poland and worldwide and disseminates this information to environmental organisations and local authorities. WPA provides databases and contacts, and organises consciousness-raising campaigns.

WPA has campaigned for separate collection of recyclables, packaging redesign, cleaner production, credits to factories that reuse waste, and bans on import and production of some types of plastic. In conjunction with Greenpeace International, WPA and others established an information exchange network on cleaner production and sustainable waste management in Central and Eastern Europe. WPA has linked its work in favor of recycling to its opposition to incineration.

WPA cooperates with other NGOs in Poland and the rest of Eastern Europe, and with Greenpeace International. WPA has created several environmental databases in conjunction with Poland’s Ministry of Environmental Protection and with the Regional Environmental Center in Hungary.

**Format of information:** Databases on environmental enterprises and organisations, and Internet resources. Literature and handbooks.

**Internet:** www.otzo.most.org.pl

**Language:** English and Polish

**Consulting or support services:**

**Fees:**

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#### **L40. Water, Engineering and Development Centre (WEDC)**

Loughborough University of Technology  
Leicestershire LE11 3TU  
United Kingdom

**Telephone:** +44 1509 222885  
**Fax:** +44 1509 211079  
**Email:** wedc@lboro.ac.uk  
**Contact:** Dr. Mansoor Ali, Ms Tricia Jackson

**Topics covered:** a b c e f g h i j k

**Description:** WEDC is extensively involved with research and training in solid waste management in a number of West Asian countries. It works primarily in conjunction low- and middle-income countries. WEDC has its own publications and a large collection of information available in its Resources Centre.

WEDC is also the home of the Global Applied Research Network (GARNET). GARNET facilitates the exchange of applied research information between researchers, academics, and field workers working internationally in the water supply and sanitation sector, including solid waste management. GARNET has various publications and newsletters that are free on request and can be distributed via email.

**Format of information:** Books, reports, newsletters, conference proceedings, and database.

**Internet:** [www.lboro.ac.uk/departments/cv/wedc](http://www.lboro.ac.uk/departments/cv/wedc)

**Language:** English

**Consulting or support services:** Research, teaching, and consulting services.

**Fees:** Some publications are free to requests from low- and middle-income countries. Short queries may be answered free of charge from WEDC's Resources Centre. There is usually a fee for any detailed research, bibliographic search, etc. WEDC also sells some of its publications, which range between US\$10-50, including packing and postage.

#### **L41. WHO Urban Environmental Health Unit**

Division of Operational Support in Environmental Health  
1211 Geneva 27  
Switzerland

**Telephone:** +41 22 791 3728  
**Fax:** +41 22 791 0816  
**Email:** helmerr@who.ch  
**Contact:** Dr. Richard Helmer

**Topics covered:** l (all public health aspects of MSWM)

**TOPICS:**

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**Description:** The Urban Environmental Health (UEH) unit of the World Health Organisation (WHO) has a mandate to (a) emphasise integrated urban health-and-environment management; (b) deal with priority health and environment issues in urban areas, such as air and water pollution, and solid and hazardous wastes; and (c) promote programs for creating conditions conducive to good health.

In MSWM, UEH activities include the public health aspects of solid waste management. Technical guidelines are being prepared, as well as a handbook on health care waste management in developing countries. Thereafter, guidelines will be prepared for the management of slaughterhouse and other wastes containing pathogens. Application of the guidelines, including those for waste minimisation, will be encouraged through regional workshops and country consultations. WHO is also contributing to international efforts for a global waste survey. WHO is directly advising local governments participating in its "Healthy Cities" project on safe and sound MSWM practice.

**Format of information:** Publications, documents, and reports.

**Internet:** The World Health Organization is at [www.who.ch](http://www.who.ch)

**Language:** English and French

**Consulting or support services:** Telephone advice, referral to WHO collaborating centres.

**Fees:** Documents are free; publications are individually priced.

#### **L42. World Resource Foundation/*Warmer Bulletin***

First Floor, The British School  
Otley Street Skipton  
North Yorkshire BD23 1EP  
United Kingdom

**Telephone:** +44 1756-709-800

**Fax:** +44 1756-709-801

**Email:** [bulletin@residua.com](mailto:bulletin@residua.com)

**Contact:** Kit Strange, Director, World Resource Foundation

*German office:*

Sigrid Janssen

Postfach 6323

D-30063 Hannover

Germany

**Tel/Fax:** +49 511 39 38 36

**Email:** [100121.1222@compuserve.com](mailto:100121.1222@compuserve.com)

TOPICS:

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

*Spanish office:*

Ana Gutierrez Dewar

C/ de los Canteros 25, E-8430

Alpedrete, Madrid

Spain

**Tel/Fax:** +34 18571728

**Email:**

**Topics covered:** a b c d e f g h i j k l

**Description:** World Resource Foundation publishes the bimonthly journal, *Warmer Bulletin*, a comprehensive source of information on all aspects of solid waste management. The bulletin focuses on Europe but also has short pieces on other continents; it is published in English, Spanish, and German. WRF maintains a large library and computer database of documents and materials on recycling, incineration, and all aspects of waste management. WRF maintains a mailing list of 80,000. There are offices in Spain and Germany.

**Format of information:** *Warmer Bulletin*, technical briefs and fact sheets, extensive library, and database

**Internet:** [www.wrfound.org.uk](http://www.wrfound.org.uk)

**Language:** English, Spanish, and German; most library documents are in English

**Consulting or support services:** Telephone networking and advising; referrals; library; databases.

**Fees:** None; journal by subscription.

#### **L43. Wuppertal Institute for Climate, Environment, and Energy**

Doppersburg 19

42103 Wuppertal

Germany

**Telephone:** +49 202 2492 0 (general number)

**Fax:** +49 202 2492 138

**Email:** [info@wupperinst.org](mailto:info@wupperinst.org)

**Contact:** Joachim Spanenberg, +49 202 2492 128

**Topics covered:** a h k l (waste prevention, lifecycle analysis)

**Description:** Wuppertal Institute is internationally renowned for its far-reaching economic and environmental analyses, and for its claim that sustainability requires industrialised countries to cut back significantly their levels of consumption. In relation to waste, Wuppertal. provides studies and research on the environmental and ecological consequences of waste, and develops and promotes strategies for achieving sustainability.

**Format of information:** Reports, conference proceedings, and other documents.

**Internet:** [www.eco-efficiency.de/english](http://www.eco-efficiency.de/english)

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

**Language:** German and English

**Consulting or support services:** Research, participation in international conferences, organisation of seminars and conferences.

**Fees:** Fees are charged for certain kinds of research or planning.

#### **L44. YTV (Helsinki Metropolitan Area Council)**

PO Box 521  
FIN-00520 Helsinki  
Finland

**Telephone:** +358 9 15611

**Fax:** +358 9 1561369

**Email:** ytv@ytv.fi

**Contact:** Tarja-Riita Metsald, Public Information Officer

**Topics covered:** a b c d e f g h i j

**Description:** YTV is the largest public benefit corporation in Finland concerned with waste, and as such is a good general resource for information on Finnish waste management. YTV also operates many collection programs, several landfills, recycling and composting projects, and has public information professionals on staff.

**Format of information:** Reports, documents, brochures, and public information calendars.

**Internet:** www.ytv.fi

**Language:** Finnish; some documents and reports are summarised in English or German

**Consulting or support services:** Within Finland, some technical assistance.

**Fees:** None.

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing   l = Misc.

## SECTION D. LATIN AMERICA AND THE CARIBBEAN

*Note: One important development in MSWM in this region has been the relative growth of “microenterprises”. Although this word is used extensively in Latin America, this document refers to such businesses as “small-scale enterprises”, for consistency with the overviews of other regions.*

### A. Topic a: Waste Reduction

Materials recovery is widespread in Latin America and the Caribbean. Recycling occurs in all large cities and in most medium-size cities. By contrast, small towns and rural areas generate highly dense wastes (containing mainly organics and soils) that are not recyclable other than via composting. In addition, there are not any markets for the recyclable materials in these areas.

Materials most often recycled are paper and cardboard, glass, metals (mostly aluminium), and plastics. All of these materials, except plastics, are recycled by large-scale industries. In the case of plastics, recycling industries are usually small. These industries shred the plastics and manufacture toys, plastic bags, and containers.

Large-scale recycling programs of non-hazardous industrial solid wastes have been established in Colombia, Mexico, and Venezuela. Wastes (mostly paper, cardboard, bottles, plastics and ferrous metals) are separated in the industrial premises and sold to specialised private recyclers. In Colombia, this program resulted from a cooperative effort to find jobs for former landfill scavengers. Generally, except for plastics, this type of recycling is profitable and environmentally adequate. The recycling of plastics generally is carried out on a small scale and is highly polluting.

In the case of domestic wastes, materials recovery occurs at all phases of the management chain (at the source, during collection, during transportation, and at the disposal sites), though there is a trend toward source separation. This trend has been driven by three factors: 1) an improvement in the management of disposal sites, which has forced scavengers to find work elsewhere; 2) factories that pay more for cleaner materials; and 3) households in the poorer countries getting paid a small amount of money for their recyclable materials.

In some large Argentine, Brazilian, Colombian, and Mexican cities, recycling bins have been set up outside supermarkets, where glass and paper products can be deposited. One of the most successful experiences is that of glass recycling in Colombia. In this case, the recycling bins were placed by a specific glass manufacturer, which also carried out a public education program. Other experiences have not been as successful, mostly because of the lack of public education on the benefits of this practice.

*Collection of recyclables at the source is done in a variety of ways, ranging from individual itinerant collectors to municipally organised collection of source-separated materials.*

Collection of materials at the source is done in a variety of ways, ranging from individual itinerants to municipally managed, segregated source collection. Although the number of itinerant scavengers is decreasing, their presence is widespread and, in general, they handle the largest volume of recyclable materials. It is not known how many people are involved in informal recycling in the region, but the number of people picking wastes on the streets is quite high. It has been estimated that approximately 100,000 people pick wastes at dumpsites.

Street pickers usually own a pushcart or a front-loaded tricycle with which they roam the streets calling for recyclable materials. The itinerants deliver the wastes to intermediaries who then sell the recyclable materials in bulk to the industrial plants. The social and health conditions of the itinerants are very poor. They are exploited by the intermediaries, who receive significant amounts of money from the industrial plants. Ignoring the intermediaries is considered to be very dangerous due to the strong economic interest that this group has in the recycling chain.

Kerbside pickup of recyclable materials is being practiced only in Brazil (a few cities have such a program) and in Mexico. Although waste management authorities acknowledge that additional costs are incurred in this effort, these are partially compensated for by the reduced amount of waste that has to be transported and disposed of in landfills. These efforts appear to have succeeded in these Brazilian cities in part because there was no tradition of individuals or cooperatives performing such collection of recyclables, and in part because of the local authorities' inclusion into their cost calculations all the externalities that others do not consider (e.g., landfill lifetime, lower consumption of natural resources, etc.) Kerbside materials collection was also attempted in some sectors in Buenos Aires, but failed reportedly due to the high costs associated with collection and the decision not to subsidise such an effort.

Materials recovery also occurs during transportation in the cities where there is less control on the transportation routes, particularly in the poorer Andean countries and in Mexico. Some of the collection vehicles deviate from their regular routes to stop and deliver the recyclable materials to the intermediaries before they go to the disposal sites. Recyclables, in this case, include not only the typical inorganic materials, but also food residues, which are used for feeding pigs. As discussed elsewhere in the document, this deviation from regular transportation routes imposes significant costs on the MSWM system, although it clearly supplements the low pay of the waste collection workers.

Scavengers are not allowed in the few managed landfills in the region. However, since many cities have open dumps, a significant amount of materials recovery occurs at the disposal site. The quality of the product is worse, of course, but the collected items can still be sold in the market.

#### A1. COOPERATIVES and Small-Scale Enterprises

In some cases the conditions of scavengers have been improved through their organization and training. Some of the most notable experiences are found in Colombia, but a number of other countries (Argentina, Brazil, Panama, Peru, and Venezuela) have followed suit. Organizations involved in recycling have assisted in the establishment of cooperatives or small-scale enterprises. In all cases, the organizations have been promoted by outside institutions such as NGOs or the local solid waste authority (some of the best cases for this can be observed in Belo Horizonte and Porto Alegre, Brazil, and in Mexico City). In the Brazilian cases, the waste authority provided a site where those in charge of recycling can carry out their work. This is also the case for Mexico City, where a recycling plant was designed and built on the landfill. The recycling facility is capable of processing on the order of 1,500 tons per day. In both cases, all revenues are kept by those who separate the materials, while the municipal authority benefits by increasing the lifetime of the landfill and providing employment to those in need.

The cooperatives or small-scale enterprises provide training, financial, and health support to their members, thus improving their overall social conditions. Often, the cooperatives have grown, taking not only former landfill workers but also other unemployed community members.

## A2. INFORMATION Sources in Latin America and the Caribbean on Topic a, Waste Reduction:

- AIDIS (Asociación Interamericana de Ingeniería Sanitaria y Ambiental)
- AIDIS-Argentina
- AMCRESPAC (Asociación Mexicana para el Control de los Residuos Sólidos y Peligrosos)
- APROSAC (Asociación para la Promoción del Saneamiento Ambiental en Comunidad)
- CEMPRE (Compromiso Empresarial para Reciclagem)
- CEPAL (Comisión Económica para América Latina)
- CEPIS (Centro Panamericano de Ingeniería Sanitaria y Ciencias del Ambiente)
- COMLURB (Companhia Municipal de Limpeza Urbana) - Rio de Janeiro
- CONAMA (Comisión Nacional del Medio Ambiente) - Guatemala
- DESCO (Centro de Estudios y Promoción del Desarrollo)
- DINAMA (Dirección Nacional de Medio Ambiente) - Uruguay
- EMASEO (Empresa Metropolitana de Aseo)
- IBAM (Instituto Brasileiro de Administração Municipal)
- IDM (Instituto de Desarrollo Municipal) - Paraguay
- IPES (Instituto de Promoción de Economía Social) - Peru
- OACA (Oficina de Asesoría y Consultoría Ambiental)
- OAS (Organization of American States)
- PAHO (Pan American Health Organization)
- PROA (Centro de Servicios Integrados para el Desarrollo Urbano)
- RAU/PGU (Red Ambiental Urbana/Programa de Gestión Urbana)
- Recuperar
- SENASA (Servicio Nacional de Saneamiento Ambiental) - Paraguay
- SLU (Superintendencia de Limpeza Urbana) - Belo Horizonte

### **B. Topic b: Collection and Transfer**

A number of large cities in Latin America and the Caribbean have fairly good waste collection coverage. Buenos Aires, Santiago, and Havana claim to collect essentially all of their wastes. São Paulo, Rio de Janeiro, Bogotá, Medellín, Caracas, Montevideo, La Paz, and Port of Spain claim more than 90% coverage. It is not clear, however, whether or not these figures include collection from squatter settlements. The waste collection system of all other cities in the region still is deficient.

All large cities use conventional equipment for collection and transfer of all or part of their wastes. Side- or rear-loaded compactor trucks carry out the collection process through pre-established collection routes. Compactor trucks function relatively well in paved urban areas. However, there is a common problem throughout the region with respect to the efficient use of this equipment: both the equipment and maintenance are very expensive. Frequently, municipalities get in debt by purchasing these vehicles without taking into account the infrastructure needed for their maintenance and the quality of the waste. Thus, a large portion of these trucks does not operate due to the lack of parts or of trained personnel to repair them.

*Non-compactor vehicles are much less expensive than compactors, are easier to maintain, and are well suited to the already dense wastes often found in Latin American cities.*

In many large cities, this problem has been resolved by privatizing the collection services. Waste collection is carried out by private enterprises that work under concession contracts with the local government. Administration of funds is more efficient, so the trucks operate most of the time.

Waste collection is also carried out using other means, depending on the availability of economic resources, road conditions, and socioeconomic level of the collection area. Wastes are collected in standard trucks, front-loaded tricycles, or carts (pulled by a tractor, animal, or person).

Conventional, commercial trucks are used when compactor trucks are not working or funds do not allow for the purchase of compactor trucks. Many solid waste professionals recommend conventional trucks over compactor trucks, because capital costs are much lower, maintenance is cheaper, and the wastes tend to be very dense, with little compactability. Still, local government officials are interested in purchasing compactor trucks, even if this implies large debts, due to the 'modern' image that this equipment brings.

Semi-motorised and manual collection systems are common in areas of the cities that are difficult to reach, as well as in smaller towns. This waste collection system is done either by individuals who receive direct payment for their services, or, by waste collection cooperatives or small-scale enterprises. These small-scale waste collection enterprises are emerging in large numbers (mainly in the Andean and Central American regions) to fill a gap left by formal systems. They generally are privately run and work either as a concession or are contracted directly by the local community (through a neighbourhood association).

In some squatter settlements in urban areas, there are small-scale enterprises that engage in primary collection: collecting wastes and taking them to a central collection point where the municipality or solid waste authority picks them up and transport them to the disposal site. In cases where such settlements are further from urban areas, residents have in some cases established manual landfills, which are described in the "Landfills" section, below.

Small-scale enterprises dealing with waste collection in the region typically include from seven to 20 people, although the entity "Recuperar", in Colombia, has more than 700 members (although they are not formally employees).

A major problem still unresolved in many cities in the region is the frequency and efficiency of waste collection. Frequency varies all the way from daily to once a week (not including the many areas of cities that are not serviced at all). Frequency, in many cases, is not determined by technical considerations such as putrefaction rates of the wastes, climate, vehicle availability, and routing necessities, but rather by how affluent an area is.

Both collection of market wastes and street sweeping in commercial areas are most often the responsibility of the municipality or of the solid waste authority. In residential areas, each residence typically is responsible for cleaning their part of the kerb. In the case of street sweeping, small-scale enterprises have had a very important role in the region. These small-scale enterprises tend to be the first (as compared to collection and disposal enterprises) to become self-sustaining.



## B1. TRANSFER Stations

Throughout South America, Mexico, and Costa Rica, particularly in the large metropolitan areas, transfer stations have been installed or are in the process of being installed. The transfer stations are usually owned and operated by the agency responsible for solid waste management in the city.

Transfer stations do not vary widely in design from those found in the technical manuals. Compactor or conventional trucks arrive at the station, where they discharge the wastes on the floor or directly into large, specially designed trailers that deliver the wastes to the disposal sites. These trailers usually do not have compactors. In Bogotá, however, there is a transfer station that uses stationary compactors, and in Rio de Janeiro as well as in Buenos Aires, wastes are deposited into a system that compacts the wastes into a trailer.

The need for the transfer stations has grown significantly in the past ten years as the distance between the city and the disposal sites increases. In cities such as Rio de Janeiro, Mexico City, Caracas, and Buenos Aires, more than 50% of the wastes go through a transfer station.

Transfer stations have proven to be much more cost effective than trucks going directly to the landfill. Fuel costs are substantially reduced. Mileage demand on trucks is lower so that operation and maintenance costs are lower and truck lifetimes are longer.

## B2. INFORMATION Sources in Latin America and the Caribbean on Topic b, Collection and Transfer:

- ABRELPE (Associação Brasileira e Resíduos Especiais de Empresas de Limpeza Pública)
- AIDIS (Asociación Interamericana de Ingeniería Sanitaria y Ambiental)
- AIDIS-Argentina
- AMCRESPAC (Asociación Mexicana para el Control de los Residuos Sólidos y Peligrosos)
- APROSAC (Asociación para la Promoción del Saneamiento Ambiental en Comunidad)
- CEAMSE (Cinturón Ecológico del Área Metropolitana Sociedad del Estado)
- CEPIS (Centro Panamericano de Ingeniería Sanitaria y Ciencias del Ambiente)
- COMLURB (Companhia Municipal de Limpeza Urbana) - Rio de Janeiro
- CONAMA (Comisión Nacional del Medio Ambiente) - Guatemala
- DESCO (Centro de Estudios y Promoción del Desarrollo)
- DINAMA (Dirección Nacional de Medio Ambiente) - Uruguay
- EMASEO (Empresa Metropolitana de Aseo)
- IBAM (Instituto Brasileiro de Administração Municipal)
- IDM (Instituto de Desarrollo Municipal) - Paraguay
- IPES (Instituto de Promoción de Economía Social) - Peru
- OACA (Oficina de Asesoría y Consultoría Ambiental)
- PAHO (Pan American Health Organization)
- RAU/PGU (Red Ambiental Urbana/Programa de Gestión Urbana)
- SENASA (Servicio Nacional de Saneamiento Ambiental) - Paraguay
- SLU (Superintendencia de Limpeza Urbana) - Belo Horizonte
- Trinidad & Tobago Solid Waste Management Company (SWMCOL)

### **C. Topic c: Composting**

Centralised composting has not been successful in Latin America and the Caribbean. The Pan American Health Organization estimates that in the last 20 years, at least 30 plants were purchased, some of which were never installed. Approximately 15 closed only a few years after installation. At the time of this review, one plant was reported in operation in São Paulo, Brazil. This plant is owned and subsidised by the municipal government of São Paulo, which is interested in its continued operation due to the lack of landfill space in the metropolitan area. Four large composting plants operated in Mexico, but none of these is still working. Two others were purchased there, but were never installed.

There are a number of reasons why centralised compost plants have not been successful in the region, the most important one being the operating costs associated with highly mechanised systems compared to final disposal in open dumps. Many of these plants were purchased without a feasibility study and without an existing market for the product. Municipalities, in general, cannot afford to subsidise these compost plants, particularly when cheaper (though less environmentally friendly) options are available. Also, due to deficient management, the plants that were put into operation soon became a public health problem.

Some community composting projects have been deemed “successful”. In most cases, however, these have been demonstration projects sponsored by NGOs or municipalities that wanted to produce compost for parks and gardens. Would be, self-sustaining, small-scale enterprises that sell compost are struggling.

Small-scale vermiculture (worm culture), which produces humus, appears to have been more successful than large-scale composting, since production times are much shorter (days vs. weeks) and the product has a wider market than compost. Successful cases have been reported in Colombia, Peru, and Cuba. Successful vermiculture generally is carried out at a very small scale, processing on the order of kilograms per day (and not tons per day) typically with five or six persons being involved. Vermiculture also benefits from the public perception that its product, humus, comes from “clean” vegetable waste, whereas compost comes originates from mixed “garbage”. This perception is probably right, in a way, since the main source of waste for vermiculture is market and agricultural wastes. Additionally, humus is richer in nutrients than is compost, and compost suffers from worse quality control problems. On the other hand, there have been some instances where source-separated organic residues such as market wastes have been used to produce compost.

There have been some pilot trials of anaerobic digestion of wastes. Although the process was shown to be technically feasible, its cost effectiveness was not demonstrated. As a result, it was never implemented.

Backyard composting is carried out in rural areas and in the poor areas of cities. The compost is used in the households for vegetable plots.

Given the characteristics of the municipal wastes generated in most municipalities in the region, biological treatment of the wastes can potentially assist in the stabilization of this component of the waste stream.

## C1. INFORMATION Sources in Latin America and the Caribbean on Topic c, Composting:

- AIDIS (Asociación Interamericana de Ingeniería Sanitaria y Ambiental)
- AIDIS-Argentina
- CEPIS (Centro Panamericano de Ingeniería Sanitaria y Ciencias del Ambiente)
- COMLURB (Companhia Municipal de Limpeza Urbana) - Rio de Janeiro
- IPT (Instituto de Pesquisas Tecnológicas do Estado de São Paulo)
- PAHO (Pan American Health Organization)
- RAU/PGU (Red Ambiental Urbana/Programa de Gestión Urbana)
- SLU (Superintendencia de Limpeza Urbana) - Belo Horizonte
- Trinidad & Tobago Solid Waste Management Company (SWMCOL)

### **D. Topic d: Incineration**

Virtually no incinerators operate in Latin America or the Caribbean, although there have been a number of feasibility studies. To date, however, the costs of this technology are far too high to be considered by local governments as an appropriate waste management technology.

One municipal incinerator did operate in Mexico City; however, it was closed in 1992 because it could not meet emission standards. Incinerators for mixed MSW were also tried in São Paulo and in Buenos Aires, but they are not operative at the present time. In these cases, operation and maintenance costs were too high. Other cities, such as Santiago, Chile have assessed the feasibility of implementing an incinerator but concluded that such an endeavour was not economically viable.

Barbados has one tiny (one ton/day) incinerator for processing wastes originating in the port. Private financing was arranged by the company that provided the incinerator; the government is now repaying the loan.

Individual buildings do not have waste incinerators because they have been prohibited by law.

## D1. INFORMATION Sources in Latin America and the Caribbean on Topic d, Incineration:

- AIDIS (Asociación Interamericana de Ingeniería Sanitaria y Ambiental)
- AMCRESPAC (Asociación Mexicana para el Control de los Residuos Sólidos y Peligrosos)
- CEPIS (Centro Panamericano de Ingeniería Sanitaria y Ciencias del Ambiente)
- COMLURB (Companhia Municipal de Limpeza Urbana) - Rio de Janeiro
- PAHO (Pan American Health Organization)

### **E. Topic e: Landfills**

The use of landfills in Latin America and the Caribbean has increased significantly in the last decade. Most capital and other large cities in countries in South America, Mexico, Costa Rica, and Trinidad and Tobago have landfills of some sort. Many of these landfills, however, are more like controlled dumps: someone checks (but does not weigh) vehicles entering the site, and scavengers do not actually sleep on the site. In some cases, the wastes are covered on a daily basis. However, there is neither a clay nor a synthetic liner at the bottom of the landfill, often no leachate collection or treatment system is in place, and no environmental monitoring is performed. Altogether, approximately 60% of the waste generated in the region is disposed of in such “landfills”.

Some large cities in the region (including Belo Horizonte, Buenos Aires, Guayaquil, Medellín, Mexico City, Santiago, and São Paulo) do have relatively well designed and operated landfills. Landfill design in these cities typically consists of a bottom clay liner, followed by a sand or ground stone layer. Synthetic liners are not commonly used except for some of the new landfills in Argentina, Brazil, and Chile. Leachate collection systems are used in a few sites, the landfills are subdivided into cells, and they generally have chimneys for venting the landfill gas. Wastes are covered daily or almost daily with topsoil.

To get a more rounded picture, one can review an analysis of landfills in Mexico conducted by the World Bank: a total of 97 controlled final disposal sites were identified, of which only 11, mostly located in the northern part of the country, had equipment and instrumentation features that could allow them to be considered landfills, rather than dumps. Many Mexican landfills face significant operational and environmental problems, as access and disposal are uncontrolled and leachate is not contained, treated, or monitored. This analysis concluded that only 15% of the MSW generated in Mexico is disposed of adequately.

*A World Bank analysis concluded that only 15% of municipal solid wastes generated in Mexico are disposed of adequately.*

In most landfills in the region, the leachate goes untreated, resulting in its infiltration into ground or surface water. Some notable exceptions are landfills in Santiago (where rainfall is very low) and in Brazil, which recirculate the leachate into the landfill, and one landfill in Buenos Aires, which has physical/chemical and biological treatment of leachate. Mexico City has also installed a treatment system in one of its landfills.

Because of the high organic content of the region's wastes, landfilled wastes tend to produce methane relatively quickly. Nevertheless, this gas is only used in Chile (such as in Santiago and in Valparaíso), where a few landfills have instituted gas collection systems. The gas is used by the cities' gas companies and reaches approximately 30% of the population in each of the cities. In Rio de Janeiro, landfill gas was collected, compressed, and used as fuel for the waste collection vehicles and in heavy machinery. Unfortunately, the pilot project was discontinued.

Central America (except for Costa Rica), the Guyanas, and most Caribbean countries do not have landfills. This is also the case for all non-capital cities in Bolivia, Ecuador, and Peru, and for many medium-size cities with the exception of those in Chile, Cuba, and Colombia. In the absence of landfills, wastes are disposed of in open dumps. These dumps pose significant environmental health risks, which, in some cases, have been documented. Scavengers enter freely into the disposal sites, sometimes even living there. These people gather a wide range of materials, including food residues to feed pigs.

Though attempts are constantly made to prevent scavengers from entering the disposal sites, these efforts usually are unsuccessful. In one case in Colombia, however, both scavengers and former guerrillas were trained and financed to start recycling and street cleaning enterprises when one dump was upgraded.

Many landfills are operated by private enterprises, particularly in Argentina, Brazil, Chile, Colombia, and Mexico. Typically, the land is owned by the local government and is given to the enterprise, which works under a concession contract.

There is no authorised disposal of MSW at sea. However, some of the poorer coastal cities do deposit MSW on riverbanks and relatively close to the ocean. The wastes are then washed into

the ocean. There are also several cases where land is being gained from the ocean by filling coastal areas with demolition wastes. MSW ends up in these places, too, causing serious odour problems.

## E1. MANUAL Landfills

Manual landfills have been developed in cities with less than 50,000 inhabitants. Manual landfills are similar in design to mechanised landfills except for their size and the equipment they require. These landfills have the capacity to receive 10 to 50 tons per day of wastes. They sometimes require the use of heavy equipment, but only for periodic preparation of the terrain and for the accumulation of cover material. Otherwise, all key steps for landfill operation are carried out manually, including cell preparation, compaction, and daily cover. The capital, operation, and maintenance costs of these landfills are much lower than a mechanised landfill. The most successful cases have been documented in Colombia, although Chile, Costa Rica, Honduras, and Peru all have manual landfills, and Ecuador and Panama are also planning to have them. Manual landfills are a viable option for small cities and towns.

In Peru, a manual landfill in Cajamarca worked well, serving 80,000 inhabitants and processing about 40 tons/day. Those involved in manual landfills in Colombia believe that in general 20 tons/day is the maximum that such facilities can reasonably handle.

## E2. INFORMATION Sources in Latin America and the Caribbean on Topic e, Landfills:

- ABRELPE (Associação Brasileira e Resíduos Especiais de Empresas de Limpeza Pública)
- AIDIS (Asociación Interamericana de Ingeniería Sanitaria y Ambiental)
- AIDIS-Argentina
- APROSAC (Asociación para la Promoción del Saneamiento Ambiental en Comunidad)
- CEAMSE (Cinturón Ecológico del Área Metropolitana Sociedad del Estado)
- CEPIS (Centro Panamericano de Ingeniería Sanitaria y Ciencias del Ambiente)
- COMLURB (Companhia Municipal de Limpeza Urbana) - Rio de Janeiro
- CONAMA (Comisión Nacional del Medio Ambiente) - Guatemala
- DESCO (Centro de Estudios y Promoción del Desarrollo)
- DIGESA (Dirección General de Salud Ambiental, Ministerio de Salud) - Peru
- DINAMA (Dirección Nacional de Medio Ambiente) - Uruguay
- EMASEO (Empresa Metropolitana de Aseo)
- IDM (Instituto de Desarrollo Municipal) - Paraguay
- IPT (Instituto de Pesquisas Tecnológicas do Estado de São Paulo)
- OACA (Oficina de Asesoría y Consultoría Ambiental)
- OAS (Organization of American States)
- PAHO (Pan American Health Organization)
- PROA (Centro de Servicios Integrados para el Desarrollo Urbano)
- RAU/PGU (Red Ambiental Urbana/Programa de Gestión Urbana)
- SENASA (Servicio Nacional de Saneamiento Ambiental) - Paraguay
- SLU (Superintendencia de Limpeza Urbana) - Belo Horizonte
- Trinidad & Tobago Solid Waste Management Company (SWMCOL)
- Universidad de Chile
- Universidad de la República, Uruguay

## F. Topic f: Special Wastes

Most special wastes are not managed appropriately in Latin America and the Caribbean; a large proportion enters the MSW stream. Although legislation on industrial and hospital wastes does exist in a number of countries in the region, only a few have implemented control programs.

Hazardous industrial wastes are rarely collected by the MSW collection system. This service is usually provided by private enterprises, which, in some cases, have specially designed trucks for this purpose. The best cases of hazardous waste collection systems can be found in Brazil and in Mexico. On the other hand, most collection services are provided in conventional vehicles, where the hazard of leakage or accidents is ever present.

*Although some collection of hazardous waste is carried out separately, industrial hazardous wastes are frequently disposed of in MSW dumps or in clandestine dumping sites.*

Although some collection of hazardous waste is carried out separately, industrial hazardous wastes are frequently disposed of in MSW dumps or in other clandestine dumping sites. For example, in Mexico, which has two operating secure landfills, an estimated 95% of the hazardous wastes are not accounted for and are presumably disposed of jointly with MSW.

In a few places in Brazil, certain types of hazardous industrial wastes are co-disposed with MSW in a technically managed way so that environmental impacts are controlled. However, co-disposal is highly controversial and is not being promoted in most countries in the region.

### F1. MEDICAL Wastes

Hospital wastes have received more attention than industrial wastes in the region, although much work is still needed to achieve proper management of these wastes. Scavengers in disposals sites are exposed to needles and other dangerous hospital wastes. There are also cases of exposure to radioactive materials from discarded hospital materials.

A large part of the work done on hospital wastes is related to characterization. Thus, there is a good understanding of the sources of pathogenic, chemically hazardous, and general solid wastes within a health care facility. However, there is not an agreement on methods for adequate treatment and disposal of such wastes. Some authorities support the separation of hazardous hospital wastes at the source and the subsequent differential treatment of such wastes, according to the specific hazards presented. Others believe that segregation at the source is very difficult and that the risk of hazardous materials entering the MSW stream is too great, so that all wastes should be collected and disposed of as hazardous hospital wastes. This is the case in the state of São Paulo, Brazil, where regulations require that all hospital wastes be collected and transported to a municipally owned, centrally located incinerator. In this case, no onsite separation of hospital wastes is allowed.

Except for the case of São Paulo, legislation typically requires that wastes be treated by onsite incineration. However, few hospitals have incinerators, and the ones that have them do not operate well. As a result, solid waste authorities, with the aim of providing a solution, sometimes allow disposal in specially designed cells within sanitary landfill facilities.

### F2. OTHER Wastes

Although not much has been written on demolition wastes in the region, they are generally a problem due to their volume and the cost of transporting them. There are not specifically

designed landfills in the region for these wastes. In many instances, demolition wastes are reused for land reclamation in coastal areas or quarries. In Mexico City, much of the demolition waste after the earthquake was used to fill up waterlogged areas of the city. These wastes are also used as a base for road construction.

Tires, oils, and batteries are usually recycled, though the recycling process is not always environmentally adequate. Recycled oil can be marketed, even though quality control is often nonexistent, because it is inexpensive. In the case of waste oils, filter residues are often disposed of in the sewers. Batteries are often taken to small-scale foundries that do not have emissions control systems and are often located in residential areas.

Since only a few cities have wastewater treatment plants, there is little sewage sludge disposal. In general, where sewage sludges are generated, they are disposed of by the rivers or on the land. In Brazil, sewage sludges are disposed of on farmland.

F3. INFORMATION Sources in Latin America and the Caribbean on Topic f, Special Wastes:

- ABRELPE (Associação Brasileira e Resíduos Especiais de Empresas de Limpeza Pública)
- AIDIS (Asociación Interamericana de Ingeniería Sanitaria y Ambiental)
- AIDIS-Argentina
- AMCRESPAC (Asociación Mexicana para el Control de los Residuos Sólidos y Peligrosos)
- CEPIS (Centro Panamericano de Ingeniería Sanitaria y Ciencias del Ambiente)
- COMLURB (Companhia Municipal de Limpeza Urbana) - Rio de Janeiro
- DESCO (Centro de Estudios y Promoción del Desarrollo)
- DIGESA (Dirección General de Salud Ambiental, Ministerio de Salud) - Peru
- OACA (Oficina de Asesoría y Consultoría Ambiental)
- PAHO (Pan American Health Organization)
- RAU/PGU (Red Ambiental Urbana/Programa de Gestión Urbana)
- SLU (Superintendencia de Limpeza Urbana) - Belo Horizonte
- Universidad de Chile

### **G. Topic g: Waste Characterization**

Several countries in Latin America and the Caribbean have reports on waste quantification and characterization. Most research conducted on waste characterization is performed in academic institutions. The research is conducted to improve waste management programs and to determine the most efficient way to recycle wastes. Also, waste management authorities characterise waste in order to estimate required landfill space and necessary infrastructure.

Lately, researchers have shown concern on the quality of the waste characterization data, as the number of variables can be very large. For example, there are significant differences between poorer and richer areas within cities, between cities and towns, between different seasons etc. The University of Chile has recently published a three-year study on waste characterization that shows that the sampling methods presently being used in the region need to be reviewed, and that available data may not be reliable. Mexico has an officially approved procedure for the analysis of wastes.

From the available data, it is clear that quantities and quality of wastes are related to the economic conditions of the countries. The richer ones generate more wastes per inhabitant, and their wastes tend to contain more paper, glass, and metal containers than in the poorer countries.

Waste quantities generated range between 0.3 to 1.0 kg/inhabitant/day (this includes commercial, market, and street-cleaning wastes). Bulk densities vary between 150 and 200 kg/m<sup>3</sup> (when measured loosely), and range from 400 to 500 kg/m<sup>3</sup> after compaction in the truck. In landfills, densities go up to 700 to 1000 kg/m<sup>3</sup> after compaction onsite.

*Researchers are concerned about the quality of waste characterization data.*

On average, wastes have a high moisture content (approximately, 45% to 50%) and have a high concentration of organic matter (40% to 50%). Organics content (and, therefore, humidity) tends to be higher in poorer countries. As the per capita GDP grows, paper, plastics, glass, and metals content grows, since there is greater consumption of manufactured products. These differences are also observed between small towns (where the organics content is high) and large cities within the same country.

Furthermore, as the region improves economically, the percentages of paper, glass, and plastic content are expected to increase. The growth rate will be slower than might have been expected, however, because there are already some campaigns promoting waste reduction in the region.

G1. INFORMATION Sources in Latin America and the Caribbean on Topic g, Waste Characterization:

- AIDIS (Asociación Interamericana de Ingeniería Sanitaria y Ambiental)
- AIDIS-Argentina
- APROSAC (Asociación para la Promoción del Saneamiento Ambiental en Comunidad)
- CEPIS (Centro Panamericano de Ingeniería Sanitaria y Ciencias del Ambiente)
- COMLURB (Companhia Municipal de Limpeza Urbana) - Rio de Janeiro
- CONAMA (Comisión Nacional del Medio Ambiente) - Guatemala
- DESCO (Centro de Estudios y Promoción del Desarrollo)
- DINAMA (Dirección Nacional de Medio Ambiente) - Uruguay
- EMASEO (Empresa Metropolitana de Aseo)
- IDM (Instituto de Desarrollo Municipal) - Paraguay
- OACA (Oficina de Asesoría y Consultoría Ambiental)
- OAS (Organization of American States)
- PAHO (Pan American Health Organization)
- RAU/PGU (Red Ambiental Urbana/Programa de Gestión Urbana)
- SENASA (Servicio Nacional de Saneamiento Ambiental) - Paraguay
- SLU (Superintendencia de Limpeza Urbana) - Belo Horizonte
- Universidad de Chile

## **H. Topic h: Management and Planning**

Solid waste management professionals in Latin America and the Caribbean agree that this topic covers the central issues that need to be addressed urgently to improve services in the MSW area. They state that technologies are well developed, and although improvements are definitely necessary, the quality of services is now more dependent on improving the present management systems.

Throughout the region, local governments are responsible for the management of solid wastes within their jurisdiction. Larger urban areas tend to have a solid waste department, whereas smaller or less organised cities often have a municipal works department that is responsible for



MSW. Whether services are privatised or publicly managed, these departments are the responsible entity for supervision of all phases of operation. However, except for a few cases (such as Buenos Aires, São Paulo, and Rio de Janeiro), the performance in these areas is quite low, since work in the solid waste area is viewed more as a punishment than a reward, and neither operation nor supervision is carried out appropriately. The participation of the private sector is expected to change this situation.

There is a visible demand for the preparation of solid waste management master plans, and a number of cities in the region are working on them. However, few plans have been implemented and solid waste management programs are largely improvised, heavily influenced by the political climate of the moment. Pressure to improve waste collection services has, in some cases, led to the strengthening of local governments' institutional capacity as well as to the privatization of the services.

Many cities have opted to carry out the management of solid wastes directly through the city administration. Large cities such as Mexico City (where the solid waste department is strong and well staffed), as well as most small capital cities, work under this scheme. By contrast, staffing is very deficient in many Central American and some Andean cities. São Paulo has contracted out the direct supervision of private contractors, thus reducing costs, while keeping the overall supervisory role.

Other large cities have commercialised management of solid wastes through the establishment of municipal enterprises. This is the case of Buenos Aires, Lima, Rio de Janeiro, Bogotá, Santiago, Caracas, Medellín, Belo Horizonte, La Paz, and Port of Spain. In these cases, the enterprises are owned (or partially owned) by the municipality, but they function independently. The means of financing the enterprises varies. In some cases, they have a mandate to be completely self-sufficient (this is the case of CEAMSE, Cinturón Ecológico del Área Metropolitana Sociedad del Estado, in Buenos Aires, and the solid waste authority in Port of Spain), while in other cases, all financial resources come through the municipality (e.g., ESMLL in Lima). In most cases, there is a combination of direct income and subsidies from the local government.

## H1. PRIVATE Sector Involvement

In all countries, there is some level of private sector involvement in solid waste management. This involvement comes at nearly all phases of the waste management process (during recycling, collection, transport, and disposal) and is carried out by all sizes of enterprises, from large-scale multinationals to small-scale enterprises. The efficiency of these private sector enterprises varies significantly.

In many cities collection of wastes is in the hands of the private sector, whether the municipality or the enterprise is responsible for management of solid wastes. For example, in cities such as São Paulo, Buenos Aires, Bogotá, Santo Domingo, and La Paz, waste collection is conducted almost completely by private enterprises. The work done by the municipality or the municipal enterprise is then confined to supervision.

*Some municipalities are unable to monitor contracts sufficiently to ensure good collection service.*

The quality of supervision depends on institutional capacity. For example, a number of municipalities in Mexico have turned to private firms in order to improve services, but the municipalities have little or no experience in arranging service contracts, awarding concessions, and monitoring compliance with contract conditions. Consequently, performance standards under

such arrangements are neither satisfactorily established nor adhered to, and expected levels of efficiency are rarely, if ever, achieved.

In some cases, such as Guatemala City, collection is done by the private sector. However, the private sector's participation is a result of the lack of municipal infrastructure and not of a plan to bid out the services. In this case, collection enterprises have ill-defined areas in which they collect wastes. The enterprises charge households directly for their services. In some cases, when a household is not happy with the services provided by one enterprise, another enterprise is hired. As a result, two separate enterprises may serve the same block.

Private sector, small-scale initiatives are also happening in low-income and in areas that are difficult-to-access. Small-scale waste collection enterprises are operating or in the planning phase in Bolivia, Colombia, Costa Rica, Ecuador, Panama, and Peru. These enterprises have started under the sponsorship of NGOs or technical cooperation organizations. They usually have an agreement with the local government in which the government pays them for their services or allows them to collect fees directly from the households in their area. The success or failure of these enterprises depends on a number of factors. First, there needs to be a clear understanding between the municipality and the enterprise, so that jurisdictions and cost recovery mechanisms are well defined. Also, appropriate training of personnel within the enterprise is needed, not only on the waste collection system but also in management of the enterprise. The latter has become the most difficult one to deal with, since individuals forming these enterprises have seldom worked in a formal setting.

Enterprises having all female personnel have demonstrated a high efficiency. These women are usually single mothers in great need of work, and the enterprises are one of the few job sources within the community (i.e., close to home). Also, these women are conscious of the relationship between proper waste management and good health.

Though not found as frequently, the private sector is also involved in operation of landfills. For example, in Buenos Aires, as well as in some of the large cities in Brazil, landfills are in the hands of private operators. Other cities with privately operated landfills are located in Colombia, Ecuador, Mexico, Panama, Paraguay, and Venezuela. In addition, most manual landfills are operated by small-scale enterprises.

## H2. PERFORMANCE Monitoring and Enforcement

There is little regular performance monitoring of solid waste operations in the region. Performance is usually measured as part of studies that assess waste collection and disposal efficiencies at one point in time. Thus, these studies rarely show time series. The results of these studies are used as planning tools. One of the best examples of performance monitoring in the region is that carried out by the Municipality of Guayaquil on its contractors (both for collection and for final disposal).

Enforcement programs are practically nonexistent. The reason for this is two-fold. First, legislation on MSWM in the region is weak, so there are few legal instruments that can be used effectively in an enforcement program. Second, solid waste management has traditionally been the responsibility of the local governments, which, claiming lack of resources, do not take enforcement measures.

### H3. EXAMPLES of Efforts Directed Toward the Poor

In Curitiba, Brazil, several innovations were introduced to promote proper waste management in the poor areas of the city. The “Garbage that is not Garbage” program attempted to promote recycling based on source separation. This program has not been very successful in terms of quantities collected, and the cost of collection of recyclables is approximately ten times that of collecting garbage.

On the other hand, the “Garbage Purchase” program has been successful in achieving the main objective of promoting the reduction of wastes in the streets. The program initially “purchased” garbage bags in exchange for transportation vouchers eventually the exchange for transportation vouchers was changed for food. A similar program, the “Garbage Exchange”, was initiated in the city of Cuauhtémoc, Mexico. In this case, six bags of garbage are exchanged for one bag of basic foods. The community itself suggests the type of food.

The success of these garbage exchange programs depends on two basic issues. First, the program needs to be sustained over time. Second, the costs need to be absorbed as part of the social program of the city and must not be considered to be part of the MSWM system.

### H4. INFORMATION Sources in Latin America and the Caribbean on Topic h, Management and Planning:

- AIDIS (Asociación Interamericana de Ingeniería Sanitaria y Ambiental)
- AIDIS-Argentina
- APROSAC (Asociación para la Promoción del Saneamiento Ambiental en Comunidad)
- ASEAM (Asociación de Entidades de Aseo Municipal)
- CEMPRE (Compromiso Empresarial para Reciclagem)
- CEPAL (Comisión Económica para América Latina)
- CEPIS (Centro Panamericano de Ingeniería Sanitaria y Ciencias del Ambiente)
- COMLURB (Companhia Municipal de Limpeza Urbana) - Rio de Janeiro
- CONAMA (Comisión Nacional del Medio Ambiente) - Guatemala
- DESCO (Centro de Estudios y Promoción del Desarrollo)
- DINAMA (Dirección Nacional de Medio Ambiente) - Uruguay
- EMASEO (Empresa Metropolitana de Aseo)
- IBAM (Instituto Brasileiro de Administração Municipal)
- IDM (Instituto de Desarrollo Municipal) - Paraguay
- INFOM (Instituto de Fomento Municipal)
- IPES (Instituto de Promoción de Economía Social) - Peru
- IPT (Instituto de Pesquisas Tecnológicas do Estado de São Paulo)
- OACA (Oficina de Asesoría y Consultoría Ambiental)
- OAS (Organization of American States)
- PAHO (Pan American Health Organization)
- PROA (Centro de Servicios Integrados para el Desarrollo Urbano)
- RAU/PGU (Red Ambiental Urbana/Programa de Gestión Urbana)
- SENASA (Servicio Nacional de Saneamiento Ambiental) - Paraguay
- SLU (Superintendencia de Limpeza Urbana) - Belo Horizonte
- Trinidad & Tobago Solid Waste Management Company (SWMCOL)

## **I. Topic i: Training**

Only recently have there been any training programs that aim to develop professionals and technicians in the solid waste management field. In the last ten years, there have been a growing number of professionals in this field; however, most of them were trained in other engineering specialties and have done most of their learning through their work.

Training and human resource development is carried out by a number of different entities in the region, including universities and technical schools, international technical cooperation agencies, solid waste management authorities, and NGOs. Universities in Argentina, Brazil, Chile, Colombia, and Mexico have strong environmental engineering programs that have solid wastes components. These programs include undergraduate and post-graduate degrees as well as research. The Universidad Nacional Autónoma de México (UNAM) and the Universidade Estadual de Rio de Janeiro (UERJ) offer annual courses on solid waste management. Professionals from these academic institutions tend to publish their work locally or through the Interamerican Association for Sanitary Engineering (AIDIS). AIDIS has contributed significantly to the intra-regional transfer of information.

Of the international organizations in the region, the Pan American Health Organization (PAHO) and its Pan American Center for Sanitary Engineering and Environmental Sciences (CEPIS) have contributed significantly to training of human resources in the region. Though professionals from industrialised countries are frequently invited to their courses, the central aim is to promote horizontal training and transfer of information, whenever possible. As a result of this, the Lima-based Pan American Network for Waste Management (REPAMAR) has been established, with the support of the German government. REPAMAR promotes research and development projects, the results of which are then expected to be transferred to other countries in the region through onsite training, study tours, and seminars.

Solid waste management authorities offer training mainly to their own personnel, though sometimes courses are open to outside professionals. These programs are limited to issues pertaining to daily operation of a landfill or to other aspects of the waste management chain under the institution's purview.

### **11. EFFORTS of NGOs**

NGOs usually direct their programs toward lower-income populations, training personnel for future operation of cooperatives or small-scale enterprises. The original training methodology prescribed a three-month period of assistance followed by total independence of a small-scale enterprise. In many cases, this has turned out to be too short, and current practice is to provide ongoing technical assistance, either through an NGO or through a promoting agency (e.g., ASEAM, Asociación de Entidades de Aseo Municipal, in Bolivia).

NGOs have found that, because the members of new small-scale enterprises typically have little, if any, experience working with other people where individuals have defined responsibilities, they must deal with the socialization required to allow people to work together effectively. NGOs have also found that they need to offer considerable assistance in management, accounting, and legal issues.

### **12. INFORMATION Sources in Latin America and the Caribbean on Topic i, Training:**

- AIDIS (Asociación Interamericana de Ingeniería Sanitaria y Ambiental)
- AIDIS-Argentina

- AMCRESPAC (Asociación Mexicana para el Control de los Residuos Sólidos y Peligrosos)
- APROSAC (Asociación para la Promoción del Saneamiento Ambiental en Comunidad)
- CEAMSE (Cinturón Ecológico del Área Metropolitana Sociedad del Estado)
- CEMPRE (Compromiso Empresarial para Reciclagem)
- CEPAL (Comisión Económica para América Latina)
- CEPIS (Centro Panamericano de Ingeniería Sanitaria y Ciencias del Ambiente)
- COMLURB (Companhia Municipal de Limpeza Urbana) - Rio de Janeiro
- DINAMA (Dirección Nacional de Medio Ambiente) - Uruguay
- IBAM (Instituto Brasileiro de Administração Municipal)
- IDM (Instituto de Desarrollo Municipal) - Paraguay
- IPES (Instituto de Promoción de Economía Social) - Peru
- OAS (Organization of American States)
- PAHO (Pan American Health Organization)
- RAU/PGU (Red Ambiental Urbana/Programa de Gestión Urbana)
- SENASA (Servicio Nacional de Saneamiento Ambiental) - Paraguay
- SLU (Superintendencia de Limpeza Urbana) - Belo Horizonte
- Trinidad & Tobago Solid Waste Management Company (SWMCOL)
- Universidad de Chile

#### **J. Topic j: Public Education**

In Latin America and the Caribbean, there is a collective realization that public education is necessary in order to improve solid waste management systems; however, efforts are limited and infrequent. Solid waste management authorities probably put forth the greatest effort in this direction. These agencies carry out educational campaigns directed toward the public, producing posters, pamphlets, and other educational materials. They invite children to their facilities and also go to the schools, where they give talks on good solid waste management practices at home and in the streets. However, these campaigns are not conducted on a continuous basis, and their impact on the children is not very large. These campaigns are also limited by financial resources, and the messages rarely go through the mass media due to the high cost of placing ads.

In recent years, a new trend can be observed in the region in the development of environmental awareness in children. The underlying concept here is that the most important target group in public education is children, and that schools need to be the avenue to teach them. Thus, environmental awareness, including proper handling of solid waste, is increasingly incorporated as part of the elementary school curriculum. The programs include development of textbooks, teacher training, and hands-on activities. The latter mainly concentrate on recycling, but also deal with environmental health education. These activities also aim to be financially self-sustaining; income from the sale of recycled products is used to improve the sanitation systems in the schools and, in some cases, to purchase teaching materials.

These programs have been implemented in Colombia (where the best experiences can be found), Brazil, Chile, the Dominican Republic, Ecuador, and Peru, and are being initiated in Mexico and Paraguay. The programs in Colombia and in Brazil have been in place long enough to show that they are successful.

Counterpart institutions in these programs vary significantly from country to country, so that ministries of education, municipalities, ministries of health, and NGOs are involved in these efforts. In Colombia, the private sector is involved through the chambers of industry and commerce.

## J1. INFORMATION Sources in Latin America and the Caribbean on Topic j, Public Education:

- AIDIS-Argentina
- APROSAC (Asociación para la Promoción del Saneamiento Ambiental en Comunidad)
- CEAMSE (Cinturón Ecológico del Área Metropolitana Sociedad del Estado)
- CEMPRE (Compromiso Empresarial para Reciclagem)
- CEPIS (Centro Panamericano de Ingeniería Sanitaria y Ciencias del Ambiente)
- COMLURB (Companhia Municipal de Limpeza Urbana) - Rio de Janeiro
- DIGESA (Dirección General de Salud Ambiental, Ministerio de Salud) - Peru
- DINAMA (Dirección Nacional de Medio Ambiente) - Uruguay
- EMASEO (Empresa Metropolitana de Aseo)
- OAS (Organization of American States)
- PAHO (Pan American Health Organization)
- PROA (Centro de Servicios Integrados para el Desarrollo Urbano)
- RAU/PGU (Red Ambiental Urbana/Programa de Gestión Urbana)
- Recuperar
- SLU (Superintendencia de Limpeza Urbana) - Belo Horizonte

## K. Topic k: Financing

Financing mechanisms depend mainly on the management system used, but politics also play an important role in the decision-making process. Some cities, mainly in Bolivia, Colombia, and Ecuador, charge fees through other utility bills (usually through the electricity bill, but this may also be done through the water bill, as in Panama). Fees are set as a percentage of the bill. Generally, the utility gives the collected funds, minus an administrative fee, to the solid waste authority. A number of studies show that this system is fair because there seems to be a direct correlation between quantity of waste generated and electricity and water consumption. This system is highly efficient and generally finances most, if not all, of the solid waste operation.

Unfortunately, this system is not always feasible, particularly in cities where utilities have been privatised. In these cases, the utility company cannot be forced to carry out this service and often is not interested in doing so as it is considered an additional administrative burden.

In most countries, households pay for MSW services through property taxes. This system is not as efficient in raising money for MSW services, because it requires the municipality to have an updated register of households, which is seldom the case. Thus, some households never pay for MSW services. Under this system, costs are seldom recovered, especially for the poorer districts of the cities; thus, the local government frequently subsidises a large fraction of the MSW operation.

Large-scale financing of solid waste operations has become available through bilateral and multilateral agencies such as the World Bank, the Interamerican Development Bank, and the governments of industrialised countries (the German government has provided a significant contribution). These financing projects include technical assistance for institutional strengthening as well as for investment in infrastructure. Some countries that have received financial assistance in this area include Argentina, Bolivia, Colombia, Guatemala, and Mexico.

## K1. INFORMATION Sources in Latin America and the Caribbean on Topic k, Financing:

- AIDIS (Asociación Interamericana de Ingeniería Sanitaria y Ambiental)
- AIDIS-Argentina
- ASEAM (Asociación de Entidades de Aseo Municipal)
- CEPIS (Centro Panamericano de Ingeniería Sanitaria y Ciencias del Ambiente)
- COMLURB (Companhia Municipal de Limpeza Urbana) - Rio de Janeiro
- CONAMA (Comisión Nacional del Medio Ambiente) - Guatemala
- DESCO (Centro de Estudios y Promoción del Desarrollo)
- IBAM (Instituto Brasileiro de Administração Municipal)
- IDM (Instituto de Desarrollo Municipal) - Paraguay
- INFOM (Instituto de Fomento Municipal)
- IPES (Instituto de Promoción de Economía Social) - Peru
- PAHO (Pan American Health Organization)
- RAU/PGU (Red Ambiental Urbana/Programa de Gestión Urbana)
- Trinidad & Tobago Solid Waste Management Company (SWMCOL)

## L. Information sources located in Latin America and the Caribbean

Note: There are information sources about MSW issues in Latin America and the Caribbean that are located in other regions. These sources often cover several areas of the world, so they are listed in this publication under the region where they are located. Notable out-of-region institutions that offer information on MSW include:

### Institutions located in Africa

UNEP-INFCITERRA

### Institutions located in Europe

ISWA (International Solid Waste Association)

SANDEC/EAWAG

WASTE, Advisers on Urban Environment and Development

Water, Engineering and Development Centre (WEDC)

World Resource Foundation/*Warmer Bulletin*

### Institutions located in North America

Canadian International Development Agency

US Agency for International Development (AID)

US Environmental Protection Agency (EPA)

The World Bank

Note: PAHO, the Pan American Health Organisation, and OAS, the Organisation of American States, are listed in this section, even though they are located in North America, because they deal almost exclusively with Latin America/Caribbean issues.

Note: In the following listings "Email" refers to an organisation's electronic mail address. "Internet" refers most often to an organisation's site on the World Wide Web, although it can also refer to gopher, ftp, or direct dial-in sites.

## L1. ABRELPE (Associação Brasileira e Resíduos Especiais de Empresas de Limpeza Pública)

Av. Paulista 807, cj. 207

CEP 01311-941

São Paulo

Brazil

**Telephone/Fax:** +55-11-3284-3211

**Email:** [cempre@amcham.com.br](mailto:cempre@amcham.com.br)

**Contact:** Ricardo Gonçalves Valente

**Topics covered:** b e f

#### TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing



**Description:** ABRELPE brings together private MSW enterprises in Brazil. These enterprises are involved in collection of wastes and management of landfill sites under contract with local municipalities. They do kerbside collection as well as regular domestic and special waste collection. They do not operate recycling plants, as this is done by the municipalities or industry. Kerbside collection covers paper, plastic, glass, and ferrous and non-ferrous metals. ABRELPE publishes a monthly bulletin, which is distributed to 240 municipalities (with a total of 75 million inhabitants) served by the member enterprises. ABRELPE is the national representative of ISWA in Brazil.

**Format of information:** Bulletins.

**Internet:**

**Language:** Portuguese

**Consulting or support services:** Provided to all municipalities serviced by member enterprises of ABRELPE.

**Fees:** Bulletins are distributed for free.

## **L2. AIDIS (Asociación Interamericana de Ingeniería Sanitaria Ambiental)**

(Interamerican Association for Sanitary and Environmental Engineering)

Sede Permanente Abel Wolman

Rua Nicolau Gagliardi, 354

05429-010 São Paulo, SP

Brazil

**Telephone:** +55-11-3812-4080

**Fax:** +55-11-3814-2441

**Email:** [aidis@aidis.org.br](mailto:aidis@aidis.org.br)

**Contact:** Ing. Luiz Augusto de Lima Pontes, Executive Director

**Topics covered:** a b c d e f g h i k

**Description:** The goal of AIDIS is to promote the development of sanitary and environmental engineering in the Americas. AIDIS organises congresses every two years where they generally have a seminar on MSW, for which annals are published. The organisation also publishes a journal called *Ingeniería Sanitaria* (Sanitary Engineering). AIDIS was established in 1948 and since then has evolved into an important association with about 32,000 members (individuals and institutions). It coordinates 24 country chapters, 17 technical divisions and provides information on available training programs and courses in the region as well as specialised consultants.

**TOPICS:**

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

**Format of information:** Publications are available either printed or on diskette.

**Internet:** [www.aidis.org.br](http://www.aidis.org.br)

**Consulting or support services:** Indirect services; provides names of available consultants and support services.

**Fees:** Publications are available to members for free and to non-members for printing and mailing costs.

### L3. AIDIS-Argentina

Av. Belgrano 1580, Piso 3  
1093 Buenos Aires  
Argentina

**Telephone:** +54-11-4381-5832/5903

**Fax:** +54-11-4381-5832/5903

**Email:** [aidisar@aidisar.org](mailto:aidisar@aidisar.org)

**Contact:** Carlos Bolsinger

**Topics covered:** a b c e f g h i j k

**Description:** AIDIS-Argentina has a Solid Wastes Division, which works with professionals in this area from the whole country. The Solid Wastes Division organises conferences, courses, and seminars on a wide number of topics related to MSW, which bring together participants from the Southern Cone countries (Argentina, Chile, Paraguay and Uruguay).

**Format of information:** Not applicable

**Internet:** [www.aidisar.org](http://www.aidisar.org), [www.sld.ar:70/aidis/pres.html](http://www.sld.ar:70/aidis/pres.html)

**Language:** Spanish

**Consulting or support services:** These services are provided upon request.

**Fees:** Not applicable.

### L4. AMCRESPAC (Asociación Mexicana para el Control de los Residuos Sólidos y Peligrosos A.C.)

Palacio de Minería  
Tacuba No. 5, Despacho B-7  
México, 06010, D.F.  
México

**Telephone:** +52-5-799-2893

+52-5-799-2797

**Fax:** +52-5-799-3727

**Email:**

**Contact:** Alfonso Chavez, President

**Topics covered:** a b d f i

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

**Description:** The main objective of AMCRESPAC is to support and strengthen professional training in the municipal and hazardous solid wastes fields. AMCRESPAC, in agreement with the Universidad Autónoma Metropolitana (UAM), offers a five-module diploma in solid wastes. Membership includes individuals and enterprises. They publish guides and bulletins on solid waste management.

**Format of information:** Paper publications

**Internet:** [www.amcrespac.org.mx](http://www.amcrespac.org.mx)

**Language:** Spanish

**Consulting or support services:** AMCRESPAC facilitates information on available consulting services to those who request it.

**Fees:** Documents are provided at cost.

### **L5. APROSAC (Asociación para la Promoción del Saneamiento Ambiental en Comunidad)**

(Association for the Promotion of Environmental Sanitation in the Community)

Apartado 810

Zona 10

Ciudad de Panamá

Panama

**Telephone:** +507-263-3370

**Fax:** +507-998-6419

**Email:** [aprosac@pananet.com](mailto:aprosac@pananet.com)

**Contact:** Maribel Rodriguez Muñoz, President

**Topics covered:** a b e g h i j

**Description:** APROSAC, an NGO established in 1995, develops integrated solid waste management projects and promotes the development of small-scale basic sanitation enterprises. The organisation executed one such project in the region of Santiago de Veraguas in Panama. APROSAC organises workshops, provides professional services, and develops training programs on this subject. APROSAC is the country node of RAU/PGU.

**Format of information:** Project documents

**Internet:** [www.pananet.com/aprosac](http://www.pananet.com/aprosac)

**Language:** Spanish

**Consulting or support services:** Services are provided primarily to local governments and other local institutions.

**Fees:** Not applicable.

### **L6. ASEAM (Asociación de Entidades de Aseo Municipal)**

Calle Pedro Salazar 355

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

Edificio Santa Marta, Piso 19  
La Paz  
Bolivia

**Telephone:** +591-2-43-1946  
+591-2-43-3561  
**Fax:** +591-2-43-1946  
**Email:** gtzaseam@ceibo.entelnet.bo  
**Contact:** Javier Abasto, General Manager

**Topics covered:** h k

**Description:** ASEAM was founded in June 1994, with sponsorship of GTZ (German Government technical assistance). The main mission of ASEAM is to strengthen the municipal waste agencies and to promote the establishment of small-scale enterprises for difficult-access areas. This mission is accomplished through training and provision of information of personnel in municipal agencies. ASEAM is also working on strengthening the fee collection system. This has already been achieved for the case of four (of the nine) member municipal enterprises through the inclusion of the fees in the electricity bill. As a result, these enterprises are collecting five times as much revenue as it used to by doing collecting directly. ASEAM also produces videos and pamphlets on public consciousness development on the need to pay waste collection fees, as well as the need to improve MSW handling behaviour.

**Format of information:** Videos and pamphlets

**Internet:**

**Language:** Spanish

**Consulting or support services:** ASEAM provides support services to all member municipalities in Bolivia.

**Fees:** Videos and pamphlets are distributed for free to member organisations.

## **L7. CEAMSE (Cinturón Ecológico del Área Metropolitana Sociedad del Estado)**

Av. Amancio Alcorta 3000  
1437 Buenos Aires  
Argentina

**Telephone:** +54-11-492-0017/21  
+54-11-4912-6912/6  
**Fax:** +54-1-925-0017  
+54-1-925-0021  
**Email:** ceamse@ceamse.gov.ar  
**Contact:** Carlos Hurst, President

**Topics covered:** b e i j

### TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

**Description:** CEAMSE is an autonomous, publicly owned institution responsible for waste management in Greater Buenos Aires. Its main role is to supervise the waste collection and disposal systems, which are mainly in the hands of private operators. CEAMSE is completely self-supporting. It charges municipalities for collection and disposal services and then pays private operators. CEAMSE publishes brochures and texts for training in waste management. It also carries out periodic public education campaigns through the media and with school children.

**Format of information:** CEAMSE publishes brochures and public education materials.

**Internet:** [www.ceamse.gov.ar](http://www.ceamse.gov.ar)

**Language:** Spanish

**Consulting or support services:** Provides consulting services to municipalities in Argentina and in other countries.

**Fees:** None.

## **L8. CEMPRE (Compromiso Empresarial para Reciclagem)**

Bento de Andrade, 126

CEP 04503-000

Jardim Paulista

Brazil

**Telephone:** +55-11-3889-7806/8564

**Fax:** +55-11-3889-8721

**Email:** [cempre@cempre.org.br](mailto:cempre@cempre.org.br)

**Contact:** Christopher Wells, Executive Secretary

**Topics covered:** a h i j

**Description:** CEMPRE is a non-profit institution that promotes recycling as part of an integrated waste management program. All CEMPRE members are large-scale industries from a variety of industrial sectors. CEMPRE disseminates information, organises seminars, and has training programs. It has published a book, jointly with IPT, on management aspects of waste recycling.

**Format of information:** Books, pamphlets; also in computerised form.

**Internet:** [www.cempre.org.br](http://www.cempre.org.br)

**Language:** Mainly Portuguese, but also Spanish and English

**Consulting or support services:** CEMPRE provides support services to private enterprises.

**Fees:** Free upon request.

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

## L9. CEPAL (Comisión Económica para América Latina)

(Economic Commission for Latin America)  
Casilla 179-D  
Santiago  
Chile

**Telephone:** +56-2-471-2000  
+56-2-208-5051  
+56-2-210-2000  
**Fax:** +56-2-208-0252  
**Email:** secepa@eclac.cl  
**Contact:** José Ocampo, Executive Secretary

**Topics covered:** a h i

**Description:** CEPAL is a United Nations Organisation focusing on economic and policy analysis. As part of its mandate, CEPAL assists countries in the identification of cost-effective policies in a variety of areas, including MSW. CEPAL holds seminars and training programs, promotes pilot projects, and publishes documents in the MSW policy development area. Among these publications is the *Technical and economic assessment of recycling process for domestic wastes - the cases of glass, paper and plastic*.

**Format of information:** Reports and booklets

**Internet:** www.eclac.cl

**Language:** Spanish and English

**Consulting or support services:** Provides support services mainly to governmental organisations.

**Fees:** Documents are provided at no cost upon request.

## L10. CEPIS (Centro Panamericano de Ingeniería Sanitaria y Ciencias del Ambiente)

(Pan American Center for Sanitary Engineering and Environmental Sciences)  
Los Pinos 259, Urb. Camacho  
Lima 12  
Peru

**Telephone:** +51-1-437-1077/7081  
**Fax:** +51-1-437-8289  
**Email:** cepis@cepis.ops-oms.org  
**Contact:** Alvaro Cantanhede, Solid Wastes Advisor

**Topics covered:** a b c d e f g h i j k

**Description:** CEPIS is a specialised centre of the Pan American Health Organisation. It provides technical assistance, training, and information to countries in the Latin American region in a

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variety of sanitary and environmental engineering issues, including MSW. Among its many publications, CEPIS has prepared and published, jointly with PAHO, the *Guía para el Diseño de Rellenos Sanitarios Manuales* (Guidelines for the Design of Manual Sanitary Landfills). CEPIS also has an environmental education program.

CEPIS is the headquarters for the Pan-American Network for the Environmental Management of Wastes (REPAMAR). REPAMAR provides technical assistance, finances pilot projects, publishes documents resulting from these projects, and disseminates information. A new pilot project in Ecuador will focus on the promotion of small-scale enterprises for MSW collection and disposal.

CEPIS also houses the Pan-American Information Network on Environmental Health (REPIDISCA). This network maintains a database with approximately 50,000 references including MSW. Many of these references are unpublished papers, such as conference presentations and thesis and research reports. REPIDISCA has cooperating centres throughout the Latin America/Caribbean region, which contribute to the input of information to the network.

**Format of information:** REPIDISCA performs bibliographical searches. Documents are photocopied and mailed upon request.

**Internet:** [www.cepis.ops-oms.org](http://www.cepis.ops-oms.org)

**Language:** A large part of the documents available in the REPIDISCA database are in Spanish, although some are in Portuguese and English

**Consulting or support services:** CEPIS and REPAMAR provide consulting services mainly to governmental organisations and, in special cases, to private organisations.

**Fees:** The Guidelines on the Design of Manual Sanitary Landfills is available for free upon request and can be obtained at the PAHO representation countries in the region. A small fee is charged for bibliographical searches using REPIDISCA. Documents requested are charged a fee equivalent to the cost of photocopies and mail.

## L11. COMLURB (Companhia Municipal de Limpeza Urbana)

Rua Major Avila 358 - 2º andar  
Tijuca, RJ CEP 20519-900  
Brazil

**Telephone:** +55 21-2204-9999  
+55 21-574-2000 x255 or 397  
+55-21-580-1434  
+55-21-580-6629

**Fax:** +55-21-2574-2282

**Email:** [pgc.comlurb@pcrj.rj.gov.br](mailto:pgc.comlurb@pcrj.rj.gov.br)

**Contact:** Jose Henrique Penido Monteiro, Advisor to the Director.

**Topics covered:** a b c d e f g h i j k

### TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

**Description:** COMLURB is part of the Municipality of Rio de Janeiro, but it functions as a private enterprise. It is responsible for solid waste collection and disposal in this city. COMLURB also does research in landfill development and gas use. As part of this program, it is presently using landfill gas to power light transportation equipment. It has also developed compost and recycling systems on a pilot level. The enterprise also manufactures waste collection equipment. It evaluated the implementation of an incinerator, but determined that it was not feasible. COMLURB has an open library specialising in solid waste.

**Format of information:** Publications include technical reports on research carried out by the enterprise and a periodical bulletin.

**Internet:** [www.rio.rj.gov.br/comlurb](http://www.rio.rj.gov.br/comlurb)

**Language:** Portuguese

**Consulting or support services:** COMLURB provides technical assistance to other MSW enterprises in Brazil.

**Fees:** Free, upon request.

## L12. CONAMA (Comisión Nacional del Medio Ambiente)

(National Commission on the Environment)

7<sup>a</sup> Av. 7-09, Zona 13

Guatemala Ciudad

Guatemala

**Telephone:** +502-2-327174

**Fax:** +502-2-327174

**Email:** [conama@rds.org.gt](mailto:conama@rds.org.gt)

**Contact:**

**Topics covered:** a b e g h k

**Description:** CONAMA was created in 1986 to be the governmental entity responsible for advising and coordinating national environmental policies. CONAMA holds the Technical Secretariat of the Comisión Nacional para el Manejo de Desechos Sólidos, CONADESCO (National Commission for Solid Wastes Management), which was established to define national MSW policies. CONAMA prepared, jointly with other national agencies and sponsored by various international organisations (including PAHO, World Bank, USAID, and CARE), the *Análisis Sectorial de Residuos Sólidos* (Sectoral Analysis of MSW).

**Format of information:** Paper documents

**Internet:**

**Language:** Spanish

**Consulting or support services:** None.

**Fees:** None.

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing



### L13. DESCO (Centro de Estudios y Promoción del Desarrollo)

Jr. León de la Fuente 110  
Lima 17  
Peru

**Telephone:** +51-1-613-8300  
**Fax:** +51-1-613-8308  
**Email:** postmaster@desco.org.pe  
**Contact:** Luis Olivera, General Secretary

**Topics covered:** a b e f g h k

**Description:** DESCO is an NGO engaged in research and consulting on a wide variety of social, economic, and political issues. Its work in the area of solid waste was initiated as a support activity to the local government of Lima. Its most important book on solid waste is *¿Basura o Desechos? El destino de lo que botamos en Lima* (Garbage or Wastes? (The fate of what we throw away in Lima) (1994). This book describes in detail the present conditions of solid waste management in Lima. In addition to the technical issues, it also analyses the socio-political problems that hamper the adequate management of solid waste in this city.

**Format of information:** DESCO publishes books and Working Papers that are available directly at the institution. It also publishes articles in magazines.

**Internet:** www.desco.org.pe

**Language:** Spanish

**Consulting or support services:** DESCO has provided support services to local governments.

**Fees:** US\$7 for the book described above.

### L14. DIGESA (Dirección General de Salud Ambiental, Ministerio de Salud)

Las Amapolas 350  
Urb. San Eugenio  
Lima 14  
Peru

**Telephone:** +51-1-442-8353  
**Fax:** +51-1-442-8353 x225  
**Email:** postmast@digesa.sld.pe  
**Contact:** Luis Chavez, Director General

**Topics covered:** e f j

**Description:** The Environmental Health Department is responsible for ensuring compliance with environmental health regulations in Peru. It is particularly concerned with the health of scavengers in dumps. The Department has been working with solid waste authorities in the country in developing proper MSW landfill design and organisation of waste pickers in the

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landfills. They also run awareness campaigns as part of their environmental health public education program. They are launching a solid waste management program for hospital wastes.

**Format of information:** Most pamphlets and small publications.

**Internet:** [www.digesa.sld.pe](http://www.digesa.sld.pe)

**Language:** Spanish

**Consulting or support services:** Support services are limited to local governments and Ministry of Health offices in Peru.

**Fees:** Not applicable.

### **L15. DINAMA (Dirección Nacional de Medio Ambiente)**

(National Office of the Environment)

Ministerio de Vivienda

Ordenamiento Territorial y Medio Ambiente (MVOTMA)

25 de Mayo 402

Montevideo

Uruguay

**Telephone:** +598 2 901-7086

**Fax:** +598 2 302-1010

**Email:** [dima36@mrree.gub.uy](mailto:dima36@mrree.gub.uy)

**Contact:** Ing. Qca. Marisol Mallo

**Topics covered:** a b e g h i j

**Description:** DINAMA was created in 1990 with the purpose of developing legislation and to protect the environment. DINAMA has a Solid and Hazardous Wastes Department, which develops legislation in this area, collects information, and provides advice to municipalities. DINAMA coordinated the preparation of the country's Sectoral Analysis on MSW, sponsored by PAHO.

**Format of information:** Paper documents

**Internet:** [www.dinama.gub.uy](http://www.dinama.gub.uy)

**Language:** Spanish

**Consulting or support services:** Advisory services are provided directly to municipal authorities.

**Fees.** None.

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## L16. EMASEO (Empresa Metropolitana de Aseo)

Beiceño 605 y Guayaquil  
Quito  
Ecuador

**Telephone:** +593 2 515 278  
+593 2 519 622  
**Fax:** +593 2 583 413  
**Email:** emaseo1@ecuanex.net.ec  
**Contact:** Hector Valencia

**Topics covered:** a b e g h j

**Description:** EMASEO is a municipal enterprise responsible for MSWM in Quito. EMASEO also carries out studies on waste characterisation, recycling, and landfill management.

**Format of information:** EMASEO publishes pamphlets and other public education materials and research documents.

**Internet:**

**Language:** Spanish

**Consulting or support services:** None.

**Fees:** Not applicable.

## L17. IBAM (Instituto Brasileiro de Administração Municipal)

Edificio Diego Lordello de Mello  
Largo IBAM  
No. 1- Humaitá  
22271-070 Rio de Janeiro  
Brazil

**Telephone:** +55-21-2536-9797  
**Fax:** +55-21-2537-1262  
**Email:** aline@ibam.org.br  
**Contact:** Victor Zular Zveibil, Environmental Group

**Topics covered:** a b h i k

**Description:** IBAM is an NGO working on the improvement of municipal management in Brazil. It has a group that works on solid waste, providing technical assistance on technologies and management, training courses and documents on the subject. IBAM has developed a Manual on Public Cleansing and a Manual on Recycling, focusing on the role of municipalities. In 1994-95 IBAM carried out a study for the Urban Management Program on basic sanitation services (including MSW) in nine metropolitan areas in Brazil. IBAM carries out studies for municipalities and other organisations on MSW. They are conducted a study on best practices in

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MSW in Brazil under sponsorship of the Canadian Federation of Municipalities. IBAM is the country node of the RAU (see RAU/PGU).

**Format of information:** Reports, books, and pamphlets available at the institution's headquarters.

**Internet:** [www.ibam.org.br](http://www.ibam.org.br)

**Language:** Portuguese and Spanish

**Consulting or support services:** IBAM provides consulting and support services directly to local governments, as well as other organisations, upon request.

**Fees:** Most documents are available for free.

### **L18. IDM (Instituto de Desarrollo Municipal)**

(Institute for Municipal Development)

Ygatimi 705, Esquina Juan E. Oleari

Casilla Postal 1161

Asunción

Paraguay

**Telephone:** +595 21-444542

**Fax:** +595 21-444079

**Email:** [rauidm@pol.com.py](mailto:rauidm@pol.com.py)

**Contact:** Isidro Coronel Salcedo, President

**Topics covered:** a b e g h i k

**Description:** IDM is a decentralised governmental institution whose purpose is to promote development of municipal governments in Paraguay. IDM is the country node of RAU/PGU. This institution has published two main documents: *Manual sobre Manejo de Residuos Sólidos Urbanos* (Manual on Urban Solid Waste Management), and *Tratamiento de Residuos en Pequeños Mataderos* (Treatment of Wastes from Small-scale Slaughterhouses).

**Format of information:** Manuals are in paperback format.

**Internet:**

**Language:** Spanish

**Consulting or support services:** Services are provided to municipalities in the country.

**Fees:** To be determined by IDM.

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## **L19. INFOM (Instituto de Fomento Municipal)**

(Institute for Municipal Promotion)

8a. Calle 1-66, Zona 9  
Guatemala Ciudad  
Guatemala

**Telephone:** +502-336-8100  
**Fax:** +502-2-346740  
**Email:** aruiz@infom.org.gt  
**Contact:** General Manager

**Topics covered:** h k

**Description:** INFOM was established in 1957 to provide financing and technical advice to municipalities. INFOM has a Solid Wastes Unit that develops studies and projects for municipalities upon demand. INFOM participated in the preparation of the *Análisis Sectorial de Residuos Sólidos* (Sectoral Analysis of MSW) sponsored by PAHO.

**Format of information:** Paper documents

**Internet:** www.infom.org.gt

**Language:** Spanish

**Consulting or support services:** Consulting and support services are provided directly to municipalities.

**Fees:** None.

## **L20. IPES (Instituto de Promoción de Economía Social)**

Calle Audiencia 194, San Isidro  
Lima 27  
Peru

**Telephone:** +51-1-421-9722  
+51-1-421-6684  
**Fax:** +51-1-440-6099  
**Email:** ipes@ipes.org.pe  
**Contact:** Cecilia Castro, Solid Wastes Team

**Topics covered:** a b h i k

**Description:** IPES is an NGO working on the development of jobs in lower economic strata through the formation of self-sustaining small-scale enterprises. IPES has promoted and actively developed small-scale solid waste collection and street cleaning enterprises throughout Peru and in Bolivia. They have found that these small-scale enterprises can be established under a variety of cultural conditions, although a number of criteria need to be taken into account. One of these is that in-depth training and support is needed for the adequate management of the enterprise, and

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that supervision is necessary during the initial phases. In addition, IPES has found that all-women enterprises are more successful than mixed or all-male enterprises. IPES has published two books of particular interest in the MSW field: *Rescatando Vida* (Rescuing Life) and *La basura en Lima, problema y soluciones* (Garbage in Lima, problems and solutions). IPES is part of a network of institutions from four countries (Bolivia, Ecuador, Costa Rica, and Peru) that promotes the decentralisation of MSW services. IPES also operates the Peru solid waste node for the RAU (see RAU/PGU).

**Format of information:** Short books that are available at the institution's headquarters.

**Internet:** [www.ipes.org](http://www.ipes.org)

**Language:** All publications are in Spanish

**Consulting or support services:** IPES provides support on a regular basis to local governments.

**Fees:** Costs of books is approximately US\$7.

## **L21. IPT (Instituto de Pesquisas Tecnológicas do Estado de São Paulo S.A.)**

Av. Prof. Almeida Prado 532  
Cidade Universitaria Armando de Salles Oliveira  
CEP 05508-901  
São Paulo, SP  
Brazil

**Telephone:** +55-11-3767-4126

**Fax:** +55-11-3767-4002

**Email:** [sac@ipt.br](mailto:sac@ipt.br)

**Contact:** Angelo Consoni, Researcher

**Topics covered:** c e h

**Description:** IPT is a research institution working on a wide range of issues, including MSW. It works both in management and technical aspects of solid waste management. IPT is initiating work in the area of remediation and closure of landfill sites, as well as composting programs. It provides assistance to municipalities in waste management systems and publishes research reports and articles.

**Format of information:** Books and research papers

**Internet:** [www.ipt.br](http://www.ipt.br)

**Language:** Portuguese

**Consulting or support services:** Services are provided to local governments in Brazil.

**Fees:** Free upon request.

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## L22. OACA (Oficina de Asesoría y Consultoría Ambiental)

Miguel Aljovin 524 Surco  
Lima 33  
Peru

**Tel.:** +51-1-447-1815  
+51-1-241-0690  
**Fax:** +51-1-242-7241  
**Email:** postmast@oaca.org.pe  
**Contact:** Mr. Marcos Alegre, Vice-Director

**Topics covered:** a b e f g h

**Description:** OACA is an NGO that has MSW as one of its activity areas. It has worked on the development of a manual sanitary landfill in northern Peru and supervises operation of this one and another one in the south. It also develops, supervises, and evaluates operation of small-scale waste collection enterprises. OACA has published one book on this subject (*La Basura: Un cuento de nunca acabar? - Garbage: A never-ending story?*), which describes the design of a waste collection program in a marginal area of Lima, and the small-scale enterprise to carry out this activity.

**Format of information:** Much of the information in OACA, except for the book mentioned above, is in unpublished form, but is available upon request.

**Internet:** www.oaca.org.pe

**Language:** Spanish

**Consulting or support services:** OACA provides consulting services to public, private, and technical cooperation agencies.

**Fees:** Most publications are distributed for free.

## L23. OAS (Organization of American States)

Department of Regional Development and Environment (DRDE)  
1889 F Street NW  
Washington, DC 20006  
United States

**Telephone:** +1-202-458-3000  
**Fax:** +1-202-458-3560  
**Email:** info@oas.org  
**Contact:** Cesar Gaviria, Secretary General

**Topics covered:** a e g h i j

**Description:** The OAS is the world's oldest regional organisation, dating to the First International Conference of American States held in Washington, DC in 1889. The basic

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purposes of the OAS are to strengthen the peace and security of the continent, promote representative democracy, and to seek solutions to political, juridical, and economic problems that arise in the 36 member states.

The DRDE was established in the mid-1960s with the aim of providing technical advisory services to the member states in addressing environmental management problems within the context of economic development. The department has provided advisory services on the location, construction, operation, and management of landfills and other solid waste management technologies to member countries as part of its approved technical assistance program.

**Format of information:** Technical reports, direct advisory services, consultant services, brochures, meetings, training workshops, conference proceedings.

**Internet:** [www.oas.org](http://www.oas.org)

**Language:** English, French, Portuguese, and Spanish

**Consulting or support services:** Through technical assistance programs of the Secretariat, as approved by the General Assembly and other bodies of the OAS.

**Fees:** None. Counterpart contributions, as well as partner contributions, are encouraged and negotiated as part of the process of providing technical assistance.

#### **L24. PAHO (Pan American Health Organization)**

525 23rd Street NW  
Washington, DC 20037-2895  
United States

**Telephone:** +1-202-974-3000

**Fax:** +1-202-974-3663

**Email:**

**Contact:** P. Pinto

**Topics covered:** a b c d e f g h i j k

**Description:** The Pan American Health Organization (PAHO) is the Regional Office of the World Health Organisation for Latin America and the Caribbean. PAHO provides assistance to countries in the region on health issues, including environmental health. As part of the Environmental Health Program PAHO carries out a number of activities in the solid waste area, including the provision of advice, training, and dissemination of information. PAHO has local offices in all member countries, through which it provides technical assistance. PAHO also carries out periodic monitoring and situation analysis of MSWM in the region. PAHO publishes an Environmental Series, one of which is dedicated to a current analysis of MSW in the region.

**TOPICS:**

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**Format of information:** Publications are in paper format.

**Internet:** [www.paho.org](http://www.paho.org), PAHO's Basic Sanitation Program (HES) is at [www.paho.org/english/hephes.htm](http://www.paho.org/english/hephes.htm) and [www.paho.org/spanish/hephes.htm](http://www.paho.org/spanish/hephes.htm)

**Language:** English, Spanish, French, and Portuguese

**Consulting or support services:** Consulting and support services are provided to public institutions.

**Fees:** None.

## **L25. PROA (Centro de Servicios Integrados para el Desarrollo Urbano)**

(Center for Integrated Services for Urban Development)

Box 11514

Calle 2 No. 7, Villa Bolivar "A" (Ceja)

La Paz

Bolivia

**Telephone:** +591 2 822148

**Fax:** +591 2 821552

**Email:** [rau@proa.bo](mailto:rau@proa.bo)

**Contact:** José Uribe

**Topics covered:** a e h j

**Description:** PROA is a non-governmental organisation working on social sector issues, including MSWM. It develops projects and provides support services in the areas of treatment, management, and recycling of MSW. PROA acts as the national node in Bolivia for RAU/PGU.

**Format of information:** Publications include books, pamphlets, cartoons, guidelines, and manuals.

**Internet:**

**Language:** Spanish

**Consulting or support services:** Support services are provided to local municipalities.

**Fees:** At cost.

TOPICS:

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## **L26. RAU/PGU (Red Ambiental Urbana/Programa de Gestión Urbana, Oficina Regional para América Latina y Caribe)**

(Urban Environmental Network/Urban Management Program, Regional Office for Latin America and the Caribbean)

García Moreno 751

Casilla 17-01-2505

Quito

Ecuador

**Telephone:** +593-2-583-961

+593-2-462136

**Fax:** +593-2-462134

**Email:** pgu@pgu-ecu.org

**Contact:** Dr. Carlos Landin

**Topics covered:** a b c e f g h i j k

**Description:** RAU/PGU is the Regional Office of the UNCHS/World Bank/UNDP Urban Management Program. This institution provides technical and financial support to small-scale demonstration projects on urban environmental issues, including solid waste. The RAU compiles and disseminates information on best practices and successful cases on solid waste management. The PGU has published a manual entitled *¿Se puede reducir la basura?* (Can wastes be reduced?). This institution also promotes and supports courses, workshops, and seminars on solid waste management.

**Format of information:** Publications are available in paper format. Information on best practices is available in a Micro-Isis database.

**Internet:** www.pgualc.org

**Language:** Spanish and Portuguese

**Consulting or support services:** Consulting services are provided in special cases.

**Fees:** The manual *¿Se puede reducir la Basura?* costs about US\$15.

## **L27. Recuperar**

Carrera 46 No. 51-58

Antigua 90979

Itagui

Colombia

**Telephone:** +57-4-372-0720

**Fax:** +57-4-277-2249

**Email:** recuperar@epm.net.co

**Contact:** Armando Montoya

**Topics covered:** a j

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
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**Description:** Recuperar is a recycling cooperative that has had a significant impact on the perception of recycling in Colombia. It has shown that recycling can have significant social and economic, as well as environmental, benefits. Recuperar initiated its activities as a result of the need to provide jobs for landfill waste pickers who had been displaced as a result of the closure of the Medellín city dump. The organisation trains and provides health and life insurance benefits to its members, who number over 700. As a result of this success, a number of cooperatives have been created in other cities in Colombia. Recuperar publishes information on its activities as well as public information and education materials.

**Format of information:** Publications are available on paper.

**Internet:**

**Language:** Spanish

**Consulting or support services:** Recuperar provides advisory services to other groups interested in developing recycling cooperatives.

**Fees:** None.

## **L28. SENASA (Servicio Nacional de Saneamiento Ambiental)**

(National Environmental Sanitation Service)

General Eugenio A. Garay, Esquina Virgen del Rosario

San Lorenzo

Paraguay

**Telephone:** +595 21 494 399

+595 21 582507

+595 21 586364

**Fax:** +595-21 583507

**Email:**

**Contact:** German Santos, Director

**Topics covered:** a b e g h i

**Description:** SENASA promotes the implementation of new urban services for MSWM. It also controls and enforces proper management of municipal and special wastes. SENASA provides training courses directed mainly to municipal technicians and inspectors.

**Format of information:** Manuals

**Internet:** [www.senasa.gov.py](http://www.senasa.gov.py)

**Language:** Spanish

**Consulting or support services:** Services are provided to municipalities, hospitals, and industries.

**Fees:** To be defined by SENASA.

TOPICS:

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## **L29. SLU (Superintendencia de Limpeza Urbana, Prefeitura Municipal de Belo Horizonte)**

Rua Tenente Garro 118/7  
Minas Gerais  
CEP 30240-360  
Belo Horizonte  
Brazil

**Telephone:** +55-31-201-8170

**Fax:** +55-31-201-8170

**Email:**

**Contact:** Superintendent

**Topics covered:** a b c e f g h i j

**Description:** The SLU is an autonomous, municipally owned institution, responsible for waste management in the city of Belo Horizonte, Brazil. The SLU operates 50% of the waste collection, and the treatment and disposal plant. The SLU installed a composting unit where organic wastes are disposed of with added microorganisms that promote decomposition; as a result, it is hoped that landfill life will be increased by about a factor of nine. The SLU initiated a construction waste recycling program, where a number of reception plants are installed throughout the city. The wastes will be taken to a recycling plant where they will be transformed into bricks. The SLU has a glass, plastic, paper, and metals recycling program where these materials are collected from voluntary receiving points in the city. The SLU has an aggressive information dissemination and public information program designed to obtain greater public participation in recycling as well as good environmental health behaviour.

**Format of information:** SLU publishes pamphlets and booklets for public dissemination.

**Internet:** [www.portal.pbh.gov.br](http://www.portal.pbh.gov.br)

**Language:** English

**Consulting or support services:** Provided on specific cases to other municipal governments.

**Fees:** None.

## **L30. Trinidad and Tobago Solid Waste Management Company Ltd (SWMCOL)**

34 Independence Square North  
Port of Spain  
Trinidad  
West Indies

**Telephone:** +1-868-625-6678

**Fax:** +1-868-623-8634

**Email:** [info@swmcol.co.tt](mailto:info@swmcol.co.tt)

**Contact:** Edison Garraway

### TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

**Topics covered:** b c e h i k

**Description:** The Solid Waste Management Company is state-owned but is decentralised and autonomous. It is responsible for waste management throughout Trinidad and Tobago and has been responsible for the development of sanitary landfills in these islands. The Solid Waste Management Company publishes reports and bulletins on its activities.

**Format of information:** Bulletins and reports

**Internet:** www.swmcol.co.tt

**Language:** English

**Consulting or support services:** Provides consulting services to other MSW authorities in the Caribbean.

**Fees:** None.

### L31. Universidad de Chile

Blanco Encalada 2120 4to Piso  
Casilla 228/3  
Santiago  
Chile

**Telephone:** +56-2-689-4171

**Fax:** +56-2-689-4171

**Email:**

**Contact:** Jose Arellano, Facultad de Ciencias Físicas y Matemáticas

**Topics covered:** e f g i

**Description:** The Universidad de Chile has a group of researchers and professors working in the solid waste field. Their work concentrates mainly on the areas of landfill design, leachate treatment, and landfill gas production. They also offer solid waste management courses at the undergraduate and post-graduate level. Their post-graduate program is directed to technical personnel working in the environmental field and lasts one year.

**Format of information:** Information is available through publications in regional journals (see AIDIS) as well as in internal documents.

**Internet:** www.uchile.cl

**Language:** Spanish

**Consulting or support services:** They provide consulting and support services regularly to local government officials.

**Fees:** Fees are charged for photocopy and mailing costs.

TOPICS:

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

### **L32. Universidad de la República, Uruguay**

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**Topics covered:** e

**Description:** The Faculty of Engineering has a group of engineers that carry out research related mainly to MSW design. Specific topics include biological treatment of landfill leachate, feasibility studies for the use of landfill gas, and modelling of the degradation of leachate in a MSW landfill. The Faculty of Engineering is organising specialisation courses in MSW for engineering students.

**Format of information:** Research papers

**Internet:** [www.fing.edu.uy/iq](http://www.fing.edu.uy/iq)

**Language:** Spanish

**Consulting or support services:** The Facultad de Ingeniería presently provides support to the Municipality of Montevideo on MSWM and landfill design.

**Fees:** None.

**TOPICS:**

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

## SECTION E. NORTH AMERICA

### A. Topic a: Waste Reduction

In the past, recycling in North America primarily took place outside the jurisdiction of waste management officials. Volunteer groups organised neighbourhood collection drives for newspapers, bottles, and cans. A well established network of haulers, brokers, and salvage yards recovered paper and metals from businesses. Today, rising disposal costs, the difficulty of siting landfills and incinerators, and renewed public concern for the environment have made recycling a top priority in North America. For example, Canada set a 50% target for reducing packaging disposal by 2000.

About 25% to 30% (by weight) of the solid waste stream in North America is currently recycled, including about 5% that is composted. This compares to under 10% recycling and virtually no centralised composting prior to 1975. More than 9,700 recycling programs are operating in communities in the United States alone, spurred on by sweeping legislative activity at all levels of government, especially the local level in the United States and the provincial level in Canada. The amounts and types of materials recovered per capita, however, differ dramatically by region, especially based on whether the area is urban, suburban, or rural. The availability of certain public infrastructure for recycling is also a fundamental determinant for reaching relatively high recycling levels and the types of material collected.

Waste reduction in North America includes source reduction, reuse, recycling, and composting (at the point of generation), all of which divert materials from disposal facilities. Source reduction involves reducing the amount and toxicity of materials before they enter the waste stream, and can include product reuse, reduced material volume, reduced toxicity, increased product lifetime, and decreased consumption. In North America, source reduction programs have been implemented through education, research, financial incentives and disincentives (e.g., volume-based fees), regulation, and technological developments.

*About 20% to 25% of the solid waste stream in North America currently is recycled, including about 5% that is composted. This compares to less than 10% recycling and virtually no centralised composting prior to 1975.*

North American recycling programs can include many elements, such as source separation, kerbside collection, centralised dropoff or buyback facilities, materials recovery facilities, and mixed-waste processing facilities. Typical materials recycled in North America include: paper products (e.g., cardboard, office paper, and newsprint), bottles and cans (e.g., aluminium, steel, glass, and plastic), ferrous scrap, batteries, tires, used oil, appliances, and construction and demolition debris. Composting, which is considered a form of recycling, reduces the volume of organic material through degradation and produces compost, a soil amendment. (See “Composting”, below, for information on backyard composting and centralised composting.)

Two main collection methods are used: 1) central collection, where generators transport materials to a dropoff or buyback centre; and 2) kerbside collection, where recyclables are collected at the point of generation (usually households). Central collection centres have been in place for many years. Now, local governments trying to achieve higher recycling rates are starting kerbside collection programs as well.

Central collection centres accept materials from homes and small businesses. They are commonly known as dropoff centres and buyback centres. Both of these centres require generators to bring recyclables to a central facility, but only buyback centres pay for the material. Both types of centres are less expensive to operate than kerbside collection programs. Central collection is most effective in rural areas where kerbside service is too expensive and in areas with high-rise apartment buildings, where solid waste collection is already centralised. Collection centres can be as simple as brightly coloured “igloo” containers in parking lots for collecting glass bottles, or as complex as multi-material centres that handle common recyclables as well as scrap metal and problem wastes. In rural areas, where residents are often responsible for transporting their own waste to disposal facilities, dropoff centres are often located at the local landfills and transfer stations.

The number of kerbside programs in the United States grew from just over 1,000 in 1988 to over 9,700 at present; over 139 million people receive kerbside pickup of recyclables. In the province of Ontario, the first kerbside recycling program was introduced in 1983. By 1987, programs were operating in 41 communities, and between 1988 and 1990, the number of household units being serviced increased dramatically from 34% to 60%. Legislation has since been passed requiring any municipality with a population greater than 5,000 to provide kerbside collection of recyclable materials, and currently, 90% of households in Ontario receive this service. Most North American kerbside programs collect recyclables from single-family homes. Residents place recyclables in special containers at the kerb for pickup by private or municipal haulers. The materials are usually transported to a central location where they are often processed before being shipped to markets. The added convenience of well run kerbside programs for residents usually results in greater waste diversion rates than for dropoff centres, but kerbside programs are also more costly to operate. One of the keys to controlling kerbside collection costs is efficiently integrating collection of recyclables with the collection of refuse. The number of programs dealing with the collection of food residuals for composting has also increased substantially in the United States during the last few years. These programs have been established to reach even higher recycling rates than typical.

A combination of mandatory municipal programs and corporate initiatives is expanding the number of companies involved in commercial recycling and the types of materials collected. Many large companies have recycled for years to reduce their waste disposal costs. In fact, more than half of the total material recycled is typically recovered from the commercial sector. In anticipation of stricter regulations, Canadian industries have initiated a proposal to assist in the financing of recycling programs. CIPSI, the Canadian Industry Packaging Stewardship Initiative, proposes to share the cost burden of kerbside recycling between the municipality, the province, and industry. To date, it is still being reviewed by the provincial governments, and it is not yet certain whether it will come into effect.

#### A1. MATERIALS Recovery Facilities and Markets for Recyclables

Materials recovery facilities (MRFs) are centralised facilities where recyclable materials are received in bulk from trucks, separated, and processed for market. The term MRF has been loosely applied to a variety of facilities from simple transfer stations with a baler to complex, mixed waste processing facilities. In 1988, there were 27 MRFs in the United States; now there are over 500. The facilities range in design capacity from 2 to 1,000 tons per day and vary widely in degree of mechanization. A MRF can be designed to recover a variety of materials including paper, glass, metals, and plastics and to separate each material into various grades. The design of the facility for a particular community or region will depend on regulatory and legislative standards, markets, and integration with the entire solid waste management system. The level of mechanization of the MRF will depend upon the materials targeted, the capital investment



desired, and market requirements. Some of these facilities are designed to receive and process mixed solid waste (also known as “dirty MRFs) while others are designed to process source-separated recyclables.

Markets for recyclable materials also vary by region; thus, access to transport and transportation costs often determine whether or not a material can be recycled economically. Seattle, San Francisco, and Los Angeles, which have major international ports, are able to sell mixed waste paper to countries of the Pacific Rim. Local governments in the mid-Atlantic states have reliable markets for glass containers because a large number of glass manufacturers are concentrated in the region. In northern rural areas, where livestock spend long winters indoors, old newsprint is shredded and used as animal bedding by local farmers. To reduce the distance to markets, some states are trying to entice secondary manufacturers to locate new plants in their state. Because post-consumer materials markets fluctuate greatly, many successful recycling programs have some storage capacity to stockpile materials until markets become available.

#### A2. INFORMATION Sources in North America on Topic a, Waste Reduction:

- Air & Waste Management Association
- American Plastics Council
- American Society of Mechanical Engineers (ASME)
- *BioCycle*, Journal of Composting & Recycling
- Bureau of National Affairs
- Business Publishers
- Canadian International Development Agency
- Clean Washington Center
- Concern
- Environment Canada
- Environmental Defense Fund
- Environmental Industry Associations
- *Gale Environmental Sourcebook*
- Government Institutes
- INFORM
- Institute for Local Self-Reliance
- Institute of Scrap Recycling Industries
- Keep America Beautiful
- National Association of Counties
- National Oil Recyclers Association
- National Recycling Coalition
- North Carolina Office of Waste Reduction
- Public Technology
- Recycling Council of Ontario
- *Resource Recovery Report*
- *Resource Recycling*
- Solid Waste Association of North America (SWANA)
- Steel Recycling Institute
- University of Missouri-Columbia, Center for Waste Management (CWM)
- University of Wisconsin Extension, Solid & Hazardous Waste Education Center (SHWEC)
- US Agency for International Development (USAID)
- US Conference of Mayors
- US Environmental Protection Agency (EPA)

- The World Bank

## **B. Topic b: Collection and Transfer**

In preparation for collection, MSW is typically stored in either metal or plastic cans, plastic or paper bags, or special containers designed for mechanised collection. Residential waste in North America is collected in at least four ways: 1) at the kerbside or alley; 2) from on the property (e.g., the backyard); 3) from a dropoff or mailbox collection point; or 4) it is directly hauled by residents to the disposal site. The most common method is kerbside or alley collection, where the resident places full waste containers at the kerb or in the alley and retrieves them once the containers are emptied. Backyard collection is more labour-intensive, more costly, and therefore less common. Collection usually occurs at least once per week and even more frequently in urban areas where storage space is limited.

Dropoff and mailbox collection centres are used in areas (e.g., rural) where individual collection is impractical and in communities where cost savings are more important than service provision. Dropoff sites typically house dumpsters or even larger roll-off containers, which may be equipped with a compactor. Special pickup dates are usually established for bulky items such as old appliances, furniture, and tree stumps. Commercial and institutional waste is usually collected from a dumpster located at the establishment. These generators often hire a collection company to handle their waste, but some local governments take on this responsibility.

A number of truck types are currently used for waste transportation, including rear, side, and front loaders, roll-off and tilt frames, transfer trailers, and vehicles specially designed for collecting recyclables. Rear and side loaders are the most common collection vehicles for residential collection and can be loaded automatically or by hand. Front loaders are typically used to pick up large dumpsters for the collection of commercial or institutional waste. Roll-off container collection is more commonly used in rural areas. The containers are placed strategically throughout the region, residents drop off their waste, and the containers are collected and transported to disposal facilities. Much larger transfer trailers are used for bulk transport of compacted waste from transfer stations to more remote disposal facilities; the transfer trailers can be either open-top or enclosed.

Because collection programs are often one of the most expensive components of local waste management systems in North America, the design and management of collection systems have undergone reevaluation and redesign. One of the main planning decisions is whether the collection system should be publicly operated, through government contract to private firms, or by freely operating private firms. Regarding increased recycling activity, while separate collection of source-separated recyclables has extended the capacity of regular refuse collection trucks, it has also demanded the purchase or modification of additional vehicles.

Due primarily to the shortage of acceptable sites, new landfills, and waste-to-energy plants often serve several communities or an entire region. Regional MSWM facilities in North America are thus making transfer stations a vital component of many waste management systems. Transfer stations are centralised facilities where waste is unloaded from smaller collection vehicles and loaded into larger vehicles for hauling. Their design typically includes a tipping floor and either bulldozers for pushing waste into transfer trailers or a compactor for packing waste into trailers. In addition, more recyclables are now being sorted and processed at transfer stations.

*Regional MSWM facilities in North America are making transfer stations a vital component of many waste management systems.*

The longer distance from the place where MSW is collected to regional waste management facilities often makes transfer stations cost effective. Transfer trailers carry larger volumes of MSW than regular collection trucks, which lowers fuel costs, increases labour productivity, and saves wear and maintenance costs of collection vehicles. These advantages, however, must be balanced against the time spent transferring waste from collection trucks to transfer trailers and the capital costs of purchasing trailers and building transfer stations.

#### B1. INFORMATION Sources in North America on Topic b, Collection and Transfer:

- Air & Waste Management Association
- American Plastics Council
- American Society of Mechanical Engineers (ASME)
- *BioCycle*, Journal of Composting & Recycling
- Business Publishers
- Canadian International Development Agency
- Environment Canada
- Environmental Industry Associations
- *Gale Environmental Sourcebook*
- North Carolina Office of Waste Reduction
- *Resource Recycling*
- Solid Waste Association of North America (SWANA)
- Steel Recycling Institute
- University of Missouri-Columbia, Center for Waste Management (CWM)
- University of Wisconsin Extension, Solid & Hazardous Waste Education Center (SHWEC)
- US Agency for International Development (USAID)
- US Conference of Mayors
- US Environmental Protection Agency (EPA)
- The World Bank

#### C. Topic c: Composting

More than 5% of the MSW stream in North America is now managed through composting programs, which were insignificant prior to the mid-1980s. The compostable portion of MSW can constitute 30% to 60% of a community's waste stream. Composting programs have been designed for a variety of organic waste streams, including yard wastes (grass trimmings, leaves, or tree prunings), food wastes, agricultural wastes, and wastewater treatment sludge (biosolids). Another alternative, which has been used only on a limited basis in North America, is mixed waste composting. Mixed waste processing facilities accept unsorted MSW in the same form as it would be received at a landfill or a waste-to-energy facility, and separate recyclable materials.

There are currently about 15 MSW composting facilities operating in the United States, many of which are relatively small-scale, processing less than 50 tons per day. In addition, a composting facility can benefit from bans on leaf and yard wastes at landfill sites. Encouraging residents to undertake their own composting activities can reduce the amount of materials requiring collection and centralised composting, thereby reducing the costs of such programs. This can be supplemented by legislative changes, as undertaken by the City of Toronto in 1996, where lawn clippings are no longer allowed to be landfilled or taken for centralised composting. Residents can either compost them or leave them on the lawn. The number of yard waste composting programs in the United States now totals over 3,800. This growth was spurred on by yard waste disposal bans that have been enacted by several of the states. Composting is the primary method of diverting yard trimmings; other management methods include land application and mulching.

Many communities have also started programs to collect Christmas trees and convert them into wood chips, which residents can collect for their gardens. Canada currently has more than 160 composting projects throughout the country.

*There are many composting programs in North America. In the United States alone, the number of yard waste composting programs now totals over 3,800.*

Like recycling, the success of a composting program is determined in large part by the availability of markets for the material. Currently, most communities find that it is possible to give compost away, but not to sell it. In order to market compost commercially, communities need to be able to provide users with a steady supply of a high quality product. This becomes more difficult as composting programs expand to include more materials. With yard waste composting, for example, the ratio of grass to leaves to brush varies with the season. At certain times of the year, nutrients are sometimes added to the final product to maintain standards. With careful planning and experimentation, communities can use different materials to produce several grades of products. Some states are establishing standards for compost that should help give potential users more confidence in the product.

Composting methods can be as simple as a small pile in the backyard or as complex as a multi-million dollar centralised in-vessel system. Low-technology methods can be implemented inexpensively, but take longer to produce a finished product. High-technology methods shorten the compost time, but have higher capital costs for buildings and equipment.

Backyard composting and mulching is a source reduction activity that saves money for both the municipality and the homeowner. Some households compost food scraps in a backyard pile or in a composting bin, typically for use in vegetable or flower gardens. Grass clippings can be left on freshly mowed lawns instead of being collected and either disposed or composted. If the clippings are short enough, they will fall through to the ground and be assimilated into the soil. Leaves can be shredded in special mulching lawn mowers. Small branches and brush can be shredded in a wood chipper and used for landscaping, or if sufficiently reduced in size, added to a compost pile. Many communities in North America have developed programs to encourage backyard composting, by offering educational materials and by distributing composting bins. A number of communities buy the bins in bulk and distribute them free of charge or for a nominal fee.

The City of Seattle has implemented a sophisticated multipoint composting program that uses a combination of kerbside pickup, dropoff, and backyard composting elements. The City sponsors four composting demonstration sites, three in urban gardens, and one next to an urban market. The City also funds a backyard composting education program run by a local organization of urban gardeners that trains volunteers to be proficient at composting. The volunteers then perform 40 hours of community outreach and education. Toronto operates a similar program through the Recycling Council of Ontario.

Anaerobic digestion involves the production of methane from the organic fraction of solid waste in enclosed, controlled reactors in the absence of air. No controlled, commercial, solid waste anaerobic digesters have yet operated in the United States. A large-scale demonstration facility (RefCoM) was operated in Florida from 1978 to 1985, but was shut down when the demonstration period ended. Due to increasing interest in the development of low cost, environmentally acceptable alternative energy sources, however, methane production through anaerobic digestion has become the subject of research and development efforts throughout the world.

There has been interest in North America in pyrolysis, a process that chemically and physically changes biomass through the addition of heat and in the absence of oxygen (or under partial oxidation). The end products of pyrolysis include a solid char, a liquid char (pyrolysis oil), and a gas (pyrolysis gas, synthesis gas, or syngas), all of which are marketable forms of energy. Although several pyrolysis and related gasification systems have been designed and constructed in the past two decades, most have been demonstration and laboratory-scale systems. The large-scale demonstration plants in the United States experienced technology problems and are no longer operating. There are currently no commercial-scale solid waste pyrolysis or gasification systems operating in North America.

#### C1. INFORMATION Sources in North America on Topic c, Composting:

- Air & Waste Management Association
- American Society of Mechanical Engineers (ASME)
- *BioCycle*, Journal of Composting & Recycling
- Clean Washington Center
- Composting Council of Canada
- Environment Canada
- Environmental Defense Fund
- Environmental Industry Associations
- *Gale Environmental Sourcebook*
- Keep America Beautiful
- National Association of Counties
- North Carolina Office of Waste Reduction
- Recycling Council of Ontario
- *Resource Recycling*
- Solid Waste Association of North America (SWANA)
- University of Missouri-Columbia, Center for Waste Management (CWM)
- University of Wisconsin Extension, Solid & Hazardous Waste Education Center (SHWEC)
- US Agency for International Development (USAID)
- US Composting Council
- US Conference of Mayors
- US Environmental Protection Agency (EPA)
- The World Bank

#### D. Topic d: Incineration

Most of the MSW combustion currently practiced in North America incorporates energy recovery in the form of steam, which is used either to drive a turbine to generate electricity or directly for heating or cooling. In the process, the volume of solid waste is reduced by up to 90% and its weight by up to 75%. In past years it was common to simply burn MSW in incinerators to reduce its volume and weight, but energy recovery has become more prevalent since the 1980s. While about 30% of the MSW stream was incinerated without energy recovery in 1960, this has decreased to about 1% today. Currently, waste-to-energy (WTE) incineration is used to manage about 10% to 15% of the MSW stream in North America.

It should be noted, however, that the recent development of regional landfills providing relatively inexpensive disposal capacity has made it more difficult for capital-intensive WTE plants to compete. Additionally, court decisions restricting communities' ability to control the flow of their

wastes and the public's concern about emissions from incinerators has made it more difficult for local authorities to meet contractual obligations to WTE plants.

*Currently, about 10% to 15% of the MSW stream in North America is incinerated. It should be noted, however, that recently developed regional landfills providing relatively inexpensive disposal capacity have provided serious financial competition to incinerators.*

The amount of solid waste processed in WTE facilities varies significantly by region. The northeastern United States currently incinerates and recovers energy from over 40% of its solid waste, while many states incinerate less than 2% of the solid waste they generate. There are currently about 100 WTE facilities in the United States.

#### D1. SPECIFIC Technologies

The three most widely used and technically proven WTE technologies used in North America are (a) massburn combustion, (b) modular combustion, and (c) refuse-derived fuel (RDF) production and combustion. Over the last several years, local governments have largely favoured massburn systems that recover electricity over other WTE technologies, such as RDF, modular units, and steam-only processes. Several other emerging WTE technologies have been pilot-tested, but are not yet commercially proven. These include fluidised bed combustion, anaerobic digestion, gasification, pyrolysis, and other related processes that convert solid waste to gaseous, liquid, or solid fuel through thermal processing.

Massburn systems are the predominant form of WTE in North America. Operating massburn facilities process about 60% by weight of the solid waste from which energy is recovered. Massburn systems generally consist of either two or three combustion units ranging in capacity from 50 to 1,000 tons per day; thus, facility capacity ranges from about 100 to 3,000 tons per day. About 90% of operating massburn facilities generates electricity. These facilities can accept refuse that has undergone little pre-processing other than the removal of oversized items, such as refrigerators and sofas. Although this versatility makes massburn facilities convenient and flexible, local programs to separate household hazardous wastes (e.g., cleaners and pesticides) and recover certain recyclables are necessary to help ensure environmentally responsible incineration and resource conservation.

Modular combustors are usually prefabricated units with relatively small capacities of between 5 and 120 tons of solid waste per day. Typical facilities have between one and four units for a total plant capacity of about 15 to 400 tons per day. Because of their small size, only about 7% of solid waste that undergoes energy recovery in North America is processed at modular WTE facilities. The majority of modular units produce steam as the sole energy product. Because of their small capacity, modular combustors are generally used in smaller communities or for commercial and industrial operations. Their prefabricated design gives modular facilities the advantage of shorter construction timeframes. On average, capital costs per ton of capacity are lower for modular units than for massburn and refuse-derived fuel plants.

“Refuse-derived fuel” (RDF) refers to solid waste that has been mechanically processed to produce a storable, transportable, and more homogeneous fuel for combustion. RDF production and combustion plants are described in another section.

Several emerging WTE technologies are at varying stages of research and development, and could become available commercially in the future. These processes include fluidised bed combustion, pyrolysis and gasification, and anaerobic digestion. Pyrolysis and gasification, and anaerobic digestion are discussed in the section on composting. In a fluidised bed combustor,

instead of a grate supporting a layer of solid fuel, the furnace contains a bed of sand or limestone supported by an air distribution system. Several facilities in the United States use fluidised beds to co-fire RDF with other fuels (e.g., sewage sludge) and at least two facilities dedicated to fluidised bed solid waste combustion are under development. They are large-scale plants that incorporate front-end processing with materials recovery.

## D2. ENVIRONMENTAL Concerns

In North America the major public concerns about the environmental risks of WTE facilities are the potential emission of contaminants into the air through exhaust stacks (i.e., particulates, nitrogen oxides, sulphur dioxide, carbon monoxide, metals, acid gases, and dioxins) and into water through leachate from ash disposal sites. US and most state and provincial air pollution control laws and regulations, however, have been strengthened in recent years to specifically address potential impacts from WTE air emissions. To meet these standards, modern pollution control equipment effectively removes the vast majority of the emissions of concern. The major air emission control technologies employed in North American WTE facilities are fabric filters or baghouses, electrostatic precipitators, and scrubbers (wet and dry). . Integration of WTE with the other elements of the solid waste management system, such as recycling and landfilling, is another important issue in North America.

## D3. INFORMATION Sources in North America on Topic d, Incineration:

- Air & Waste Management Association
- American Society of Mechanical Engineers (ASME)
- *BioCycle*, Journal of Composting & Recycling
- Bureau of National Affairs
- Clean Washington Center
- Concern
- Environment Canada
- Environmental Defense Fund
- Environmental Industry Associations
- *Gale Environmental Sourcebook*
- North Carolina Office of Waste Reduction
- *Resource Recovery Report*
- Solid Waste Association of North America (SWANA)
- University of Missouri-Columbia, Center for Waste Management (CWM)
- US Agency for International Development (USAID)
- US Conference of Mayors
- US Environmental Protection Agency (EPA)
- The World Bank

## E. Topic e: Landfills

Landfilling is still the primary means of managing solid waste in North America, handling about 65% to 70% of MSW. This represents a significant decrease since the late 1980s, when landfills were used to manage over 80% of MSW. While the fraction of MSW that is landfilled has declined slightly over the past few years, the total amount generated continues to increase, resulting in a gross increase in the amount of MSW that is landfilled. MSW landfills in the United States are allowed to accept only non-hazardous solid waste, such as household garbage, except for small quantities of residential and commercial hazardous waste exempted from hazardous waste management laws.

Although there are approximately 2,100 MSW landfills operating in the United States alone, this represents a significant decline since environmental regulations on landfills, including a ban on open dumping, were first issued in 1979. Recent regulatory requirements expanded on those first issued in 1979, so that landfills must now meet strict design and operating requirements designed to minimise hazards to public health and the environment. As many landfills have approached the end of their useful lives and local officials encounter the problem of siting new landfills, some communities have been faced with a serious landfill “capacity crisis”. This has already occurred in many areas, particularly in the Northeast and the Midwest.

*Approximately 75% to 70% of the MSW stream is landfilled in North America. Landfills must now meet strict design and operating requirements designed to minimise hazards to public health and the environment.*

Partly in response to this situation, fewer but larger, more environmentally sound, regional landfills (“megafills”) are being designed and built to handle current and future waste disposal needs. These new landfills, which provide considerable relatively low-cost capacity, are designed to comply with stricter federal and state regulations and are being built in part via private sector investment. Siting of regional landfills can be difficult, however. In the Toronto area, for example, the siting process for new landfills became such a contentious issue that responsibility was taken away from the local and regional governments in 1991, and a separate body, accountable to the provincial government, was established. This body has since been disbanded

MSW landfills, either old or new, can pose threats to human health and the environment. The greatest concern is the potential for contaminants from a landfill to pollute valuable ground water or surface water supplies. In addition, accumulated quantities of landfill gas can pose the threat of fires or explosions. A state-of-the-art landfill in North America includes sophisticated engineering features to prevent the release of hazardous substances to the environment, including liners, leachate collection, final covers, and other features.

Natural or synthetic materials are often used to line the bottom and sides of landfills to prevent the migration of leachate into nearby ground water and surface water. Leachate retained by the liner will accumulate and possibly leak through the liner unless it is removed by a leachate collection system. Leachate collection systems are installed above the liner and consist of a perforated piping system that collects and carries the leachate to a storage tank. Final covers are placed over closed landfills to prevent the infiltration of rain and other sources of water, thereby minimizing the production of leachate. Some landfills in the United States now re-inject leachate or add water into the landfill to speed biodegradation. This process is discussed further in another section.

Additional operating requirements typically include the exclusion of hazardous waste; control of disease vector populations; control and monitoring of methane gas production; restriction of public access; construction of run-on and run-off controls; protection of surface water from pollutants; and maintenance of compliance records. Landfill gas can be recovered as a source of energy at landfills that generate sufficient quantities of methane. The technology necessary to recover landfill gas is proven and commercially available. Over 150 landfills located throughout the United States currently recover methane gas.

If groundwater or surface water contamination, explosive gas emissions, disease vectors, or other environmental problems exceed acceptable standards, corrective actions are required in order to remedy the problem. Specific actions taken vary depending on the particular case, but typically



will include many of the same elements described in the previous paragraph (e.g., landfill cover, leachate collection and treatment, landfill gas collection), albeit in an improved fashion if previous designs failed. Landfills that cannot meet environmental standards must close, and in most cases must meet closure and post-closure care requirements to ensure protection of human health and the environment.

About 10% of the approximately 1,200 sites on the United States “Superfund” list of hazardous waste sites are former MSW landfills. The vast majority are old landfills that are on the list because in the past they accepted quantities of industrial hazardous waste along with MSW. Cleanup of these sites must meet very strict standards costing an average of US\$25 million per site. Remedial activities can include onsite or offsite incineration, and offsite disposal at a hazardous waste management facility.

Landfill mining is the process of recovering buried resources by literally digging up, or mining, a facility to recover soil, recyclable materials such as aluminium, glass, and plastics, and combustible materials that can be used as fuel in WTE facilities. Landfill mining is a relatively new concept, but like other MSW management options, the feasibility of landfill mining will depend on site-specific circumstances and can involve environmental risks, such as encountering hazardous waste materials.

Landfills in North America are seen as a necessary component of any integrated MSW management system. Although recycling and composting can divert a significant portion of MSW from landfills, not all MSW is recyclable or compostable. Likewise, although waste-to-energy technologies can significantly reduce the volume of MSW, all WTE facilities produce residual ash that must be landfilled. In addition, as WTE facilities are shut down for repairs or maintenance, MSW will have to be diverted to landfills.

E1. INFORMATION Sources in North America on Topic e, Landfills:

- Air & Waste Management Association
- American Society of Mechanical Engineers (ASME)
- *BioCycle*, Journal of Composting & Recycling
- Bureau of National Affairs
- Canadian International Development Agency
- Environment Canada
- Environmental Education Enterprises
- Environmental Industry Associations
- *Gale Environmental Sourcebook*
- Michigan State University
- National Association of Counties
- North Carolina Office of Waste Reduction
- Public Technology
- Recycling Council of Ontario
- Solid Waste Association of North America (SWANA)
- University of Missouri-Columbia, Center for Waste Management (CWM)
- University of Wisconsin Extension, Solid & Hazardous Waste Education Center (SHWEC)
- US Agency for International Development (USAID)
- US Conference of Mayors
- US Environmental Protection Agency (EPA)
- The World Bank

## F. Topic f: Special Wastes

Household hazardous waste collection programs have the potential to reduce the toxicity of the municipal waste stream. Many products found in the home have the same chemicals and characteristics as hazardous waste generated by industry, but because of the relatively small quantities generated, are generally exempt from regulation. In recent years, the number of household hazardous waste collection programs in North America has increased dramatically. In 1980, there were two such programs in the United States; by 1990, the number of programs had grown to 855, including dozens of permanent household hazardous waste dropoff centres. The majority of states in the United States have enacted disposal bans for certain special wastes, including vehicle batteries (84%), tires (64%), and motor oil (38%). Several states have enacted laws aimed at cleaning up tire dumps, while others are attempting to recycle tires.

Some of the most commonly collected materials are oil-based paints, paint thinners, used motor oil, pesticides, household cleaners, wood preservatives, antifreeze, and batteries. Paints, lead-acid batteries, and used oil are typically recycled; the other products are transported to licensed hazardous waste disposal facilities. While household hazardous waste programs can raise community awareness, they do not, in and of themselves, encourage citizens to reduce the amount of hazardous waste they generate.

Unfortunately, the environmental benefits of household hazardous waste programs have in many cases been minimal because most communities have found that only a small portion of residents use the dropoff centres. Participation by less than 1% of households in the community is typical, and participation rates as low as 0.2% are not uncommon. Twenty to forty pounds of hazardous waste are typically collected per participating household. However, because many participants dispose of hazardous waste accumulated over several years in their first visit to a collection event, future collection efforts will probably result in lower quantities of waste per participating household.

*Household hazardous waste programs have been costly to operate. Typically, only a small portion of residents participates.*

To raise participation rates, some communities are offering kerbside collection service for household hazardous wastes. Some kerbside programs are restricted to the collection of used oil. In others, small batteries are put in plastic bags and left next to the container of recyclables. The driver places the batteries in a special container in the truck. Other communities are seeking to collect all types of household hazardous wastes at the kerbside. These programs can recover a greater proportion of the targeted materials than dropoff centres, but they are also more costly to operate. In addition, hazardous waste left at the kerb unsupervised can be spilled or disturbed by children or animals, raising serious safety and liability concerns. Some communities avoid these potential problems by having homeowners make appointments for the collection of these waste products.

In addition, household hazardous waste programs are costly to operate. Programs need trained staff members to identify, package, transport, and treat or dispose of the wastes. The cost of three one-day pilot household hazardous dropoff projects in the State of Illinois ranged from US\$22,000 to US\$50,000 per project, the primary determinant of cost being the amount of waste collected. Typical costs at a well publicised event can be well over US\$2 per pound of waste collected. Programs with limited publicity and low participation can cost over US\$9 per pound.

Sewage sludge from wastewater treatment (also known as biosolids) is handled separately from MSW, but it can end up in some of the same management facilities; it is either landfilled,

incinerated, spread on land, or composted. While disposal at sea used to be common, this approach is now banned in the United States.

Medical waste has attracted considerable attention because of repeated incidents of pollution by some types of hospital waste on East Coast beaches and increased concern about the transmission of communicable diseases. Infectious waste generated by health care facilities, laboratories, and veterinary hospitals is classified by states and provinces as hazardous, special, or solid waste, usually requiring pretreatment before land disposal. Most is burned in hospital incinerators, but medical waste is also disposed of in landfills and public sewers. Other treatment methods include steam or gas sterilization, irradiation, and chemical disinfection. For both medical and other hazardous wastes, there are privately owned facilities that compete to handle the wastes.

Construction and demolition debris consists of a variety of waste materials from building and demolition sites, including steel, asphalt, concrete, brick, plaster, wallboard, and piping. Most construction and demolition debris are currently disposed of in landfills in North America. It is usually separated from other solid waste because it is relatively inert and requirements for its disposal are not as stringent as for conventional MSW. However, toxic substances (e.g., asbestos or PCBs) found in debris must be handled separately. Much construction and demolition debris contains recyclable material, such as asphalt for road construction and repair and bricks and cinder blocks for fill.

#### F1. INFORMATION Sources in North America on Topic f, Special Wastes:

- Air & Waste Management Association
- American Society of Mechanical Engineers (ASME)
- *BioCycle*, Journal of Composting & Recycling
- Business Publishers
- Clean Washington Center
- Environment Canada
- Environmental Industry Associations
- *Gale Environmental Sourcebook*
- Government Institutes
- INFORM
- Keep America Beautiful
- Michigan State University
- National Oil Recyclers Association
- North Carolina Office of Waste Reduction
- *Resource Recycling*
- Steel Recycling Institute
- University of Missouri-Columbia, Center for Waste Management (CWM)
- University of Wisconsin Extension, Solid & Hazardous Waste Education Center (SHWEC)
- US Agency for International Development (USAID)
- US Conference of Mayors
- US Environmental Protection Agency (EPA)
- The World Bank

## G. Topic g: Waste Characterization

In municipal waste management systems that rely almost exclusively on landfills, there is relatively little need to characterise the types and quantities of material disposed (unless, of course, this includes hazardous wastes). As communities in North America add source reduction, recycling, composting, and waste-to-energy (WTE) facilities to the system, the need for reliable data about what is in the waste stream has become paramount to the waste management program's success. Because each of these technologies addresses discrete segments of the waste stream, these data assist municipalities in: a) determining the best management methods for different materials; b) planning recycling and composting programs by identifying the amounts of recyclables and organic materials generated by residential, commercial, and possibly industrial sectors; c) sizing WTE facilities based on the amount of wastes remaining in the waste stream after recycling and composting; and d) estimating waste transportation and separation costs using local estimates of total municipal waste volume and weight.

Local waste characterization studies provide baseline data for municipalities to assess their progress toward specific waste management goals. In addition, projections of the size and composition of the future MSW stream helps communities plan MSW management facilities that often have operating lifetimes of several decades. The US Environmental Protection Agency estimates US national MSW generation using the “material flows” methodology, along with food and yard waste sampling data. The “material flows” model estimates MSW generation based on the production and consumption of materials that are found in the waste stream, with adjustments for imports, exports, and product lifetimes. These estimates do not include several commonly landfilled wastes, such as construction and demolition debris, wastewater treatment sludge, and non-hazardous industrial wastes. In addition, the data do not distinguish MSW generated from residential, commercial, and institutional sectors.

*While local governments can extrapolate data from other sources for initial planning purposes, it is generally felt that an actual sampling (waste characterization) study should be performed before making significant capital investments.*

Using nationwide data for local planning is likely to lead to inaccurate estimates of local MSW quantities and composition, and could result in costly mistakes in purchasing equipment and sizing facilities. Local waste characterizations, on the other hand, are based on actual waste stream studies conducted at landfills, WTE facilities, materials recovery facilities (MRFs), or transfer stations. Well designed and implemented studies can provide reliable information about the amount of specific products and materials generated by each sector (i.e., residential, commercial, or industrial), the amount of waste recycled, seasonal variations in the waste stream, and differences between urban, suburban, and rural areas. For example, a study in San Francisco, California found that 33% of the disposed residential waste stream (i.e., post-recycling) was food waste, whereas yard waste only accounted for 7%.

Comprehensive waste characterization studies can be expensive undertakings in North America, costing from as low as US\$20,000 (for a 7-day program, during one season) to upwards of US\$150,000 (for a 14-day program conducted during four seasons). Furthermore, the cost of the program is dictated by the number of materials that are segregated. While local governments can extrapolate data from other sources for initial planning purposes, it is generally felt that an actual sampling study should be performed before making significant capital investments. Waste characterization studies often include the following elements: 1) an approach to sample collection that ensures representative sampling; 2) four-season programs of at least one week each; 3) multiple waste categories (e.g., about 25), with added detail on recyclables; 4) waste quantities by generation source; 5) an estimation (or determination) of the heating value of waste if WTE is

being considered or of other chemical characteristics; and 6) a survey of businesses, haulers, and brokers to quantify commercial recycling activities and disposal practices. A waste characterization study can also include sampling wastes from specific types of generators such as restaurants, hotels, offices, and manufacturers to determine waste generation and characterization by sector, and kerbside sorts to establish baseline data for tracking source reduction programs, household hazardous wastes, and program effectiveness.

Identifying generation rates and management methods for commercial waste is particularly important. On average, commercial waste accounts for 40% of the municipal waste stream in North America, but percentages vary by community. In Los Angeles, California, commercial sources produced nearly two-thirds of the city's MSW in the late 1980s. Conversely, some rural areas generate almost no commercial waste. Construction and demolition debris is sometimes a major portion of the waste stream and a good source of recyclable materials. Construction and demolition debris can be included in commercial waste estimates or broken out separately. In New Jersey, construction and demolition debris accounted for 25% of the waste generated, and 13.4% of the total waste recycled.

The composition of commercial and industrial waste in North America is significantly different from that of residential waste. Residential waste includes relatively high concentrations of paper, glass, food, and yard waste, whereas commercial and industrial waste includes a high concentration of paper, metals, and wood. The primary waste generators in the commercial sector tend to be hotels, restaurants, shopping centres, and hospitals. Waste characterization studies should be updated periodically to account for changes in population density, industrial concentration, and community affluence. In 1994, the province of Ontario passed legislation requiring all industrial, commercial, and institutional (ICI) operations employing more than 100 people to conduct waste audits and submit waste reduction plans. These plans served two important purposes: they ensure the ICI sector took the necessary actions to achieve the national target of 50% waste reduction by 2000, and they provided local and provincial waste management staff with information on both the volume and composition of waste being generated.

To anticipate changes in the size and composition of the MSW stream and to make decisions concerning its management, local officials generally make projections of the future MSW stream based on the impact of at least two factors: 1) demographics; and 2) recycling, composting, and source reduction programs. Although consumer behaviour and product composition also are important factors affecting MSW generation and composition, the impact of these factors is difficult to predict and can have an ambiguous overall effect. Some general trends are, however, evident. The percentage of paper and plastics in the waste stream is expected to continue to increase. . In addition, changes in local industry and commerce will affect the size and composition of the commercial and industrial waste streams.

## G1. CHANGES in the Waste Stream

Changes in MSW generation due to demographics can be divided into two basic factors: 1) changes in population, and 2) changes in per capita generation. Population growth or decline due to changes in the birthrate, deathrate, or migration will significantly affect the generation of residential, commercial, and industrial MSW. At the national levels, North American populations are expected to continue to increase, but regions and localities can expect to see much more dynamic changes due to migration and other factors.

Over time, changes in MSW generation due to demographic factors have depended not only on population changes, but also on the amount and type of waste that each person generates (i.e., per

capita generation). Per capita generation depends on at least three major factors: socioeconomic status, the degree of urbanization, and household size. The effect of socioeconomic status on MSW generation is uncertain. As North Americans have become more affluent on average, they have purchased more of all goods, which has increased waste generation. Although the majority of the population lives in urban areas, the degree of urbanization has some effect on MSW generation. Rural areas often have lower per capita generation rates for at least some components of the waste stream (e.g., fewer newspapers because they are printed weekly rather than daily and are more often burned as fuel).

Recycling, composting, and source reduction initiatives have altered the characteristics of the MSW stream that is sent to WTE facilities and landfills. In general, it is expected that, as more recycling programs are put into place, the “rest” waste will consist primarily of inert matter and the bulk density of the material will increase.

#### G2. INFORMATION Sources in North America on Topic g, Waste Characterization:

- Air & Waste Management Association
- American Society of Mechanical Engineers (ASME)
- *BioCycle*, Journal of Composting & Recycling
- Concern
- Environment Canada
- Environmental Industry Associations
- North Carolina Office of Waste Reduction
- Solid Waste Association of North America (SWANA)
- University of Missouri-Columbia, Center for Waste Management (CWM)
- US Conference of Mayors
- US Environmental Protection Agency (EPA)
- The World Bank

#### H. Topic h: Management and Planning

Local governments in North America have primary responsibility for managing MSW, with some involvement by state or provincial authorities and less by the federal or central government. Canada's approach is even more decentralised than that of the United States; the Canadian federal government has few legislative mandates regarding MSWM, although it does have authority regarding hazardous wastes. In the United States, on the other hand, there are minimum national-level design and operating standards in existence or under development for landfills, incineration, and materials recovery facilities. State-level standards that meet or exceed these federal minimums must be adopted at the state level and implemented by local governments and private firms.

Local public works departments normally administer solid waste programs, although other departments such as health or the environment are often involved. In addition, a number of parties who have an interest in local MSWM decisions have access to the political process, including elected officials, the news media, business interests, and citizen's organizations. In some states and provinces, the economic and environmental pressures of waste disposal are causing the responsibility for waste management to shift from the local to the state/provincial level. The most serious or publicly contentious concerns have tended to get pushed even to the federal level in the United States.

## H1. PLANNING and Incentives

Some states and provinces have done little in the way of solid waste planning, while others have developed extensive legislation, innovative approaches, and highly skilled solid waste staff. Most have solid waste plans of some sort that define the goals and agenda for regional waste management action. These plans and supporting law often place requirements on the resources and programs of the local community and suggest appropriate program approaches. Approaches for fostering planning include both mandatory requirements for plan development, adoption, and implementation, as well as voluntary programs bolstered by incentives. Some laws require local governments to set up recycling centres or programs that will achieve specific levels of recycling; other laws impose recycling responsibilities on industries and businesses.

States and provinces also encourage local waste management approaches by making funding contingent upon indicators of program activity, such as yard waste and recycling programs. Legislation may also contain provisions for grants, matching funds for feasibility studies, technical assistance, program development and implementation, training programs, public education, educational curriculum materials, household hazardous waste and special waste programs, marketing and service directories, and information networks for both public and private waste managers.

*The US Environmental Protection Agency and many states have established a hierarchy for waste management planning and implementation that ranks options roughly in terms of their desirability and relative role in an integrated waste management system.*

The US Environmental Protection Agency and many states have established and adopted a hierarchy for waste management planning and implementation that ranks options roughly in terms of their desirability and relative role in an integrated waste management system: reduction and reuse, recycling and composting, waste-to-energy incineration, and land disposal. The specific application of this planning scheme will of course depend on local geographic, environmental, social, and economic conditions. The State of Oregon, for example, has established strict priorities for local planners, resulting in several very successful integrated waste management strategies on the county level and one of the most successful recycling programs in the United States. Some state recycling plans are mandatory, while others make recycling services available to local communities on a voluntary basis. Some states encourage a regional approach in order to better coordinate waste management efforts.

Tax and other incentive-based policies also play a role in some jurisdictions, with tax credits being given for the purchase of recycling equipment or for particular industries that undertake recycling activities, such as paper or used oil recycling. Deposit-refund systems are used in some jurisdictions for beverage containers, tires, and automotive batteries. The beer industry in Ontario has been remarkably successful operating a deposit-refund system for years with more than a 90% capture rate. The success is in a large part due to the centralised nature of beer distribution through provincially operated Brewers Retail outlets, the only authorised distributors of beer. The soft drink industry across Canada has been far less successful in operating deposit-refund systems, largely due to the decentralised nature of its distribution.

Product procurement guidelines are another tool governmental units sometimes employ at all levels. The US federal government, for example, has procurement guidelines mandating the purchase of paper, lubricating oil, retread tires, building insulation, and other products with a certain recycled content.

## H2. OWNERSHIP and Management

Ownership and management of solid waste collection and disposal facilities in North America varies along a spectrum from fully publicly owned and operated programs, to government contracts with private firms, to freely operating private firms in an open market. Often-cited advantages of private or contractual systems include increased system efficiency and service due to competition, less susceptibility to political influence, greater management flexibility, and lower strain on government budgets. The advantages of a publicly owned and operated system include its nonprofit character, government purchasing advantages, centralised operation, and standardised procedures.

As an outgrowth of restrictions on local government spending, municipalities have increasingly turned to private ownership and operation of solid waste disposal and collection services. Studies have shown that municipalities can often cut their costs significantly by contracting out waste collection services. Private ownership also transfers much of the technical, financial, and potential cleanup risks to the private sector. In addition, many municipalities prefer privatization because they do not have ready access to the necessary pool of operators, engineers, and maintenance personnel required to operate a facility.

Some municipalities prefer public ownership of solid waste facilities because public ownership gives community officials more control over facility development and operation. Another alternative is some form of joint public/private ownership and operation agreement. This option has the advantage of enabling the risks and costs of facility design, construction, and operation to be allocated between a community and its contractors in a way that is tailored to local needs and circumstances. Many municipalities choose facilities that are publicly owned, but privately operated, often by the same firms that designed and built the facilities.

To encourage efficient MSW operations, some cities, such as Phoenix, have turned to privately operated service in some areas, while maintaining municipally operated service in others. Some of these cities have even adopted competitive bidding between the city's public works department and private contractors.

## H3. INFORMATION Sources in North America on Topic h, Management and Planning:

- Air & Waste Management Association
- Association of State & Territorial Solid Waste Management Officials
- *BioCycle*, Journal of Composting & Recycling
- Bureau of National Affairs
- Canadian Environment Industry Association
- Canadian International Development Agency
- Clean Washington Center
- Composting Council of Canada
- Environment Canada
- Environmental Defense Fund
- Environmental Industry Associations
- INFORM
- Institute for Local Self-Reliance
- Michigan State University
- National Association of Counties
- North Carolina Office of Waste Reduction
- Public Technology



- *Resource Recycling*
- Solid Waste Association of North America (SWANA)
- University of Missouri-Columbia, Center for Waste Management (CWM)
- University of Wisconsin Extension, Solid & Hazardous Waste Education Center (SHWEC)
- US Agency for International Development (USAID)
- US Composting Council
- US Conference of Mayors
- US Environmental Protection Agency (EPA)
- The World Bank

## **I. Topic i: Training**

MSW training and human resource development in North America takes place through several mechanisms, including: a) meetings, conferences, workshops, and short courses sponsored by professional associations, trade associations, and government agencies; b) higher education at universities and colleges; and c) private and public continuing education courses. For example, the University of Wisconsin-Extension Solid and Hazardous Waste Education Center provides solid and hazardous waste education to agencies, governments, and other organizations. It offers numerous publications, case studies, fact sheets, and correspondence courses on a wide variety of MSWM issues, such as composting, landfilling, MSW, pollution prevention, recycling, reduction and reuse, special wastes (e.g., tires, ink, antifreeze, batteries), and waste-to-energy systems. It also produces videos on recycling and source reduction. Several courses on a wide variety of MSWM issues are also offered each year through the University of Wisconsin's Department of Engineering professional development program.

Another example is the Air and Waste Management Association, a nonprofit, technical, scientific, and educational organization with more than 16,000 members in 65 countries and chapters worldwide. It provides opportunities for technological exchange, professional development, public education, and networking. The Association produces a variety of publications designed for the working environmental professional. It also holds an annual meeting with about 175 technical sessions, as well as periodic international specialty conferences and courses. The Association offers a series of teachers' manuals, workshops, satellite seminars, videos, and 50 to 100 short continuing education courses each year.

The Solid Waste Information Clearinghouse (SWICH) and Solid Waste Assistance Program (SWAP), operated by the Solid Waste Association of North America (SWANA) and funded by the US Environmental Protection Agency, is yet another example. SWAP supplies MSWM professionals with the most up-to-date information on issues that impact the field. SWANA also runs several MSW training courses, covering topics such as ground water monitoring, landfills, waste screening, recycling systems, MSW collection systems, transfer stations, financing, and integrated MSW management systems. The association also sponsors an annual international solid waste exposition and numerous specialty symposia.

### **II. INFORMATION Sources in North America on Topic i, Training:**

- Air & Waste Management Association
- American Society of Mechanical Engineers (ASME)
- Canadian International Development Agency
- Clean Washington Center
- Composting Council of Canada
- Environmental Education Enterprises

- Environmental Industry Associations
- Government Institutes
- Michigan State University
- National Association of Counties
- National Oil Recyclers Association
- North Carolina Office of Waste Reduction
- Solid Waste Association of North America (SWANA)
- University of Missouri-Columbia, Center for Waste Management (CWM)
- University of Wisconsin Extension, Solid & Hazardous Waste Education Center (SHWEC)
- US Agency for International Development (USAID)
- US Composting Council
- US Conference of Mayors
- US Environmental Protection Agency (EPA)
- The World Bank

## **J. Topic j: Public Education**

Public attitudes in North America today have been largely shaped by the waste management practices of the past, when no distinction was made between toxic wastes and other types of waste. Solid waste management facilities are often assumed to present the same threats to human health and the environment as hazardous waste facilities, in part because many municipal landfills that used to receive hazardous wastes have appeared on the US “Superfund” list of abandoned hazardous waste sites.

Perhaps the most common feeling linking many public interest groups is the NIMBY (“Not In My Back Yard”) syndrome. A similar acronym that has emerged with regard to the siting of landfill and WTE facilities is the LULU (Locally Unwanted Land Use) view. These stances have evolved from public concerns about protecting the environment and local property values, fear of health risks, distrust of government institutions, and concerns about preserving the community. Developing a complete public education and involvement program can help overcome this view, in cases where that is appropriate.

One of the first steps in planning a public participation strategy is to identify the community groups that will want to take part in the process. These groups include people who feel they will be directly affected by the proposed systems, but can also encompass many sectors of the community including elected officials, civic groups, business interests, environmentalists, other government officials, and the media. Waste management agencies employ a range of techniques to gauge public attitudes, from informal interviews to sophisticated opinion polls.

Many people question the safety of new waste management facilities. While all waste management methods are associated with some level of risk, the public does not always understand or trust technical information about the effectiveness of environmental controls. In addition to concerns about air emissions and ground water, people often assume that waste management facilities will attract vermin, spread litter, and smell. Giving citizens input into setting standards and enforcing good operating practices can help alleviate these concerns.

*Giving citizens input into setting standards and enforcing good operating practices can help alleviate citizens’ concerns about the safety of MSWM facilities.*

Once concerns have been defined, public education materials and programs are often designed to address them. Although the waste management authority will have its own viewpoint, the public

education program must be kept scrupulously objective in order to win public confidence. Public education programs typically have many different components, including written materials tailored for different audiences, different distribution mechanisms and channels of communication, and facility tours. Short brochures and fact sheets can present key points to wide audiences, while more technical studies are often distributed to members of an oversight committee. Newsletters are a good method of keeping interested citizens aware of new developments and summarizing report findings.

The specific content of public education materials depends on the nature of public concerns. In general, materials often need to address four themes: 1) why a new waste management system is needed; 2) the risks of the current and proposed systems, including the hazards, probability of exposure, and any uncertainties about data on risks; 3) system costs (including the costs of doing nothing) and how they will be paid; and 4) how to participate in the decision-making process.

## J1. PUBLIC Involvement

Public involvement differs from public education in that it provides a forum for two-way communication between local officials and the public. Citizens are more likely to respond favourably to MSWM plans if they have participated in developing them. Public meetings provide an opportunity for waste management officials to discuss planning issues and to hear local concerns. When more complicated information is presented, a workshop may be needed to accompany the public meeting.

Citizens' advisory groups often provide structured opportunities for local officials to learn about citizen preferences. These committees can be formed during the planning process for a facility and remain active throughout facility siting, permitting, and operation. A citizens committee can also take responsibility for identifying public concerns regarding the health and environmental impacts of proposed facilities and choosing management systems to address those concerns.

Communities sometimes measure public support for waste management plans via a referendum. If plans are approved, local government officials have a popular mandate to proceed. If the need for a new system is not recognised, however, officials can be left with the difficult choice of proceeding with plans anyway, or halting action until the public agrees that it is necessary.

Mediation through an independent third-party negotiator can help citizen groups, local officials, industry representatives, and other parties involved in the siting and implementation process find common ground. The use of a mediator might begin in the early stages of the planning process, when goals and criteria for the solid waste management system are being established. The need for mediation often becomes especially acute during the site selection process.

Even with the best plans, integrated systems are likely to have negative impacts on some members of the community. Mitigation, a process whereby community members and facility developers negotiate compensation for impacts, is one way to keep these problems from stopping the entire process. One helpful way to deal with NIMBY concerns, local officials are finding is to compensate a community for hosting a MSW facility. This can be done through host community fees or one-time investments. Host fees are becoming common practice in many areas of North America. In some cases, host fees collected for refuse that is combusted or landfilled are deposited in a community fund. One-time investments can include funding recreational facilities, parks, recycling programs, and the education and operation of a local citizens' oversight committee. Facility owners sometimes offer free refuse collection and/or disposal for the host community.

Public participation during the permitting stage is often incorporated through public hearings, which can greatly affect the length of an approval process. If a constant, clear dialogue has been maintained between all interested parties throughout the planning and siting process, the potential for delays during permitting is often reduced. If the process has not gone smoothly, public pressure can block facility development at the permitting stage. Depending on the number and complexity of the permits required and the nature of public opposition, in the United States it can take from two years to more than eight years for a facility to complete the permit phase and begin operation.

## J2. INFORMATION Sources in North America on Topic j, Public Education:

- Air & Waste Management Association
- American Plastics Council
- American Public Works Association
- American Society of Mechanical Engineers (ASME)
- *BioCycle*, Journal of Composting & Recycling
- Clean Washington Center
- Composting Council of Canada
- Concern
- Environment Canada
- Environmental Defense Fund
- Institute for Local Self-Reliance
- Keep America Beautiful
- Michigan State University
- North Carolina Office of Waste Reduction
- Recycling Council of Ontario
- Steel Recycling Institute
- US Composting Council
- US Conference of Mayors
- US Environmental Protection Agency (EPA)
- The World Bank

## K. Topic k: Financing

Traditionally, funding for community solid waste systems in North America comes from a general fund whose primary source of revenue is a property tax. A growing trend toward tax reform in recent years, coupled with falling revenues due to economic problems in some areas, as well as desires for incentive-based fees in other regions, has led many communities to seek alternative funding sources. For example, some jurisdictions fund solid waste programs through sales taxes, a municipal utility tax, or special tax levies for specific facilities or programs. Another approach, user fees, can be equitable and efficient if properly administered. Fees are often assessed on the basis of actual costs of collection and disposal, and can be either uniform or variable-rate depending on the amount and kind of service provided. A straight user charge allocates an equal share to all users within a service-level group.

## K1. VOLUME-Based Rates

Volume-based rates charge residents directly for the amount of garbage they produce. This rate system provides an economic incentive for waste reduction and recycling. Local governments or haulers can charge residents using either an average or marginal cost rate structure. The average cost structure is a flat rate for each volume disposed (e.g., per container). The marginal cost structure has a fixed cost for the first trash can, then a sliding amount for each additional can that in some cases is based on the actual cost of transportation and disposal. Interest in volume-based rates is growing. During the mid-1980s, solid waste management costs began to escalate. Since then volume-based rates have become increasingly popular throughout the United States in cities and towns of all sizes. More than 1,000 communities in the United States now use a variable-rate structure for MSW collection. In Canada, the number is lower than that, although interest in this financing option is increasing. The first user fee program was implemented in Ontario in 1991. Since then, more than 30 municipalities have adopted this approach. While the US experience does not indicate that the size of the municipality is a factor contributing to the effectiveness of a user fee program, the Canadian experience to date suggests that size may be a factor, perhaps due to the political acceptability of user fees.

*Volume-based rates have become increasingly popular throughout the United States, where more than 1,000 communities now use a variable rate structure for MSW collection.*

Volume-based rates are administered by one or more of the following means: charging the resident for the disposal of a predetermined number of cans each week; selling specially marked bags that residents must use for garbage disposal; selling tags or stickers that residents must place on each container of waste to be disposed of; or weighing each resident's garbage before depositing it in the truck.

Volume-based rates have led to significant increases in the amount of material recycled and quantity of yard wastes diverted out of the waste stream and into compost piles. In theory, they can lead to changes in consumer purchasing behaviour, though there are few data on this subject. Measuring changes in waste generation rates can be complicated if residents increase the use of garbage compactors. (Some communities set weight limits to guard against overstuffed cans.) Another phenomenon is the tendency for people to store more items in the home when confronted with disposal restrictions. Illegal dumping is another potential problem.

There are also a number of problems that arise in trying to determine the effectiveness of a user pay program. It is difficult to determine which diversion initiatives may be contributing to a reduction in waste generation. New or expanded recycling opportunities, backyard composting programs and public education/awareness programs can all influence the amount of waste being produced. This is further complicated by a lack of historical data to use for accurate comparisons to be made. While user pay programs appear to be effective in encouraging a reduction in the quantity of waste being generated, such findings should be viewed with some caution.

## K2. REVENUE Sources

Disposal site fees or “tipping fees” are also normally charged at landfills, transfer stations, and WTE incinerators in North America, and more recently at materials recovery facilities. Tipping fees are usually charged on a per ton basis and may depend on the type of refuse received; for example, stumps, tires, and demolition debris are more difficult to compact and cover. Tipping fees often are set below true operating costs, especially if the costs of environmental controls, closure, post-closure maintenance, and liability are considered. Tipping fees can also be set above true operating costs, as happened in southern Ontario in the late 1980s and early 1990s, as an

economic instrument to encourage waste diversion. Private haulers took advantage of lower disposal costs at US landfills, exporting almost one million tons per year. Rather than reducing the amount of waste being generated, the increased tipping fee merely redirected the waste.

Revenues can also be generated from recycled materials, energy produced by incinerators, and methane gas recovered at landfills, or in rarer cases by composting programs.

Three basic types of capital financing are used in North America: current revenues, borrowed funds, and private financing. The most common method of obtaining capital equipment has been to purchase it as necessary using current revenue. Current revenue financing has been used mainly for purchasing collection vehicles and for selected land disposal systems. On the other hand, extensive system upgrades or capital-intensive solutions to waste problems can necessitate the raising of capital through borrowing or contracting with a private firm.

Borrowing through issuance of general obligation bonds is the most flexible and least costly method used. The issuing locality guarantees the bond with its “full faith and credit”, based on its ability to levy property taxes. Municipal revenue bonds are sometimes used because they generally do not require voter approval and do not affect a community's legal debt limits. A revenue bond is issued to finance a particular project with associated revenue-producing services. Because revenue bonds do not carry the full faith and credit of the community, but rather pledge the net revenue generated by the project, they are considered more risky and thus carry a higher interest rate.

Bank loans are sometimes used for short-run, small-scale capital requirements, but are not a viable alternative to long-run bond financing. Lease agreements are often used for land or equipment, where a private lessor owns the land or equipment and leases it to the municipality. Equipment leases are typically for under five years, while land leases are often longer.

Private financing methods involve contracting with a private firm for waste management services and transferring to it the burden of raising capital. The range of options open to the private firm vary in terms of the procurement, management, and degree of ownership and control of the facilities. Industrial revenue bonds or pollution control revenue bonds, for example, can be issued by a municipality for a private enterprise. In this case, the municipality technically owns the facility and leases it to the private firm; this technique saves on borrowing costs.

### K3. INFORMATION Sources in North America on Topic k, Financing:

- American Society of Mechanical Engineers (ASME)
- *BioCycle*, Journal of Composting & Recycling
- Business Publishers
- Clean Washington Center
- Composting Council of Canada
- Environment Canada
- Environmental Industry Associations
- INFORM
- Institute for Local Self-Reliance
- North Carolina Office of Waste Reduction
- Public Technology
- *Resource Recycling*
- Solid Waste Association of North America (SWANA)
- US Composting Council

- US Conference of Mayors
- US Environmental Protection Agency (EPA)
- The World Bank

## L. Information sources located in North America

Note: Most telephone and fax numbers that are marked “toll free” are free only from within the United States and, in some cases, Canada.

Note: There are information sources about MSW issues in North America that are located in other regions. These sources often cover several areas of the world, so they are listed in this publication under the region where they are located. Notable out-of-region institutions that offer information on MSW in North America include:

### Institutions located in Africa

UNEP-INFOTERRA

### Institutions located in Europe

ISWA (International Solid Waste Association)

Note: PAHO (Pan American Health Organisation) and OAS (Organisation of American States) are listed under Latin America/Caribbean, even though they are located in North America, because they deal primarily with Latin America/Caribbean matters.

Note: In the following listings “Email” refers to an organisation’s electronic mail address. “Internet” refers most often to an organisation’s site on the World Wide Web, although it can also refer to gopher, ftp, or direct dial-in sites.

## L1. Air and Waste Management Association

One Gateway Center, Third Floor  
Pittsburgh, Pennsylvania 15222  
United States

**Telephone:** +1-412-232-3444  
toll free 1-800-270-3444

**Fax:** +1-412-232-3450

**Email:** info@awma.org

**Contact:** Mike Roy, Manager of International Programs, ext. 3144

**Topics covered:** a b c d e f g h i j

**Description:** The Air and Waste Management Association (A&WMA) is a non-profit, technical, scientific, and educational organisation with more than 16,000 members in 65 countries and chapters worldwide. The Association provides a neutral forum for addressing all viewpoints (e.g., technical, scientific, economic, social, political, and public health) of an environmental management issue. It serves its members and the public by promoting environmental responsibility and technical and managerial leadership in the areas of waste processing and

#### TOPICS:

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control, environmental management, and air pollution. A&WMA's worldwide network represents many disciplines (the physical and social sciences, health, engineering, law, and management) and attracts decision-makers from the government, industry, business, and research communities. It provides opportunities for technological exchange, professional development, public education, and networking.

The Association produces a variety of publications designed for the working environmental professional. Monthly periodicals include the *Journal of the Air & Waste Management Association*, fact sheets include topics such as municipal waste, landfills, and recycling hazardous waste. It also holds an annual meeting with about 175 technical sessions, as well as periodic international specialty conferences and courses. The Association offers a series of teachers' manuals, workshops, satellite seminars, videos, and 50-100 short continuing education courses each year. An extensive publications catalogue of more than 100 titles is available.

**Format of information:** Books, articles, videos, fact sheets, specialty conferences, workshops, continuing education, technical sessions at annual meeting, and satellite courses.

**Internet:** [www.awma.org](http://www.awma.org)

**Language:** English and some Spanish and French

**Consulting or support services:** Will refer requests to members with relevant expertise.

**Fees:** Fees for most meetings and publications. Fact sheets are free.

## L2. American Plastics Council

1300 Wilson Boulevard  
Arlington, Virginia 22209  
United States

**Telephone:** +1-703-253-0710  
toll free 1-800-243-5790

**Fax:** +1-703-741-6582

**Email:**

**Contact:**

**Topics covered:** a b j

**Description:** The American Plastics Council is a national trade association of plastic resin producers. Its goal is to promote plastics, and it works to contribute to the understanding of environmental issues relating to plastics. The American Plastics Council has 10 publications on plastics recycling, including *How to Collect Plastics for Recycling*, (which has an accompanying video available along with it), *Perfecting the Plastics Drop-Off*, *Educating Your Community About Plastics Recycling: A Do-It-Yourself Kit*, and *Waste Reduction Strategies for Rural Communities*.

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**Format of information:** Written materials and videotape.

**Internet:** [www.plasticsresource.com](http://www.plasticsresource.com)

**Language:** English

**Consulting or support services:** None.

**Fees:** None.

### **L3. American Public Works Association**

Committee on Solid Waste Management  
1301 Pennsylvania Avenue NW, Suite 501  
Washington, DC 20004  
United States

**Telephone:** +1-202-393-2792

**Fax:** +1-202-737-9153

**Email:** [apwadc@us.net](mailto:apwadc@us.net)

**Contact:** Stephanie Osborn

**Topics covered:** j

**Description:** The American Public Works Association (APWA), a non-profit association of local public works departments and associated professionals in the public and private sectors, has a Committee on Solid Waste Management whose purpose it is to provide guidance on MSWM to public works professionals in both the public and private sectors. APWA publishes a membership directory and various books, manuals, and special reports. On MSWM, it has published *Solid Waste Collection and Disposal*, a summary report on North American practices, and *Solid Waste Collection Practice*, on management methods and innovative technology.

APWA's educational programs include technical sessions at their annual congress, satellite training, onsite presentations, and videotape seminars. The recently formed Committee on Solid Waste Management intends to produce more materials on solid waste management in the near future.

**Format of information:** Books, written reports, satellite training, and videotape seminars.

**Internet:** [www.pubworks.org](http://www.pubworks.org)

**Language:** English

**Consulting or support services:** None.

**Fees:** Fees are charged for some reports; please inquire.

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#### **L4. American Society of Mechanical Engineers (ASME)**

Solid Waste Processing Division  
3 Park Avenue  
New York, New York 10016-5990  
United States

**Telephone:** +1-973-882-1167  
toll free +1-800-843-2763  
**Fax:** +1-212-591-7674  
**Email:** manese@asme.org  
**Contact:** Elio Manes

**Topics covered:** a b c d e f g i j k

**Description:** The American Society of Mechanical Engineers (ASME) is a non-profit educational and technical organisation that promotes technology transfer in solid waste and other engineering issues. It runs conferences, courses, and exhibits, publishes technical journals, reports, books, and magazines on mechanical engineering, and disseminates information about mechanical engineering and technology to schools and the general public. It conducts one of the largest technical publishing operations in the world, holds more than 30 technical conferences each year, and sets many industry and manufacturing standards (such as performance test codes for incinerators). Its international membership of 125,000 includes 9,000 members outside the United States, and it has 10 chapters in other countries.

The Solid Waste Processing Division is active in the overall solid waste processing field, including materials and energy recovery, recycling, and hazardous wastes. The Division co-sponsors a biennial Solid Waste Processing Conference and Exhibit, publishes diverse publications including technical papers, hosts meetings, conducts guided tours of major solid waste processing facilities in the United States and Canada, offers scholarships for students interested in solid waste management, and produces a newsletter of activities, research, and upcoming meetings.

**Format of information-** Technical reports, pamphlets, proceedings, courses, and videotapes.

**Internet:** [www.asme.org](http://www.asme.org)

**Language:** English

**Consulting or support services:** Will refer requests to members with relevant expertise.

**Fees:** Fees are charged for conferences, courses, videos, and most publications.

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

## **L5. Association of State and Territorial Solid Waste Management Officials**

444 North Capitol Street NW, Suite 315  
Washington, DC 20001  
United States

**Telephone:** +1-202-624-5828

**Fax:** +1-202-624-7875

**Email:**

**Contact:**

**Topics covered:** h

**Description:** The Association of State and Territorial Solid Waste Management Officials (ASTSWMO) is a non-profit association that represents directors of state and territorial waste management programs and members of their staffs. Each year they update the Directory of State Management Program Officials, which offers all the information needed to directly contact the key regulatory officials in the environmental protection agency of any US state or territory. The Directory includes the names, addresses, telephone numbers, and fax number for the directors of the solid waste division and their key staff.

**Format of information:** The Directory is their only relevant publication.

**Internet:** [www.ASTSWMO.org](http://www.ASTSWMO.org)

**Language:** English

**Consulting or support services:** None.

**Fees:** The cost of the Directory is \$40.

## **L6. *BioCycle*, Journal of Composting & Recycling**

J.G. Press  
419 State Avenue  
Emmaus, Pennsylvania 18049  
United States

**Telephone:** +1-610-967-4135

**Fax:** +1-610-967-1345

**Email:** [biocycle@jgpress.com](mailto:biocycle@jgpress.com)

**Contact:** Rill Ann Miller

**Topics covered:** a b c d e f g h j k

**Description:** *BioCycle* is a monthly magazine emphasising composting and recycling and is held by many to be North America's premier magazine on composting. It includes information on how to launch and expand composting projects, on techniques to improve operations and compost quality, and offers advice from the world's leading compost researchers. The magazine's annual feature on "The State of Garbage in America" summarises the current MSW management

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situation in the United States, including the state of landfill and WTE management. Other topics are covered as they relate to composting and recycling. *BioCycle* also has some coverage of composting and recycling initiatives in Canada and other countries. Its publisher, J.G. Press, also publishes *Compost Science and Utilization*, a quarterly peer-reviewed scholarly journal on composting. The journal includes articles on compost utilisation, worldwide composting research, economics, operational optimisation, and soil, water, and energy conservation. The organisation also holds four conferences on composting and waste diversion each year in the United States.

**Format of information:** Monthly magazine.

**Internet:** [www.jgpress.com/biocytle](http://www.jgpress.com/biocytle)

**Language:** English

**Consulting or support services:** None.

**Fees:** A subscription for *BioCycle* is \$69 per year for the United States, \$89 per year for Canada, and \$97 per year for all other countries; single issues are \$6. A subscription for *Compost Science and Utilization* is \$129 per year for the United States and \$154 per year for all other countries.

### **L7. Bureau of National Affairs, Inc.**

1231 25th Street NW  
Washington, DC 20037  
United States

**Telephone:** +1-202-452-4323  
toll free 1-800-372-1033

**Fax:** +1-301-294-6651  
toll free 1-800-253-0332

**Email:** [bnaplus@bna.com](mailto:bnaplus@bna.com), [customercare@bna.com](mailto:customercare@bna.com)

**Contact:**

**Topics covered:** a d e h

**Description:** The Bureau of National Affairs, Inc. (BNA) is a private company that conducts research and publishes reports on environmental issues in North America and worldwide. Three publications are of primary interest: *Solid Waste Recycling: The Complete Resource Guide*, *Environment Reporter*, and *International Environment Reporter*. *Solid Waste Recycling* includes information on US federal and state recycling laws and regulations, legal issues, local initiatives, corporate programs and policies, selected report excerpts, guidelines, and a list of solid waste management contacts, periodicals, and literature. *Environment Reporter: Current Reports* is a periodical newsletter providing brief articles on a wide range of environmental issues, including solid waste management. *Environment Reporter: Reference File* consists of a set of comprehensive loose-leaf reports on US federal and state environmental laws, including solid waste. The *International Environment Reporter* has a similar mission, but with a worldwide scope. Each has a useful guide to government contacts, including addresses and telephone numbers. They are available at some libraries.

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**Format of information:** Printed weekly reports and reference documents.

**Internet:** www.bna.com and www.bnaplus.com for BNA-PLUS

**Language:** English

**Consulting or support services:** BNA-PLUS conducts customised research for a fee. Call for more information.

**Fees:** Fees are charged for all publications and services.

### **L8. Business Publishers, Inc.**

8737 Colesville Road, Suite 1100  
Silver Spring, Maryland 20910-3928  
United States

**Telephone:** +1-301-589-5103  
toll free +1-800-274-6737

**Fax:** +1-301-587-4530

**Email:** bpinews@bpinews.com

**Contact:**

**Topics covered:** a b f k

**Description:** Business Publishers, Inc. (BPI) publishes 20 environmental newsletters, including the *Solid Waste Report*, a weekly report covering regulations, technology, and economics of solid waste management generation, collection, resource recovery, recycling, and disposal. *Medical Waste News* is a biweekly newsletter, covering identification, handling, transportation, treatment, and disposal of medical wastes. *World Environment Report* is also published biweekly and deals with a broader focus of environmental issues, including waste management.

**Format of information:** A variety-of newsletters on environmental topics.

**Internet:** www.bpinews.com

**Language:** English

**Consulting or support services:** None.

**Fees:** Annual subscription to Solid Waste Report is \$675.00 plus \$27 airmail outside the United States.

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

## **L9. Canadian Environment Industry Association (Association Canadienne des Industries de l'Environnement)**

280 Albert Street #802  
Ottawa, Ontario K1P 5G8  
Canada

**Telephone:** +1-613-236-6222  
**Fax:** +1-613-236-6850  
**Email:** info@ceia-acie.ca  
**Contact:** James Reinhart

**Topics covered:** h

**Description:** The Canadian Environment Industry Association (CEIA/l'ACIE) is an umbrella group representing provincial companies, associations, and organisations that are dedicated to environmentally sustainable economic development through the provision of state-of-the art products, technologies, and services. CEIA/l'ACIE holds conferences, produces a newsletter, and publishes proceedings, such as *Developing Agreements on the Siting of Waste Management Facilities*, and proceedings for the 17th and 16th Annual Canadian Waste Management conferences.

**Format of information:** Workshops, conferences, newsletter, and proceedings are all available in print; the 17th Annual Waste Management Conference proceedings are also available on computer diskette.

**Internet:** www.ceia-acie.ca

**Language:** English and French

**Consulting or support services:** None.

**Fees:** Conference and workshop proceedings are available to the public for a fee.

## **L10. Canadian International Development Agency**

Canadian Partnerships Branch  
200 Promenade du Portage  
Gatineau, Quebec K1A 0G4  
Canada

**Telephone:** +1-819-997-5006  
**Fax:** +1-819-953-6088  
**Email:** info@acdi-cida.gc.ca  
**Contact:** Linda Collette, Senior Environmental Advisor

**Topics covered:** a b e h i

**Description:** The Canadian International Development Agency (CIDA), Canadian Partnerships Branch undertakes joint development projects with industrial, non-governmental, and university

**TOPICS:**

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partners including technical assistance, professional services, training, funding, and monitoring and evaluation. The Partnerships Branch has had projects related to MSW management in the following countries: Argentina, Benin, Chile, Colombia, Ecuador, Grenada, Haiti, Ivory Coast, Mexico, Panama, Peru, Senegal, South Africa, Sri Lanka, Tunisia, and Turkey. Project purposes range from general institutional capacity building for environmental management to implementation of specific technical solutions such as a landfill or other waste management facility. Questions on projects in specific regions or countries can be directed to the staff.

**Format of information:** N.A.

**Internet:** [www.acdi-cida.gc.ca](http://www.acdi-cida.gc.ca)

**Language:** English and French

**Consulting or support services:** None.

**Fees:** None.

### **L11. Clean Washington Center**

2200 Alaskan Way, Suite 460  
Seattle, Washington 98121  
United States

**Telephone:** +1-206-443-7746

**Fax:** +1-206-443-7703

**Email:**

**Contact:** Joan Wright

**Topics covered:** a c d f h i j k

**Description:** The Clean Washington Center is dedicated to creating markets for recycled materials. Its primary focus is on glass, mixed paper, plastic, yard waste, tires, oil, and construction, demolition, and land clearing debris. The Center works in partnership with industry to develop the industrial capacity for the use of recycled materials. The Center has more than 55 publications on waste recycling, including directories, market analyses, policy initiatives, demonstration project reports, and technology assistance reports.

**Format of information:** Each report is summarised in a companion fact sheet.

**Internet:** [www.CWC.org](http://www.CWC.org)

**Language:** English

**Consulting or support services:** None.

**Fees:** Reports are currently \$20 each and fact sheets are normally free of charge.

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## L12. Composting Council of Canada

16 Northumberland Street  
Toronto, Ontario M6H 1P7  
Canada

**Telephone:** +1-416-535-0240  
**Fax:** +1-416-536-9892  
**Email:** info@compost.org  
**Contact:** Susan Antler

**Topics covered:** c h i j k

**Description:** The Composting Council of Canada is a non-profit association, serving as a forum to advocate and advance the use of composting as a means of reducing the waste stream while reclaiming the organic fraction for beneficial purposes. The Council seeks to support composting systems and programs, provide an information network, sponsor and co-sponsor research, ensure realistic compost quality standards, develop markets for compost, and educate the public. The Council publishes a quarterly newsletter for members and has several publications.

**Format of information:** Decision-making and teachers' guides, reports, brochures, newsletter.

**Internet:** www.compost.org

**Language:** English and French

**Consulting or support services:** Will refer requests to members with relevant expertise.

**Fees:** Fees for reports range from free to CAN\$60.

## L13. Concern, Inc.

1794 Columbia Road NW  
Washington, DC 20009  
United States

**Telephone:** +1-202-328-8160  
**Fax:** +1-202-387-3378  
**Email:** concern@igc.apc.org  
**Contact:** Darragh Lewis (for publications)

**Topics covered:** a d g j

**Description:** Concern, Inc., a non-profit organisation, provides environmental information to individuals and groups and encourages them to act in their communities. Its primary activity is to publish and distribute reports that define key environmental issues and contain suggestions for individual and group action. Concern supplies information on a broad range of issues including recycling, pollution prevention, water resource protection, and energy efficiency. Concern's publications give an overview of issues and include guidelines to encourage and aid citizen participation in the community and in policy decisions at the local, state, and federal levels of

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government. Concern publishes two guides on solid waste issues: *Waste Choices for Communities* and *Household Waste: Issues and Opportunities*.

**Format of information:** Reports.

**Internet:**

**Language:** English

**Consulting or support services:** None.

**Fees:** Each publication listed above is \$4 plus international postage and handling.

#### **L14. Environment Canada**

45 Alderney Drive  
Dartmouth, Nova Scotia B2Y 2N6  
Canada

**Telephone:** +1-902-426-7231

**Fax:** +1-902-426-6348

**Email:** 15<sup>th</sup>.reception@ec.gc.ca

**Topics covered:** a b c d e f g h j k

**Description:** Environment Canada is Canada's primary national agency for environmental protection. As primary responsibility for MSW management lies at the provincial and local levels, Environment Canada is involved with issues of national concern, setting national standards, public education, and certain special priority areas. Current areas of focus include, but are not limited to, composting, landfill gas, construction and demolition debris, packaging recycling, lifecycle analysis, waste material exchanges, and contaminated site remediation. The agency is a useful intermediary for acquiring contacts for information at the provincial and local levels.

**Format of information:** Fact sheets and reports.

**Internet:** www.ns.ec.gc.ca

**Language:** English and French

**Consulting or support services:** None.

**Fees:** Most publications are free, but there may be a charge for certain large reports.

#### **L15. Environmental Defense Fund**

257 Park Avenue South  
New York, New York 10010  
United States

**Telephone:** +1-212-505-2100

**Fax:** +1-212-505-2375

**Email:** members@environmentaldefense.org

**Contact:**

TOPICS:

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

**Topics covered:** a c d h j

**Description:** The Environmental Defense Fund (EDF) is a leading non-profit environmental advocacy organisation in the United States with over 250,000 members and more than 60 full-time scientists, engineers, lawyers, and economists. One of EDF's goals was to achieve a 50 percent recycling rate in the United States by the year 2000. Their list of publications on waste reduction, composting, recycling, and incineration include *Coming Full Circle: Successful Recycling Today* and *Recycling and Incineration: Evaluating the Choices*.

**Format of information:** Reports, books, brochures, and issues papers.

**Internet:** [www.edf.org](http://www.edf.org)

**Language:** English

**Consulting or support services:** None.

**Fees:** Fees for publications range from free to US\$25.

### **L16. Environmental Education Enterprises, Inc.**

6011 Houseman Road  
Ostrander, Ohio 43061  
United States

**Telephone:** +1-740-368-9393  
toll free 1-800-792-0005

**Fax:** +1-740-362-4339

**Email:** [e3@e3power.com](mailto:e3@e3power.com)

**Contact:**

**Topics covered:** e i

**Description:** Environmental Education Enterprises Inc. (E<sup>3</sup>) serves the needs for the continuation of training environmental professionals on changing technology. E<sup>3</sup> training seminars integrate the disciplines required to successfully assess and remediate environmental problems. E<sup>3</sup> offers training on cutting edge technology with a hands-on emphasis. Many of its training programs contain some type of classroom demonstration of applicable equipment or field training. The target audience of E<sup>3</sup> are engineers, geologists, and scientists working as environmental professionals. These may be consultants, government employees, industry representatives, and academics. E<sup>3</sup> offers some of its short courses on solid waste management, such as "Pollution Prevention as a Strategic Weapon", "Fundamentals of Environmental Sampling", and "Landfill Remediation: Regulations and Technologies for Cleanup of Subtitle D, Subtitle C and Superfund Landfills".

**Format of information:** Training programs and courses.

**Internet:** [www.e3power.com](http://www.e3power.com)

**Language:** English

**Consulting or support services:** None.

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**Fees:** Fees courses are approximately \$300 per day for standard courses and more than \$1000 per day on standard computer classes where computers are supplied.

### **L17. Environmental Industry Associations**

4301 Connecticut Avenue NW, Suite 300  
Washington, DC 20008  
United States

**Telephone:** +1-202-244-4700

**Fax:** +1-202-966-4818

**Email:**

**Contact:** Faye Cohen

**Topics covered:** a b c d e f g h i k

**Description:** The Environmental Industry Associations (EIA), formerly the National Solid Wastes Management Association (NSWMA), represents companies that manage solid, hazardous, and medical wastes; manufacture and distribute waste equipment; and offer related pollution-prevention services. EIA provides an information source on recycling, landfilling, incineration, public education, standards for equipment, safety and training products, privatisation, and international waste management trends. Periodicals include *Recycling Times*, a bi-weekly newspaper on recycling markets, data, and trends; *Infectious Wastes News* for generators and handlers of bio-hazardous wastes; and *Waste Age*, a monthly magazine covering all aspects of solid waste management. EIA also hosts expositions and seminars. Public education materials include the children's book *Walt Wastenot Activity Book*, an all-audience brochure called *Professionally Managed Landfills*. A publications and products catalogue is available upon request.

**Format of information:** Trade fairs, technical conferences, reports, magazines, and other publications.

**Internet:** [www.envasns.org](http://www.envasns.org)

**Language:** English; basic brochure on EIA is available in Spanish

**Consulting or support services:** None.

**Fees:** Fees for publications and products are listed in the publications in the catalogue.

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

**L18. Gale Environmental Sourcebook (A Guide to Organisations, Agencies, and Publications)**

Gale Research, Inc.  
PO Box 33477  
Detroit, Michigan 48232-5477  
United States

**Telephone:** +1-313-961-2242  
toll free 1-800-877-4253  
**Fax:** +1-313-961-6083  
toll free 1-800-414-5043  
**Email:** galeord@gale.com  
**Contact:**

**Topics covered:** a b c d e f

**Description:** The *Gale Environmental Sourcebook* contains information on organisations, agencies, programs, publications, videos, and electronic products, concerned with the environment. It provides descriptive and contact information on approximately 12,000 resources that offer information on a variety of topics, including solid waste management issues. Gale Research also publishes several other sourcebooks on related topics.

**Format of information:** In addition to print, this sourcebook may also be available on CD-ROM, through an online service, and on computer diskette or magnetic tape.

**Internet:** www.gale.com

**Language:** English

**Consulting or support services:** None.

**Fees:** There are fees charged for all publications; the 1994 Sourcebook was \$85.

**L19. Government Institutes, Inc.**

4 Research Place, Suite 200  
200 Rockville, Maryland 20850  
United States

**Telephone:** +1-301-921-2300  
**Fax:** +1-301-921-0373  
**Email:** giinfo@govinst.com  
**Contact:**

**Topics covered:** a f i

**Description:** Government Institutes, Inc. publishes nearly 200 books on a variety of environmental, health and safety issues, and presents training courses and materials to professionals in these fields. Its many publications include *Pollution Prevention: Strategies and*

TOPICS:

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g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

*Technologies, Federal Facility Pollution Prevention: Planning Guide and Tools for Compliance, Medical Waste Incineration Handbook, Case Studies in Waste Minimization, and a monthly newsletter, Waste Minimization and Recycling Report. The Government Institutes Catalog is available upon request.*

**Format of information:** Courses, books, videos, periodicals, CD-ROM products, and electronic publishing are available on a number of subjects

**Internet:** [www.govinst.com](http://www.govinst.com)

**Language:** English

**Consulting or support services:** None.

**Fees:** Fees for all materials.

## **L20. INFORM, Inc.**

120 Wall Street, 16<sup>th</sup> Floor  
New York, New York 10005-4001  
United States

**Telephone:** +1-212-361-2400

**Fax:** +1-212-361-2412

**Email:** [fishbein@informinc.org](mailto:fishbein@informinc.org)

**Contact:** Bette K. Fishbein

**Topics covered:** a f h k

**Description:** INFORM is a non-profit environmental research and education organisation that identifies and reports on practical solutions to protect natural resources and public health. INFORM's research, reports, and communications activities focus on chemical hazards, solid waste, air quality and energy and land and water conservation. Its solid waste focus is on recycling and reducing municipal waste at its source. Among its nine solid waste publications are: *Business Recycling Manual*, *Making Less Garbage: A Planning Guide for Communities*, and *Burning Garbage in the US: Practice vs. State of the Art*. It also produces 13 free fact publications, such as *Waste Prevention Factsheet*, and the newsletter, *INFORM Reports*. A publication list is available on request.

**Format of information:** Books, abstracts, newsletter, fact sheets, and articles.

**Internet:** [www.informinc.org](http://www.informinc.org)

**Language:** English

**Consulting or support services:** None.

**Fees:** Fact sheets and executive summaries of reports are free; fees for other publications vary.

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## L21. Institute for Local Self-Reliance

927 15th Street NW, 4th Floor  
Washington, DC 20005  
United States

**Telephone:** +1-202-898-1610  
**Fax:** +1-202-898-1612  
**Email:** info@ilsr.org  
**Contact:** Neil Seldman, President

**Topics covered:** a h j k

**Description:** The Institute for Local Self-Reliance (ILSR) studies the technical feasibility and economic viability of creating human-scaled, self-reliant communities. ILSR provides governments, businesses, and grassroots community organisations with the technical expertise and policy initiatives that form the economic framework of local self-reliance. ILSR works in the areas of energy and materials efficiency, public policy, and recycling and economic development. Publications include a significant number on solid waste topics, including *Beyond 40 Percent: Record-Setting Recycling and Composting Programs*, *Creating Local Recycling Markets*, and *Co-Collection of Recyclables and Mixed Waste: Problems and Opportunities*. Altogether, ILSR has approximately 30 publications on recycling and related topics; a publication list is available upon request.

**Format of information:** Reports

**Internet:** www.ilsr.org

**Language:** English

**Consulting or support services:** Self-Reliance, Inc. is ILSR's consulting arm.

**Fees:** Fees are charged for all publications; contact Self-Reliance, Inc. for estimates of consulting fees.

## L22. Institute of Scrap Recycling Industries, Inc.

1325 G Street NW, Suite 1000  
Washington, DC 20005-3104  
United States

**Telephone:** +1-202-737-1770  
**Fax:** +1-202-626-0900  
**Email:** isri@isri.org  
**Contact:** Robin Wiener, President

**Topics covered:** a

**Description:** The Institute of Scrap Recycling Industries, Inc. (ISRI) is a North American trade association of the scrap processing and recycling industry. It represents companies that process,

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broker, and consume scrap commodities, including metals, paper, plastics, glass, rubber, and textiles. ISRI works to increase the awareness of the industry's role in recycling. ISRI produces a number of publications, videos, educational materials, and promotional items covering topics such as environmental compliance, safe operations, radioactivity issues, metals industry and business information, metals identification, industry policy positions, and public relations. It also produces a number of brochures, including *Design for Recycling*, *Recycling Scrap Iron and Steel*, *Recycling Nonferrous Scrap Metals*, *Recycling Paper*, *Recycling Plastics*, and the *Handbook of Recycling Techniques*. It also publishes the magazine *Scrap*. A catalogue of publications and audiovisuals is available on request.

**Format of information:** Publications, videos, educational materials, and promotional items

**Internet:** [www.ISRI.org](http://www.ISRI.org)

**Language:** English

**Consulting or support services:** Available to ISRI members only.

**Fees:** Fees for all materials.

### **L23. Keep America Beautiful, Inc.**

1010 Washington Boulevard  
Stamford, Connecticut 06901  
United States

**Telephone:** +1-203-323-8987

**Fax:** +1-203-325-9199

**Email:** [mspigelman@kab.org](mailto:mspigelman@kab.org)

**Contact:** Monica Surfaro Spigelman

**Topics covered:** a c f j

**Description:** Keep America Beautiful, Inc. (KAB) is a non-profit public education organisation dedicated to improving waste handling practices in American communities. KAB works to educate individuals about solid waste, litter prevention, and public lands stewardship. KAB has many publications, such as *The Role of Recycling in Integrated Solid Waste Management to the Year 2000*, *Close the Loop*, *Buy Recycled*, *Waste in the Workplace*, *Household Appliances*, and *The Environment*. Examples of fact sheets include: *An Introduction to Municipal Solid Waste Management*, and *Commercial Waste: Opportunities for Waste Minimization*. Brochures on recycling and litter prevention are also available. Videos include *Beyond the Bins - Sustaining a Recycling Program in Your Community*. Its children's education materials include *Waste in Place*, *Waste: A Hidden Resource*, and *Mister Rogers' Recycling Video*. An educational catalogue, listing publications and other materials, is available on request.

**Format of information:** Reports, brochures, children's educational materials, and videos.

**Internet:** [www.KAB.org](http://www.KAB.org)

**Language:** English

**Consulting or support services:** None.

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**Fees:** Most brochures and fact sheets are free for the first copy; other publications and videos at varying fees.

#### **L24. Michigan State University**

Department of Community, Agriculture, Recreation and Resource Studies (CARRS)  
131 Natural Resources Building  
East Lansing, Michigan 48824-1222  
United States

**Telephone:** +1-517-353-5190  
**Fax:** +1-517-432-3597  
**Email:** prtr@msu.edu  
**Contact:** Professor Gaylan Rasmussen  
Also: Louis F. Twardzik, Professor Emeritus

**Topics covered:** e f h i j

**Description:** The Department is establishing a research and design centre for the study of alternative uses for landfills once the planned capacity has been exhausted. The aim is to provide urban planners and public officials with viable options for transforming landfills into parks and recreation areas, as well as other open-space uses. Rehabilitated landfills may subsequently serve as a magnet for attracting housing, industrial parks, offices, and commercial development to adjacent lands -turning areas that had zero community value into productive zones for investment.

The centre plans to develop an integrated set of technologies and will combine various disciplines and activities, including civil engineering, open-space design, environmental risk assessment, training, and institution-building. It will also address long-term management considerations.

**Format of information:** Technical reports and a database. A newsletter and eventually a website are contemplated.

**Internet:** [www.prr.msu.edu/Main](http://www.prr.msu.edu/Main)

**Language:** English

**Consulting or support services:** The centre will provide advisory services, undertake research projects, and work with communities to develop integrated proposals and financial plans for restoring and managing landfill sites. The centre will also offer training through workshops and seminars for officials involved in landfill management and development.

**Fees:** Fees for advisory services are negotiated on a case-by-case basis. Materials are available in accordance with MSU Extension and Outreach policies.

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## L25. National Association of Counties

440 First Street NW  
Washington, DC 20001  
United States

**Telephone:** +1-202-393-6226  
**Fax:** +1-202-393-2630  
+1-202-737-0470  
**Email:** tgoodman@naco.org  
**Contact:** Tom Goodman, Public Affairs Director

**Topics covered:** a c e h i

**Description:** The National Association of Counties (NACo) is a non-profit association for America's county governments with a membership that includes about two-thirds of the 3,045 county governments. NACo's primary objectives are to act as a liaison with other levels of government, act as a national advocate for counties, and to help counties find innovative methods to meet their challenges. It co-sponsors an annual conference on solid waste issues, and publishes a quarterly environmental newsletter, fact sheets on pollution prevention information sources, and a report, *Introduction to Sustainable Development*.

**Format of information:** Newsletter, conference, fact sheets, report.

**Internet:** www.naco.org

**Language:** English

**Consulting or support services:** None.

**Fees:** Most publications are currently free.

## L26. National Oil Recyclers Association

12429 Cedar Road, Suite 26  
Cleveland Heights, Ohio 44106-3172  
United States

**Telephone:** +1-703-753-4277  
**Fax:** +1-703-753-2445  
**Email:** sparker@noranews.org  
**Contact:** Scott D. Parker, Executive Director

**Topics covered:** a f i

**Description:** The National Oil Recyclers Association (NORA) is a national trade association whose prime objective is advancing the interests of companies in the United States engaged in the safe recycling of used oil. The association represents the oil recycling industry, including re-refining, wastewater treaters, oil filter recyclers, antifreeze recyclers, hazardous waste treaters,

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and major oil companies. NORA publishes the newsletter, *NORA News*, hosts two conferences a year, and provides education outreach to schools and the community.

**Format of information:** Newsletter, conferences, educational outreach materials.

**Internet:** [www.noranews.org](http://www.noranews.org)

**Language:** English

**Consulting or support services:** Available only to members.

**Fees:** Postage fees for publications; directory of membership for sale; membership for international members \$250.

## **L27. National Recycling Coalition**

1325 G Street NW, Suite 1025

Washington, DC 20005

United States

**Telephone:** +1-202-347-0450

**Fax:** +1-202-347-0449

**Email:** [info@nrc-recycle.org](mailto:info@nrc-recycle.org)

**Contact:** Meg Morris, President

**Topics covered:** a

**Description:** The National Recycling Coalition (NRC) is a coalition of individuals and organisations committed to maximising recycling, as well as advancing source reduction, reuse, and composting. It provides recycling education and information, develops markets for recovered materials, and promotes policies for recycling and conservation. NRC hosts an annual conference, forums and seminars on recycling and waste reduction, research committees, workshops, and a 30-page guidebook on implementing a recycled product purchasing program. NRC publishes *Buy Recycled Newslines*, a newsletter of the Buy Recycled Business Alliance, and NRC's newsletter *The NRC Connection*.

**Format of information:** Newsletters, seminars, conferences, special forums, and audiocassettes of its recent annual meeting,

**Internet:** [www.nrc-recycle.org](http://www.nrc-recycle.org)

**Language:** English

**Consulting or support services:** None.

**Fees:** Some fees may apply to non-members.

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## L28. North Carolina Office of Waste Reduction

Solid Waste Program  
DPPEA  
1639 Mail Service Center  
Raleigh, North Carolina 27699-1639  
United States

**Telephone:** +1-919-715-6500  
toll free 1-800-763-0136  
**Fax:** +1-919-715-6794  
**Email:** ron\_still@owr.ehnr.state.nc.us, nowaste@owr.ehnr.state.nc.us  
**Contact:** Ron Still

**Topics covered:** a b c d e f g h i j k

**Description:** The North Carolina Office of Waste Reduction provides technical assistance on methods to eliminate, reduce, or recycle wastes prior to treatment or disposal. It addresses air and water pollution and hazardous and solid waste from industries, businesses, institutions, government agencies, and residences. The Office of Waste Reduction has numerous publications, films, guides, and fact sheets on waste reduction, including *Composting Yard Trimmings and Municipal Solid Waste*, *Construction and Demolition Debris Reduction and Recycling: A Regional Approach*, *How to Start or Expand a Recycling Collection Program*, *Fact Sheet Used Tires*, and *Beyond Recycling: A Waste Reduction Manual for Schools*. A publication list is available on request.

**Format of information:** Publications include reports, case studies, manuals, guides, fact sheets, brochures, films, promotional posters; the office also conducts workshops and training courses.

**Internet:** [www.p2pays.org](http://www.p2pays.org)

**Language:** English; one person currently on staff speaks fluent Spanish

**Consulting or support services:** None.

**Fees:** Many publications currently free, but may institute fees in the future.

## L29. Public Technology, Inc.

1301 Pennsylvania Avenue NW, Suite 800  
Washington, DC 20004-1793  
United States

**Telephone:** +1-202-626-2400  
**Fax:** +1-202-626-2498  
**Email:** ksmalls@pti.org  
**Contact:** Karen Smalls, Publications

**Topics covered:** a e h k

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**Description:** Public Technology, Inc. (PTI) is the non-profit technology research, development, and commercialisation subsidiary of the three top local government associations: the National League of Cities, the National Association of Counties, and the International City/County Management Association. PTI has as its members some of the most progressive and entrepreneurial city and county governments in the United States. PTI's programs currently focus on the environment, energy, telecommunications and information, public safety, and transportation. The cities and counties of the Urban Consortium, a network of large PTI members, formed the Environmental Task Force in 1988 to test and disseminate innovative solutions to environmental problems. The Task Force has partnerships with the US Environmental Protection Agency, the US Department of Energy, and several research institutions. It has conducted information exchanges on innovative approaches in solid waste, water, and air quality between local and federal officials, and has published several reports and handbooks. Publications on MSW management include *Lessons Learned Recycling Handbook*, *Landfill Methane Recovery and Utilization: A Handbook for Local Governments*, and the *Local Government Guide to Solid Waste Competitive Service Delivery*. A publication list is available upon request.

**Format of information:** Reports.

**Internet:** [www.pti.org](http://www.pti.org)

**Language:** English

**Consulting or support services:** None.

**Fees:** There is a charge for most publications.

### **L30. Recycling Council of Ontario**

489 College Street, Suite 504  
Toronto, Ontario M6G 1A5  
Canada

**Telephone:** +1-416-960-1025  
toll free 1-800-263-2849

**Fax:** +1-416-960-8053

**Email:** [rco@web.apc.org](mailto:rco@web.apc.org)

**Contact:**

**Topics covered:** a c e j

**Description:** The Recycling Council of Ontario (RCO) is a non-profit organisation founded in 1978. It is a leading authority on waste management; represents industry, business, government, and community groups. It works to inform and educate all members of society about the generation of waste, the avoidance of waste, the more efficient use of resources and the benefits and/or consequences of these activities. Ongoing issues it addresses include refillable beverage containers, kerbside users fees, incineration, waste export, household hazardous waste, and the economics of recycling. RCO research appears in the form of articles in its publications *RCO Update* and *RCO Policy Bulletin*. It hosts an annual conference and trade show, composting demonstration programs, and workshops. Information packets ranging from "how to compost"

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guidelines to directories on markets, contracts, and municipal programs are also available. It provides position papers on major waste management issues, and its more than 20 publications, directories, databases, and videos include topics such as incineration, composting, and proceedings from conferences. Examples of publications include *A Guide to Green Building Materials and Methods*, *Background Composting: Summary of Results of the Model Community Projects*, and *Multi-Residential Composting*. It also produces a slide show on home composting. A publication list is available upon request.

**Format of information:** Newsletters, conferences, information packets, guides, slide show.

**Internet:** www.rco.on.ca

**Language:** English

**Consulting or support services:** None.

**Fees:** Fees vary for directories, publications, databases, videos, and slide show.

### **L31. Resource Recovery Report**

PO Box 3356  
Warrenton, Virginia 20188-1956  
United States

**Telephone:** +1-540-347-4500

**Fax:** +1-540-514-6007

**Email:** rrr@coordgrp.com

**Contact:**

**Topics covered:** a d

**Description:** *Resource Recovery Report* is a monthly newsletter review of resource recovery progress. In addition to the newsletter, *Resource Recovery Report* publishes *Membership Organisations Active in Solid Waste Management*, a directory of more than 200 associations with an active or indirect role in MSWM.

**Format of information:** Newsletter and directory.

**Internet:**

**Language:** English

**Consulting or support services:** None.

**Fees:** *Resource Recovery Report* is \$227/year for subscriptions in the United States; foreign subscribers add \$25 for airmail.

### **L32. Resource Recycling**

PO Box 42270  
Portland, Oregon 97242-0270  
United States

**Telephone:** +1-503-233-1305

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**Fax:** +1-503-233-1356  
**Email:** info@resource-recycling.com, jpowell@resource-recycling.com  
**Contact:** Jerry Powell

**Topics covered:** a b c f h k

**Description:** *Resource Recycling* is a relatively small but knowledgeable publishing company specialising in solid waste recycling issues. Its major publication is *Resource Recycling*, a monthly journal on recycling and composting. It also publishes some periodic newsletters (e.g., *Plastics Recycling Update* and *Container Recycling Report*, and *E-Scrap News*), as well as detailed directories on recycling information contacts (e.g., directories of US and Canadian scrap processors and waste management resources on the Internet).

**Format of information:** Monthly magazine, newsletters, and directories.

**Internet:** www.resource-recycling.com

**Language:** English

**Consulting or support services:** Consulting services on recycling are sometimes available upon request.

**Fees:** An annual subscription to *Resource Recycling* costs US\$51 in the United States. Fees are also charged for directories and newsletters.

### **L33. Solid Waste Association of North America (SWANA)**

1100 Wayne Avenue  
Silver Spring, Maryland 20910  
United States

**Telephone:** +1-301-585-2898  
toll free 1-800-467-9262

**Fax:** +1-301-585-0297  
+1-301-589-7068

**Email:** info@SWANA.org

**Contact:** Dr. John Skinner, Executive Director

**Topics covered:** a b c d e g h i k

**Description:** The Solid Waste Association of North America (SWANA) is a non-profit association whose mission is to advance the practice of environmentally and economically sound MSWM. This mission is accomplished largely through training and certification courses, conferences and symposia, legislative and regulatory advocacy, networking and the publication of guidance documents. SWANA holds several MSW training courses, covering topics such as groundwater monitoring, landfills, waste screening, recycling systems, MSW collection systems, transfer stations, financing, and integrated MSW management systems. It also sponsors an annual international solid waste exposition and numerous specialty symposia.

**Format of information:** Fact sheets and reports.

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**Internet:** www.swana.org

**Language:** English; some German and Spanish

**Consulting or support services:** Will refer to member professionals for assistance.

**Fees:** Photocopy fees are charged for more specific publications that come from their library. Symposia, expositions, and courses have different fees.

### **L34. Steel Recycling Institute**

680 Andersen Drive  
Pittsburgh, Pennsylvania 15220-2700  
United States

**Telephone:** +1-412-922-2772  
toll free 1-800-876-7274

**Fax:** +1-412-922-3213

**Email:** sri@recycle-steel.org, craw67ford@aol.com

**Contact:** Greg Crawford, VP Operations

**Topics covered:** a b f j

**Description:** The Steel Recycling Institute is an industrial association dedicated to promoting steel recycling. It provides resources for education and public information on steel recycling, including information on the recycling of cans, appliances, cars, and construction debris. It publishes *The Recycling Magnet*, a quarterly newsletter, and numerous brochures, including *Residential Recycling of Empty Steel Paint Cans*, *Recycling Empty Steel Aerosol Cans in Curbside and Dropoff Programs*, *Recycling Steel Appliances*, *Recycling Scrapped Automobiles*, *Steel Recycling Starts in the Home: A Guide to Residential Steel Recycling*, and *Recycling Steel Cans from Food Service Facilities*.

**Format of information:** Print material, videos, and audiotapes.

**Internet:** www.recycle-steel.org

**Language:** English

**Consulting or support services:** Not available outside the United States.

**Fees:** No fee for brochures, varying fees for videos and audiotapes.

### **L35. University of Missouri-Columbia, Center for Waste Management (CWM)**

E2509 Engineering Building East  
Columbia, Missouri 65211  
United States

**Telephone:** +1-573-882-6269

**Fax:** +1-573-882-4784

**Email:** peytonl@missouri.edu

**Contact:** Dr. Lee Peyton, Director

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**Topics covered:** a b c d e f g h i

**Description:** The Center for Waste Management (CWM) is an interdisciplinary centre that promotes research and applications, technology development and transfer, and education and training in environmental and waste management. CWM focuses on waste control and treatment, waste minimisation, clean production, pollution prevention, monitoring and assessment, recovery and reuse, remediation, and final disposal. Its research programs cover agricultural waste, air quality, bioremediation, fate and transport of contaminants, hazardous waste treatment, radioactive waste, waste minimisation and reuse, water quality, and water and wastewater treatment.

**Format of information:** Training courses, technology summary sheets, graduate-level environmental engineering courses through distant learning technology and electronic conferencing.

**Internet:** [www.missouri.edu/~cwmwww](http://www.missouri.edu/~cwmwww)

**Language:** English

**Consulting or support services:** CWM provides consulting services in the areas described above.

**Fees:** Consulting services have fees. Publications are free, but there are only a few at present.

### **L36. University of Wisconsin Extension, Solid and Hazardous Waste Education Center (SHWEC)**

610 Langdon Street, Room 529  
Madison, Wisconsin 53703-1195  
United States

**Telephone:** +1-608-262-0385

**Fax:** +1-608-262-6250

**Email:** [shwec@uwm.edu](mailto:shwec@uwm.edu)

**Contact:**

**Topics covered:** a b c e f h i

**Description:** The University of Wisconsin Extension Solid and Hazardous Waste Education Center (SHWEC) provides waste reduction services to waste generators in Wisconsin. Among its many functions, SHWEC specialists promote the benefits of source reduction, recycling, and pollution prevention strategies, and they also provide solid and hazardous waste education to agencies, governments, and other organisations. It offers numerous publications, case studies, fact sheets, and correspondence courses on a wide variety of MSWM issues, such as composting, landfilling, pollution prevention, recycling, reduction and reuse, special wastes (e.g., tires, ink, antifreeze, batteries), and waste-to-energy systems. Videos on recycling and source reduction are also available. A publication list is available upon request.

**Format of information:** Publications, case studies, fact sheets, and correspondence courses. .

**Internet:** [www1.uwex.edu/ces/shwec](http://www1.uwex.edu/ces/shwec)

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**Language:** English

**Consulting or support services:** Depending on specific requests, research specialists with relevant expertise may be available for consultative work.

**Fees:** No fees are normally charged, but there may be some modest charges to cover publication costs.

### **L37. US Agency for International Development (USAID)**

Information Center  
Ronald Reagan Building  
Washington, DC 20523-1000  
United States

**Telephone:** +1-202-712-4810

**Fax:** +1-202-216-3524

**Email:** [pinquiries@usaid.gov](mailto:pinquiries@usaid.gov)

**Contact:**

**Topics covered:** a b c d e f h i

**Description:** The US Agency for International Development (USAID) is located within the US Department of State. USAID's Development Information Center is its information depository. The Center houses a searchable computer database with over 160 reports and other publications categorised under the heading "solid wastes" over the last 15 years. Staff can conduct database searches and send out annotated search reports that include relevant information such as the title, subject, author, year written, and an abstract. Full reports can then be ordered from the Development Information Services Clearinghouse (Email: [docorder@disc.mhs.compuserve.com](mailto:docorder@disc.mhs.compuserve.com)).

**Format of information:** Reports are available in print or on microfiche.

**Internet:** [www.usaid.gov](http://www.usaid.gov)

**Language:** Primarily English and occasional French, Spanish, and Arabic

**Consulting or support services:** None.

**Fees:** Copies of reports are charged on a per page basis. Institutions in developing countries may receive up to five titles on microfiche free of charge. Ordering instructions and fees are described in an instruction sheet included with any database search.

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### L38. US Composting Council

4250 Veterans Memorial Highway, Suite 275  
Holbrook, New York 11741  
United States

**Telephone:** +1-631-737-4931  
**Fax:** +1-631-737-4939  
**Email:** buckstop@vdot.net  
**Contact:** Stuart Buckner

**Topics covered:** c h i j k

**Description:** The Composting Council works to achieve maximum conservation, composting, and utilisation of organic materials in an environmentally and economically sustainable manner. The Council develops the science and technology necessary for the growth of the composting industry and transfers that knowledge to industry, government, and the general public. It also has outreach and public education programs. The Composting Council has fact sheets, several publications, and educational videos. Examples of publications and fact sheets include *Uses and Benefits of MSW Compost: A Literature Review*, *Compost Facility Planning Guide*, *Compost Facility Operating Guide*, *Recommended Test Methods for the Examination of Compost and Composting*, and *A Review of Composting Literature*. It also produces fact sheets, such as *Composting Basics* and *Backyard Composting Dos & Don'ts*. A publication list is available upon request.

**Format of information:** Fact sheets, educational videos, and reports.

**Internet:** [www.compostingcouncil.org](http://www.compostingcouncil.org)

**Language:** English

**Consulting or support services:** None.

**Fees:** Fact sheets are free in small quantities, publications have varying costs.

### L39. US Conference of Mayors

1620 Eye Street NW, Suite 300  
Washington, DC 20006  
United States

**Telephone:** +1-202-861-6774  
**Fax:** +1-202-467-4276  
**Email:** [gpowell@usmayors.org](mailto:gpowell@usmayors.org)  
**Contact:** Geri Powell, Managing Director

**Topics covered:** a b c d e f g h i j k

**Description:** The Conference of Mayors administers the Municipal Waste Management Association (MWMA), a national membership association that brings together local governments

**TOPICS:**

a = Waste Reduction   b = Collection & Transfer   c = Composting   d = Incineration   e = Landfills   f = Special Wastes  
g = Waste Characterization   h = Management & Planning   i = Training   j = Public Education   k = Financing

and other organisations with a common interest in the management of MSW through reduction, recovery, reuse, and recycling of materials and energy from the waste stream. Among many objectives, MWMA provides information and assistance to local government officials, educates the public about waste management, and encourages the most effective development of comprehensive waste management through research and technical assistance efforts. It also has many committees working on specific solid waste issues, such as composting, waste-to-energy, and pollution prevention. The MWMA has several publications and videos on solid waste including *Recycling in America's Cities: A Summary of 163 City Recycling Programs*, *Recycling in Schools: How to Develop Your Own Program*, *National Composting Program*, and an annual *Report to the Nation on Recycling and Solid Waste*, *Whose Waste Is It Anyway? Assuring Flow Control for Municipal Waste Processing Facilities*, and *Garbage Solutions: A Public Officials Guide to Recycling and Alternative Solid Waste Management Technologies*. A publication list is available upon request. MWMA also holds an annual solid waste conference.

**Format of information:** Publications, reports, and videos.

**Internet:** [www.usmayors.org/uscm/mwma](http://www.usmayors.org/uscm/mwma)

**Language:** English

**Consulting or support services:** None.

**Fees:** Fees are charged for most publications; consult publication list.

#### **L40. US Environmental Protection Agency (EPA)**

Office of Solid Waste (5305W)  
1200 Pennsylvania Avenue NW  
Washington, DC 20460  
United States

*Office of Solid Waste (OSW), Municipal and Industrial Solid Waste Division*

**Telephone:** +1-703-412-9810 for Solid Waste Hotline  
toll free 1-800-424-9346

**Fax:** +1-703-308-8686

**Email:**

**Contact:**

**Topics covered:** a b c d e f g h i j k

*Office of International Activities (OIA)*

**Telephone:** +1-202-564-6613

**Fax:** +1-202-565-2411  
+1-202-565-2408

*INFOTERRA./USA*

**Telephone:** +1-202-260-5917

**Fax:** +1-202-260-3923

**Email:** [library-infoterra@epamail.epa.gov](mailto:library-infoterra@epamail.epa.gov)

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**Description:** The US Environmental Protection Agency (EPA) is the principal US federal agency for environmental matters, including solid waste, hazardous waste, air, and water. Its functions include: setting and enforcing environmental standards; conducting research on the causes, effects, and control of environmental problems; and assisting states and local governments. The Municipal and Industrial Solid Waste Division of EPA's Office of Solid Waste (OSW) has primary responsibility for MSW management issues. The Solid Waste Hotline or the Solid Waste Assistance Program (301-585-2898, toll free 800-677-9424) is the easiest way to order specific publications, to order a publications catalogue, or to request information on a particular topic. The catalogue lists hundreds of technical and non-technical publications on all aspects of MSW management.

EPA's Office of International Activities (OIA) provides technical assistance and guidance for several projects in Asia (e.g., China, India, Indonesia, Japan) and Latin America (e.g., Mexico, Chile, Bolivia). OIA relies on the Office of Solid Waste for substantive expertise on MSW and coordinates EPA's international projects. It does not fund its own projects; rather, it assists projects sponsored by the US Agency for International Development or the host country.

INFOTERRA/USA is part of the UN Environment Programme's information exchange and referral service, providing a variety of information including EPA technical reports, environmental regulations, educational materials, and referrals to international environmental experts.

**Format of information:** For a catalogue of publications call the Solid Waste Hotline or use the Internet.

**Internet:** [www.epa.gov](http://www.epa.gov)

**Language:** English

**Consulting or support services:** None.

**Fees:** A fee is charged for some publications, but most are free. Refer to the publications catalogue.

#### **L41. The World Bank**

Urban Development Division  
1818 H Street NW  
Washington, DC 20433  
United States

**Telephone:** +1-202-473-1000  
+1-202-473-1301

**Fax:** +1-202-522-3232

**Email:**

**Contact:**

**Topics covered:** a b c d e f g h i j k

**TOPICS:**

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**Description:** The World Bank provides financial support and technical assistance to client governments in developing countries for municipal infrastructure and services, including MSWM. Within the Bank, the Urban Development Division carries out a number of activities in the solid waste area, including research and policy analysis and the provision of advice, training, and dissemination of information both for Bank project officers as well as client institutions. Through the Urban Development Division, the Bank also participates in a collaborative program on solid waste management involving the Urban Management Programme (UMP) of UNDP, UNCHS and The World Bank, and a number of other bilateral organisations. The UMP publications series contains a number of reports related to MSWM.

**Format of information:** Publications are in paper format.

**Internet:** [www.worldbank.org/urban](http://www.worldbank.org/urban)

**Language:** English, Spanish

**Consulting or support services:** The Urban Development Division provides consulting and support services to public institutions and technical cooperation agencies.

**Fees:** Publications are distributed free to developing country practitioners, and at cost to industrialised country professionals.

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