

# Technical Brief: Solid Waste Management

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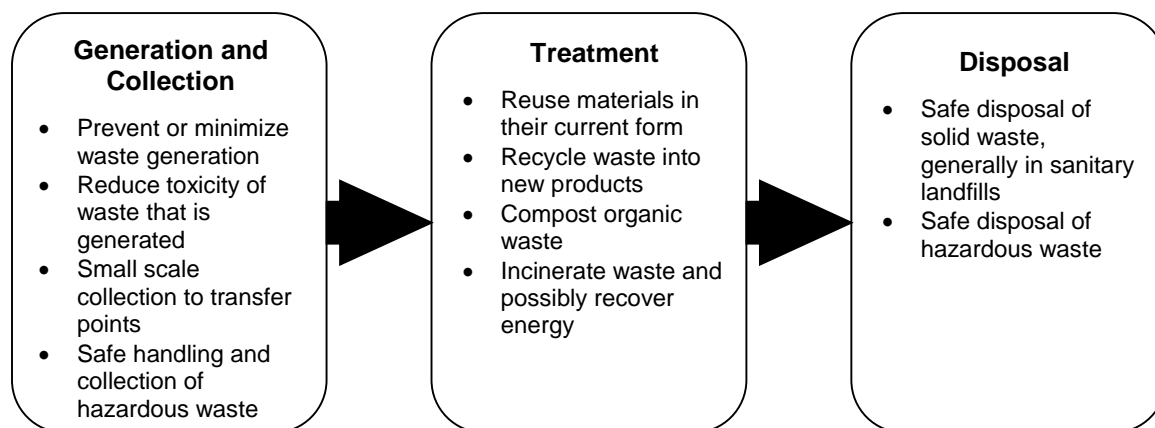
# Technical Brief: Solid Waste Management

## 1 Introduction

The term “waste” has a different meaning for different people. In general, one can say that waste is a product or material that is ‘unwanted’ and does not have value anymore for the person who throws it away. But ‘unwanted’ is subjective and the waste could have value for another person in a different circumstance, or even in a different culture (WASTE, 2001). Waste is often called other names like rubbish, trash, refuse or garbage. Human and animal excreta are not considered to be solid waste and are managed differently as discussed in the CAWST’s Technical Briefs on Introduction to Sanitation and Animal Excreta Management.

Integrated waste management is a process with different stages where intervention activities can be effective. Generally, the earlier a waste management activity is practiced in the process, the better. This is also commonly known as the waste management hierarchy.

### Waste Management Stages and Activities



Solid waste is uncontrolled in many parts of the world. A typical solid waste management system in a developing country has a variety of problems, including:

- Low collection coverage
- Irregular collection services
- Open dumping
- Uncontrolled burning
- Air and water pollution
- Breeding of disease vectors
- Unsafe handling through informal waste management activities (e.g., waste picking)

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## Risks Associated with Poor Waste Management

- Breeding sites for disease vectors, including flies, mosquitos and rodents
- Air, water and general pollution resulting in respiratory problems, poor water quality, and decline in living conditions
- Fires in uncontrolled dump sites
- Unsafe human contact with hazardous waste
- Blocked drains causing increased flooding, especially in high density urban areas



## 2 Waste Generation and Collection

The poor in developing countries produce significantly less waste (about 0.4 to 0.9 kg per person per day) than people living in industrialized countries (between 1.1 and 5.07 kg per person per day). The poor living in rural communities also tend to produce less waste than those living in urban areas since they have less income and less access to consumer products. However, urbanization and rising incomes will eventually lead to people using more resources and therefore generating more waste (Hoornweg and Thomas, 1999).

Waste composition—or what waste is made of— is also influenced by external factors such as geographical location, the population's standard of living, energy source and weather. Generally, the waste produced by low and middle income countries contains a high percentage of organic material, ranging from 40 to 85% of the total. As populations become wealthier and more urbanized, their waste composition changes to have a higher percentage of consumer packaging materials such as paper, plastic, glass, and metal (Hoornweg and Thomas, 1999).

Minimizing the amount of waste a community generates reduces the need for collection and the cost for collection services. Collection can account for almost 50% of the total annual cost of urban solid waste management (Tchobanoglous *et al.*, 1993).

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Most urban centres have some kind of waste collection and disposal service. These services often only cover the wealthier sections of the city. Peri-urban and unplanned, informal housing areas may have no or limited service, and in these settings waste is usually collected from centralized points located at the perimeter of the area. In such cases, large scale methods of transport (e.g., trucks, compactors) won't usually work because of the width, slope, congestion, and surface of the roads. A possible solution in densely populated communities is to use hand carts, semi-motorized carts, front-loaded tricycles, or carts pulled by animals to transport waste to a transfer point.



Motorcycle and solid waste cart  
(Credit: Shaw)

### 3 Waste Treatment

Solid waste treatment includes the following activities:

- Reuse materials in their current form (e.g., wearing clothes passed on from a neighbour)
- Recycle waste into new products (e.g., aluminium from cans is melted down and made into new cans)
- Compost organic waste and create a soil amendment
- Incinerate waste and possibly recover energy

#### 3.1 Recycling

Separating and recycling paper, metal, plastic, and glass is already a common practice in developing countries since it is a way for many people to informally earn a living. Materials that have high market prices are often recycled, and include paper, glass, and metal.

In developing countries, recycling is usually part of the informal sector (i.e., individuals or working teams who are not usually incorporated or registered as a business; do not keep formal accounting books; and do not usually pay license fees or taxes). Often it is waste pickers who sort out recyclable materials from mixed waste at gutters, street bins and piles, markets, transfer points, collection trucks, and dumps (legal and illegal). They generally sell the recyclables to a middleman who in turn sells it to a company that will use or export the material. Without the activities of the informal sector, much more waste would end up in dumps or the environment.



Informal sector activities are seldom recognized, supported or promoted by the local authorities. Waste picking is one of the highest risk jobs in urban areas, especially for children. Waste pickers live and work in very poor conditions (often at the dump site), and are subject to social stigma and frequent harassment.

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## 3.2 Composting

Composting is a natural process that decomposes organic material (i.e., material that once came from a living thing) into a valuable soil amendment that can be used for agriculture. Composting is especially appropriate in many developing countries and has the following benefits:

- Diverts waste from collection, transportation and disposal, especially since as much as 85% of the waste stream in low- and middle- income countries can be composted
- Improves the quality of recyclable materials since they are not contaminated with organic material
- Reduces landfill leachate and methane gas (a greenhouse gas that is 21 times more powerful than carbon dioxide)
- Enhances the effectiveness of fertilizers in agriculture
- Can be implemented at different levels, from households to large-scale centralized facilities
- Can be started with very little capital and operating costs
- Accommodates seasonal waste fluctuations, such as leaves and crop residue after harvest

(Adapted from Hoornweg et al., 1999)

Composting is a traditional practice that is already used in many rural communities to manage household and agricultural waste, but can also be done in peri-urban and urban areas. Household composting can be a simple way to manage kitchen and garden waste. It's most appropriate for homes that have enough space in their yard for the compost piles, and where they can use the final compost product in their own gardens.



Composting can take anywhere from two months in hot and humid countries with well-tended compost piles to a few years in colder countries with untended compost piles. The process needs water, oxygen, and organic materials such as household food waste and agricultural waste (e.g. husks, leaves).

There are many different composting designs and options. Composting units can be made out of locally available materials such as wood, bamboo, clay bricks, and wire mesh. The design and operation of the composters should not attract rodents, insects, or other scavenging animals. Keeping meat, fish, bones, dairy, cooked and fatty food out of the composter is the best way to keep pests away from the unit.



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Vermicomposting may also work in developing countries, especially for households in urban centers with little land space. This process uses the natural digestion of redworms and earthworms to break down organic material. From the moment it hatches, a worm can consume daily its body weight in organic matter such as vegetables, fruit, leaves, grass, meat, fish, sludge, cardboard, and paper. The worms can be housed in any ventilated container with a lid that has drainage holes or a layer of gravel in the bottom to let liquid created in the process to drain.

Further details about composting are provided in CAWST's Technical Brief: Composting.

### 3.3 Incineration

Incineration burns waste at extremely high temperatures in a controlled environment and turns it into ash, gas, and heat. It is usually done to reduce the amount of waste to be disposed, and in some cases, the heat generated by incineration can be also used to generate electric power. Incineration is also a popular option for treating some hazardous waste, like medical waste produced by clinics and hospitals.

Incineration is commonly used to treat waste in industrialized countries where there is little space for landfill disposal, especially in Europe and Japan. Modern, large-scale incineration facilities use advanced technology and are designed by engineers to protect people and the environment from odours, dust, and air pollution.

Large-scale incineration facilities are not as common in developing countries due to the high cost and complexity of the technology. Simple burning of waste is more commonly practiced in developing countries to reduce the volume of waste to be disposed. However, burning is not the best option for waste treatment since it releases harmful chemicals into the air. It creates thick smoke that contains carbon monoxide, nitrogen oxide, and soot; all of which are hazardous to human health and air quality. In particular, burning plastic like polyvinyl chloride (PVC) is very harmful since it produces chemicals that can cause cancer. There are some materials (such as wood, paper, and construction debris) that are less harmful when burned and are commonly used as fuel for cooking and heating.

It may be necessary to burn household waste if landfill space is very limited. In this case, it is best to burn the waste as far away as possible from people, keep it contained in a pit or barrel to prevent the fire from uncontrolled spreading, and burn it as hot as possible. The ashes may be contaminated and should be disposed of in a pit or landfill.

## 4 Disposal

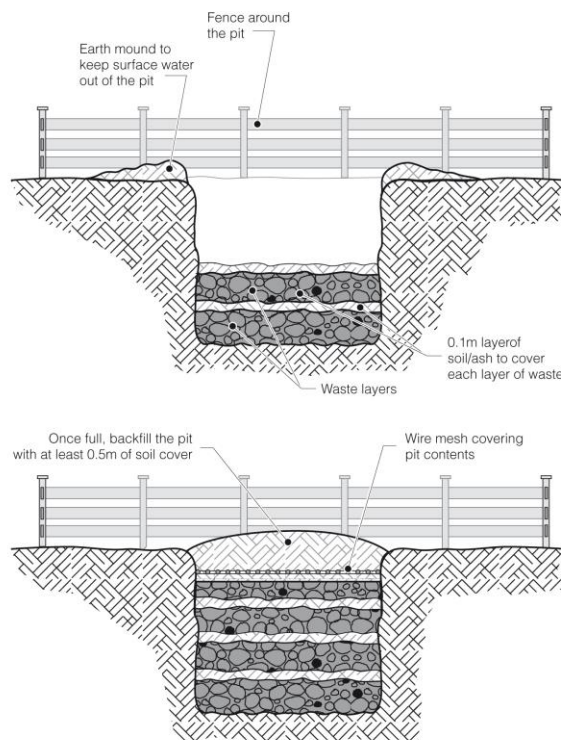
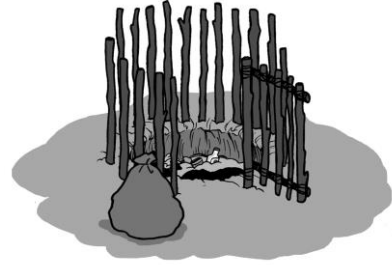
All communities will produce some waste even with the best minimization and treatment practices. The most common way to deal with this waste is to bury it. In industrialized countries, waste is disposed in sanitary landfills which are engineered to meet environmental regulations. A sanitary landfill is designed to protect soil, ground and surface water; reduce odours and pests; capture leachate; and reduce harmful gas emissions. Sanitary landfills can be found in large cities in some developing countries. However, open dumping is more common due to a lack of the resources needed to properly construct and operate a sanitary landfill.

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In small rural communities that produce relatively small quantities of waste, households can manage their waste disposal on-site. In larger rural communities, waste disposal may be best managed as a community service, with one or several conveniently located, large waste disposal sites shared by everyone. In this case, individuals can either transport their own waste to the site or organize a collection service similar to those found in urban areas.

The following are best practices for locating and maintaining a small-scale waste disposal site:

- Locate the site at least 500 metres away and downhill from drinking water sources.
- Ensure that there is at least 2 metres between the bottom of the disposal pit and the highest annual groundwater level. The more distance between the bottom of the pit and the groundwater, the lower the risk of contamination.
- Do not dispose waste in an area susceptible to flooding.
- Locate the site in clay-like soil if possible. The smaller the soil grain size, the lower the risk of soil and groundwater contamination. Do not dispose waste in sandy areas.
- Cover waste with 0.1 metres of soil or ash regularly (e.g., daily or weekly) to reduce smells and pests, and prevent waste from blowing away.
- Construct a fence to keep animals and children out of the disposal site.
- Once full, backfill the pit with at least 0.5 meters of soil cover.



Design of a solid waste disposal pit (Credit: Chatterton, WEDC)

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## 5 Hazardous Waste

Proper collection, treatment and disposal of hazardous waste is a large problem in developing countries. Hazardous waste includes:

- Toxic waste
- Medical waste
- Pharmaceuticals
- Chemicals
- Batteries

This waste needs specialized collection and treatment beyond just putting it in a landfill. However, much of the risk from hazardous waste occurs in the stages before disposal. For example, needles from syringes that are not separated from the regular waste can pose a large health threat to waste collectors and waste pickers.

In many cases, the technology needed to treat and dispose of hazardous waste is not affordable or feasible (i.e., incinerators). However, there are actions that can be taken to minimize exposure to hazardous waste such as:

- Use less hazardous materials as substitutes
- Separate hazardous waste from general household waste
- Use better storage before and during collection of hazardous waste
- Dispose hazardous waste in a separate landfill site from general household waste
- Take medical waste to a local health care facility for disposal, if available



### **Hazardous Waste Management**

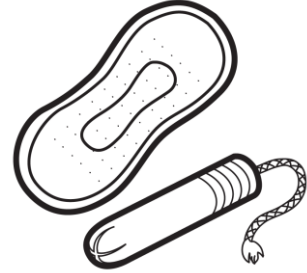
- **Do not reuse** containers that held hazardous material.
- **Do not burn** hazardous waste.
- **Do not dispose** hazardous waste in latrines, drainage channels, water sources or on the ground.



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## 6 Menstrual Hygiene Waste

Women and girls need to use clean material to absorb or collect their menstrual blood. Sanitary pads or tampons are most commonly used and these are normally changed around four times a day during menstruation. Some sanitary pads are meant for single use and are disposed afterwards, while others can be washed and reused. It is estimated that most women will use between 7,000 to 10,000 sanitary pads or tampons in their life. On average, a woman throws away 125 to 150 kg of sanitary pads, tampons and applicators in her lifetime (House et al., 2012).



To manage menstruation hygienically and with dignity, it is essential that women and girls have a way to safely dispose used sanitary products at home, in schools and in public places. Waste management facilities needed for menstrual hygiene include the following:

- A discrete, washable container with a lid in which sanitary products can be temporarily stored
- Collection, transfer and emptying of the containers
- Treatment and final disposal of sanitary products through incineration, burying or other method

Each stage of menstrual waste management must be discrete and not cause embarrassment to women and girls by taking the following into consideration:

- The collection point should offer privacy
- Final disposal should not be near to male latrines or involve walking past groups of men or boys
- In schools, students may be embarrassed to see their female teachers disposing of their sanitary products, so separate disposal facilities or times for students and teachers may be necessary



The waste chain should also be hygienic and not cause risks to those responsible for operating it. Methods sometimes used for the treatment and final disposal of sanitary products include:

- Incineration
- Composting of biodegradable products
- Disposal into a latrine
- Disposal into a small-scale pit
- Disposal into a regular waste management collection and disposal system

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When there is no convenient method for disposing sanitary products, women and girls often throw them into latrines. Potential problems with this disposal method can be:

- The sanitary products can easily block pour flush latrines
- Pit latrines can fill up more quickly
- Non-biodegradable sanitary products can pose a challenge for the degradation process in composting latrines
- It can also cause problems with pumps and vacuum trucks when emptying pit latrines

(House et al., 2012)

Further details are provided in CAWST's Technical Brief: Menstrual Hygiene Management.

### 7 Solid Waste Attitudes

Waste management is often a very low priority for people, even though it is an obvious and very visible issue in many rural, peri-urban and urban communities. Generally, individuals and communities prioritize safe drinking water projects above sanitation, and especially above solid waste management.

Other attitudes that may have to be overcome are stigmas that are attached to the handling of waste. Some cultures may not find it acceptable to handle waste or find it inconvenient to separate waste. They may also look poorly upon those whose job it is to collect or transport the waste, in particular waste pickers who are not officially recognized.

It may be difficult to change people's attitudes and behaviours. Behaviour change is necessary to get people to spend the effort, time and money needed to separate waste (into recyclables, compostable material and general waste) and to treat and dispose of it properly. Community desire and awareness coupled with culturally sensitive and appropriate solutions are necessary for a successful solid waste project.



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## 8 Additional Resources

CAWST (2013). Technical Brief: Composting. CAWST, Calgary, Canada. Available at: [www.cawst.org/resources](http://www.cawst.org/resources).

- This technical brief discusses how to safely and properly compost organic waste in developing countries.

CAWST (2013). Technical Brief: Menstrual Hygiene Management. CAWST, Calgary, Canada. Available at: [www.cawst.org/resources](http://www.cawst.org/resources).

- This technical brief discusses the challenges of menstrual hygiene management, including a lack of access to appropriate sanitation facilities, for women and girls in developing countries.

UN-HABITAT (2010). Solid Waste in the World's Cities. London, UK. Available at: [http://www.waste.nl/sites/waste.nl/files/product/files/swm\\_in\\_world\\_cities\\_2010.pdf](http://www.waste.nl/sites/waste.nl/files/product/files/swm_in_world_cities_2010.pdf)

- The goal of this book is to enable decision-makers to develop and implement solutions to meet solid waste needs in cities around the world.

House, S., Mahon, T. and S. Cavill (2012). Menstrual Hygiene Matters: A Resource for Improving Menstrual Hygiene Around the World. WaterAid, London, UK. Available at: [www.wateraid.org/what-we-do/our-approach/research-and-publications/view-publication?id=02309d73-8e41-4d04-b2ef-6641f6616a4f&sc\\_lang=en](http://www.wateraid.org/what-we-do/our-approach/research-and-publications/view-publication?id=02309d73-8e41-4d04-b2ef-6641f6616a4f&sc_lang=en)

- This resource includes a range of technical options for waste collection containers and incinerators to handle menstrual hygiene waste.

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