



# What Is Integrated Solid Waste Management?

**T**his fact sheet provides an overview of options for managing solid waste, identifies the important issues you should consider when planning for solid waste management, and describes the link between solid waste management and climate change. The other fact sheets in this series include:

- How To Establish Recycling and Composting Programs
- What Are the Components of Waste Collection and Transport?
- What Are the Options for Waste Disposal?

## Why Is Solid Waste Management a Challenge?

Waste generation increases with population expansion and economic development. Improperly managed solid waste poses a risk to human health and the environment. Uncontrolled dumping and improper waste handling causes a variety of problems, including contaminating water, attracting insects and rodents, and increasing flooding due to blocked drainage canals or gullies. In addition, it may result in safety hazards from fires or explosions. Improper waste management also increases greenhouse gas (GHG) emissions, which contribute to climate change (for more information on climate change and the impacts from solid waste, see next page). Planning for and implementing a comprehensive program for waste collection, transport, and disposal—along with activities to prevent or recycle waste—can eliminate these problems.

## What Is Integrated Solid Waste Management?

Integrated Solid Waste Management (ISWM) is a comprehensive waste prevention, recycling, composting, and disposal program. An effective ISWM system considers how to prevent, recycle, and manage solid waste in ways that most effectively protect human health and the environment. ISWM involves evaluating local needs and conditions, and then selecting and combining the most appropriate waste management activities for those conditions. The major ISWM activities are waste prevention, recycling and composting, and combustion and disposal in properly designed, constructed, and managed landfills (see Figure 1). Each of these activities requires careful planning, financing, collection, and transport, all of which are discussed in this and the other fact sheets.



- **Waste Prevention.** Waste prevention—also called “source reduction”—seeks to prevent waste from being generated. Waste prevention strategies include using less packaging, designing products to last longer, and reusing products and materials. Waste prevention helps reduce handling, treatment, and disposal costs and ultimately reduces the generation of methane.
- **Recycling and Composting.** Recycling is a process that involves collecting, reprocessing, and/or recovering certain waste materials (e.g., glass, metal, plastics, paper) to make new materials or products. Some recycled organic materials are rich in nutrients and can be used to improve soils. The conversion of waste materials into soil additives is called composting. Recycling and composting generate many environmental and economic benefits. For example, they create jobs and income, supply valuable raw materials to industry, produce soil-enhancing compost, and reduce greenhouse gas emissions and the number of landfills and combustion facilities.
- **Disposal (landfilling and combustion).** These activities are used to manage waste that cannot be prevented or recycled. One way to dispose of

waste is to place it in properly designed, constructed, and managed landfills, where it is safely contained. Another way to handle this waste is through combustion. Combustion is the controlled burning of waste, which helps reduce its volume. If the technology is available, properly designed, constructed, and managed landfills can be used to generate energy by recovering methane. Similarly, combustion facilities produce steam and water as a byproduct that can be used to generate energy.

### Developing a Plan for Integrated Solid Waste Management

Planning is the first step in designing or improving a waste management system. Waste management planners should, for example, take into consideration institutional, social, financial, economic, technical, and environmental factors (see Table 1). These factors vary from place to place. Based on these factors, each community has the challenge of selecting the combination of waste management activities that best suits its needs.

Because integrated solid waste management involves both short- and long-term choices, it is critical to

**Figure 1—Integrated Solid Waste Management**



set achievable goals. While developing your ISWM plan, you should identify goals or objectives (e.g., protect human health, protect water supplies, eliminate open dumping, increase recycling or composting). The ISWM plan will help guide you through the implementation process. Do not neglect

to ask for the community's input in developing your plan, so as to ensure an informed public and to increase public acceptance.

Government plays an important role in developing and enforcing waste management standards, providing funding, and managing day-to-day

**Table 1 - Important Questions to Consider and Steps to Take When Developing an Integrated Solid Waste Management Plan**

FACTORS	QUESTIONS TO CONSIDER	STEPS TO TAKE
<b>Institutional</b> (laws and processes)	<b>Are existing laws and policies adequate to allow the government to properly implement ISWM?</b>	<ul style="list-style-type: none"> <li>Establish a national policy and pass laws on solid waste management standards and practices.</li> <li>Identify the roles and responsibilities of each level of government.</li> <li>Ensure the local government has the authority and resources to implement an ISWM plan.</li> </ul>
<b>Social</b> (local customs and religious practices, public education)	<b>What types of waste does your community generate and how it is managed?</b>	<ul style="list-style-type: none"> <li>Encourage citizen participation in all phases of waste management planning to help gain community awareness, input, and acceptance.</li> </ul>
<b>Financial</b> (funding)	<b>Where will you go to get funds for creating a solid waste management system?</b>	<ul style="list-style-type: none"> <li>Identify sources that can provide funding for solid waste management, including general revenues or user fees, the private sector, and government or international agency grants and loans.</li> </ul>
<b>Economic</b> (costs and job creation)	<b>What will it cost to implement various waste management activities?</b>	<ul style="list-style-type: none"> <li>Calculate the initial capital investment requirements and long-term operating and maintenance costs associated with the various waste management activities.</li> <li>Evaluate the public's ability and willingness to pay.</li> <li>Evaluate activities based on effectiveness in handling waste and potential for job creation.</li> </ul>
<b>Technical</b> (location and equipment)	<b>Where will you build collection and disposal facilities and what equipment will you need?</b>	<ul style="list-style-type: none"> <li>Include geological factors, transport distances, and projected waste generation in siting and design considerations.</li> <li>Determine what equipment and training will be necessary to perform the waste management tasks. (See <i>How To Establish Recycling and Composting Programs</i>, <i>What Are the Components of Waste Collection and Transport?</i>, and <i>What Are the Options for Waste Disposal?</i> fact sheets.)</li> </ul>
<b>Environmental</b> (natural resources and human health)	<b>Will solid waste management activities (e.g., landfilling or combustion) affect the environment?</b>	<ul style="list-style-type: none"> <li>Establish procedures to verify the protection of groundwater and drinking water.</li> <li>Monitor compliance with the national standards to ensure human health risks are minimized.</li> </ul>

operations of solid waste management activities. Each level of government may have responsibility in your ISWM plan: national governments typically set standards for solid waste management; the state, provincial, or regional governments may help monitor and enforce these standards; and local governments often play the primary role of managing solid waste activities on a daily basis. All levels may also provide funding for solid waste management activities. Two primary costs must be considered in any waste management system: initial capital costs (to purchase equipment or construct new facilities) and ongoing operations and maintenance costs. These costs can be funded in a number of ways including private equity, government loans, local taxes, or users fees.

## Implementing an Integrated Solid Waste Management Plan

Once you have developed and written your solid waste management plan, you can begin to implement the various combinations of waste

management activities. Implementing an ISWM plan is an ongoing process, so expect to make adjustments to the plan along the way. Always evaluate system inefficiencies and make adjustments to improve or expand solid waste management services. Figure 2 (on back page) illustrates how you can implement an ISWM plan. Some of these questions may have been answered during development of the ISWM plan, but it is important to see how they fit into the comprehensive implementation process. Equally important, it emphasizes the need to provide public education and keep the community involved in every step of the process.

Be flexible and creative when implementing your plan. If you are not making progress in a certain area, be prepared to reevaluate components of your plan. It is helpful to keep in mind the ultimate goal of ISWM: to improve human health and protect the environment.

### DEFINITIONS

**Combustion:** Refers to controlled burning of waste with environmental control technology to reduce the waste volume and generate energy.

**Composting:** The controlled aerobic biological decomposition of organic matter, such as food scraps and plant matter, into humus, a soil-like material.

**Aerobic:** Decomposition process in the presence of oxygen (see “composting”).

**Anaerobic:** Decomposition process in the absence of oxygen (see “methane”).

**Landfill:** Disposal site for nonhazardous solid wastes. The waste is spread into layers, compacted to reduce its volume, and covered by material such as clay or soil, which is applied at the end of each operating day.

**Methane:** Gas generated when wastes in a landfill decompose anaerobically; comprises approximately 50 percent of the gases emitted from landfills.

**Recycling:** The act of collecting, reprocessing, and/or recovering certain waste materials to make new materials or products

# What Is the Relationship Between Climate Change and Solid Waste?

## WHAT IS THE GREENHOUSE EFFECT?

The Earth's atmosphere contains many types of gases, including those known as "greenhouse gases," which hold in the sun's warmth (see text box). Scientists call this naturally occurring phenomenon the "greenhouse effect." Greenhouse gases help regulate global temperatures. Certain human activities such as burning fossil fuels and dumping solid waste, however, produce additional greenhouse gases and upset the natural balance by raising global temperatures.

## WHY SHOULD I BE CONCERNED ABOUT GREENHOUSE GAS EMISSIONS?

Greenhouse gas emissions are slowly changing the Earth's climate. The Earth has already become slightly warmer in the past 100 years and will continue to become warmer. This could cause serious human health and environmental consequences because a warmer climate may cause more frequent and severe heat waves, damage agriculture, and cause droughts in some places and floods in others.

## HOW DOES SOLID WASTE IMPACT CLIMATE CHANGE?

Even before a material or product becomes solid waste, it goes through a long cycle that involves removing and processing raw materials, manufacturing the product, transporting the materials and products to markets, and using energy to operate the product. Each of these activities has the potential to generate greenhouse gas emissions through one or more of the following means:

- **Energy consumption.** Extracting and processing raw materials, manufacturing products, and transporting materials and products to markets all generate greenhouse gas emissions by consuming energy from fossil fuels.
- **Methane emissions.** When organic waste decomposes in landfills, it generates methane, a greenhouse gas.

- **Carbon storage.** Trees absorb carbon dioxide, a greenhouse gas, from the air and store it in wood through carbon sequestration. Waste prevention and recycling of wood and paper products allow more trees to remain standing in the forest, where they can continue to remove carbon dioxide from the air, which helps minimize climate change impacts.

Different wastes and waste management activities have varying impacts on energy consumption, methane emissions, and carbon storage. For example, recycling reduces greenhouse gas emissions by preventing methane emissions from landfills or open dumps and by preventing the consumption of energy for extracting and processing raw materials. Communities that are looking for ways to help prevent climate change can start by implementing an integrated solid waste management program.

## WHAT ARE GREENHOUSE GASES?

Some greenhouse gases—such as water vapor, carbon dioxide, methane, nitrous oxide, and ozone—occur naturally in the atmosphere, while others result from human activities.

**Carbon dioxide** is released to the atmosphere when solid waste, fossil fuels (oil, natural gas, and coal), and wood and wood products are burned. **Methane** is emitted during the production and transport of coal, natural gas, and oil; the decomposition of organic wastes in municipal solid waste landfills; and by livestock. **Nitrous oxide** is emitted during agricultural and industrial activities, as well as during the combustion of solid waste and fossil fuels.

Each greenhouse gas differs in its ability to trap heat in the atmosphere. Methane traps over 21 times more heat than carbon dioxide, and nitrous oxide absorbs 310 times more than carbon dioxide. The higher the heat trapping potential of the gas, the greater the impact on climate change. Efforts to decrease emissions of these gases help reduce climate change impacts.

**Figure 2—Comprehensive Integrated Solid Waste Management Planning Process**

