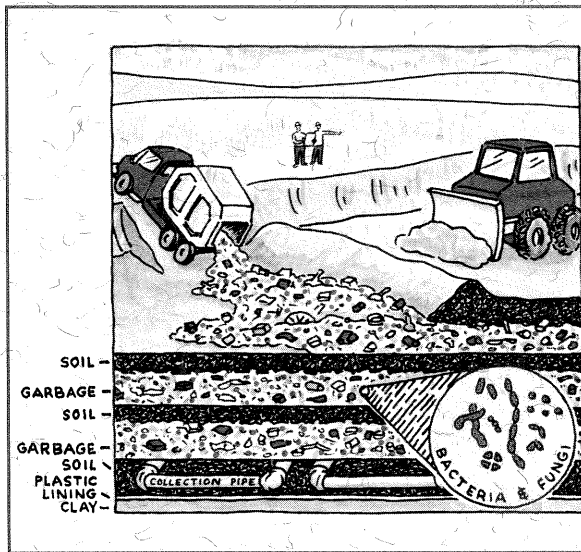


LANDFILLS

Next time you drop something into the trash can, think about where it will end up — about 16% of our trash is incinerated (burned) and 22% recycled, leaving 62% to be buried in landfills.



gas collection systems, groundwater monitoring, and protective liners, localities merely found a gorge or scooped out a pit and dumped in their wastes. Vermin, odors, contaminated water, and fires were some of consequences.

A landfill is a specially designed facility for the burial of municipal solid waste (or other specially-designated waste). Although it is now apparent that in most locations there is no immediate crisis in landfill capacity, landfills remain a relatively finite resource with current technologies. Continued suburban sprawl combined with public antagonism force location of new facilities farther and farther away from the centers of the populations they serve, driving waste transportation costs to prohibitive levels. Longer distances to landfills also mean greater environmental impacts.

HISTORY OF THE LANDFILL

In earlier farming societies, people burned garbage and fed food waste to livestock. As urban development continued, dumps or open pits were used for a city's trash; but these sites lacked regulation and resulted in contamination. Before leachate and methane

In the 1960's and 70's, with more and more people in industrialized countries becoming environmentally conscious, governments began to ban uncontrolled dumps. Today, design and performance standards regulate monitored landfill sites. These sites often accept trash from distant locations, creating landfills of phenomenal size. The Fresh Kills Landfill on Staten Island in New York accepts all of New York City's residential and institutional waste, and is thus the largest in the United States. It receives up to 17,000 tons of garbage six days a week, and is 3,000 acres and 25 times the volume of the Great Pyramid of Giza.

While solid waste management approaches vary across the United States, it is interesting to note that the "average" recycling figure of 22% quoted above is still below the U.S. Environmental Protection Agency's (EPA) initial goal of 25% recycling.



Clearly, the development of solid waste solutions is far from complete.

Waste reduction and recycling remain the ideal solutions. However, the gulf between the variety and sophistication of disposed materials and the technology to recover those materials remains enormous.

Although incineration does reduce waste volume, increasingly expensive current technology, along with its more stringent emission controls, results in a larger amount of ash. In addition, the resulting ash is subject to testing as a toxic hazardous waste, yielding further potential disposal challenges.

The United States and other countries around the world are beginning to recognize the need for an "integrated" solid waste management approach. This approach includes a combination of waste prevention, waste reduction and disposal techniques that can be used to effectively manage the problem of municipal solid waste. By reducing, reusing, recycling, and composting "waste" materials, less materials will appear in the waste stream to go to landfills or incinerators.

WHAT HAPPENS IN A LANDFILL?

Three classes of soil-dwelling bacteria and fungi interact to degrade garbage. *Cellulolytic microbes* initiate the process by breaking down the cellulose in paper, wood, and other plant wastes. Then *acidogens* ferment these sugars into acids, which *methanogens* convert into carbon dioxide and methane. Thus, the waste in a landfill changes with time.

Although green advertising claims such as photodegradable and biodegradable sound good, they aren't always genuine. Plastics labeled biodegradable due to the addition of starch simply disintegrate into tiny non-degradable pieces after the starch has been degraded. Photodegradable plastics cannot degrade in a garbage can or in a landfill: their breakdown requires exposure to sunlight.

To protect the environment, modern landfills are designed to isolate their contents from the environment. Layers of soil seal the waste from air and light. When landfills are closed, additional liners and caps seal the landfill, acting to greatly slow all waste degradation. Therefore, even organics such as food or paper can take decades to deteriorate.

Researchers have unearthed cabbages, carrots, and readable newspapers that have been buried in landfills for over 30 years.

Some researchers are trying to turn sanitary landfills from permanent repositories for waste into biological reactors. They are trying to change the entire concept of landfilling from a tomb for waste to a method for processing it. New designs and operating procedures, if allowed to develop, may transform landfills into a component of recycling and reuse systems. Combined with landfill mining and processing technology for the mined materials, the possibility of re-using landfill capacity exists.

TYPES OF MATERIALS LANDFILLED

Municipal solid waste landfills are filled with everything we throw away, from unrecycled glass bottles, which will virtually never deteriorate in a landfill, to grass clippings and other yard wastes which constitute nearly 20% of all garbage landfilled. Grass clippings could easily be left on lawns, or composted along with other yard and organic wastes and eventually placed on flower and vegetable gardens to provide nutrients.

Disposable and nondurable (made to last less than three years) products and packaging materials are major culprits in the growth of waste. In just one day, Americans toss out 150,000 tons of packaging material; this would fill about 10,000 tractor trailers, which would stretch 120 miles end to end. (Source: *Garbage* magazine)

Although largely hidden from the public by design, waste management is a very big operation in any town or city. After the retailer and consumer have reaped the sales advantages of extravagant and often bulky packaging and the convenience of throw-away products, the citizen pays, through taxes or other fees, for the hidden cost: disposal. Citizens also pay a less obvious price through depletion of natural resources, reduced habitat and a variety of other environmental impacts.

ENVIRONMENTAL CHALLENGES

Disposal safety depends more on how a waste facility is designed and managed than on the characteristics of any single material that is being disposed. Improper or inadequate design and

operation of waste control systems may cause contamination of aquifers, air pollution, breed disease-carrying vermin, or result in fires and explosions.

Current landfill technologies bring with them a number of operational difficulties and potential environmental challenges:

- Methane gas is produced in a landfill by anaerobic (without oxygen) decomposition. The gas may be collected using current technology and then used to generate electricity, or it can be purified and used as a power-generating fuel. In addition, new air quality technology is able to reduce the amount of methane and other polluting gases released by landfills.
- Leachate is the thick liquid that forms when garbage decomposes. At its best, it is like very strong sewage water; at its worst, it carries with it hazardous materials dissolved from the waste. While older landfills do not have the protective designs, modern landfills have multiple liner systems consisting of clay and synthetic materials. Above these are systems to collect the leachate so that it can be treated. All these systems exist to protect groundwaters. (It should be noted that most regions are taking steps to upgrade or close older landfills to protect the environment.)
- Loose waste is a problem itself: it attracts vermin of all kinds that can carry disease, and it can fly away in the breeze. At the end of every working day, "daily cover" must be applied to minimize these problems. When a facility stops accepting waste, a final multi-layer cover at least as water-tight as the liner system must be constructed to keep liquids away from the buried waste. Vegetation is planted to protect the cap from erosion.

After the landfill is closed, the degradation and settlement of the contents eventually reaches completion and stabilization. Upon stabilization, some landfill sites are used as parks, playgrounds, golf courses, or other facilities. In the United States, John F. Kennedy and La Guardia Airports were both built on landfills.

HOUSEHOLD HAZARDOUS WASTES

Many of the products we use in our homes are considered hazardous materials. A hazardous material is one that is toxic or will corrode metal, burn, or explode. Be careful about what wastes you throw away: one small bottle of nail polish can leak several toxic pollutants into a landfill. If every citizen convinces him or herself that "my hazardous materials are so small they won't matter," the total problem remains enormous. Oven cleaners, batteries, motor oil, paints, varnishes, thinners, fluorescent bulbs, mercury switches, etc. should be collected and taken to a household hazardous waste drop-off site. If you are unaware of a drop-off site in your area, watch your newspaper for announcements of collection sites and dates, or call your local solid waste management organization. If there are no household hazardous waste collection programs in your area, encourage your community to start one.

Everyone pays dearly to rid themselves of trash, and costs will continue to rise in the future unless there is a reduction in the amount of waste generated and landfilled. Space is limited in existing landfills; for example, a third of the United States' landfills will be filled to capacity by the mid-1990s. Because of the NIMBY (Not In My Backyard) syndrome, which results from concern about a landfill's effects on health and the environment, there is difficulty in finding new sites to bury trash. Land for landfills is costly as a result of this resistance. Remember:

- The cost of new accessible landfill volume is soaring;
- Even with giant strides in waste processing technology, we cannot foresee a future that does not require some landfilling;
- Neither recycling nor waste-to-energy are panaceas;
- Some landfill research is seeking to change landfills from tombs to reactors that can produce useful recycled material and be at least partially reused.

Thus, we must seek to continually improve all the technologies that make up integrated waste management. As citizens, we must demand that technology continue to improve so that we can meet our increasing goals of environmental protection without bankrupting ourselves.

WHAT YOU CAN DO

Landfilling is, and will likely remain, a major component of integrated waste management. No matter what the mix of technologies in waste control, we can all help by reducing the amount of waste we generate. Because everyone contributes to the problem, everyone must become part of the solution. A combination of these efforts will lessen the problem and improve the safety and efficiency of waste management systems.

- Strictly follow your community's recycling and collection programs.
- Compost your yard wastes along with other organic wastes such as vegetable and fruit scraps, coffee grounds, egg shells, etc. Use the composted materials to provide nutrients for your flower and vegetable gardens, shrubs, and trees.
- Mulch leaves and grass clippings on your yard; select plants requiring less maintenance, such as ground covers and shrubs instead of grass.
- Shop with an environmental conscience by choosing products with less packaging, and support recycling markets by purchasing recycled and recyclable products.
- Buy durable rather than disposable products. Select those items with longer warranties — they have been designed to last longer.
- Borrow and rent durable items such as heavy equipment, power tools, books, and videos.
- Children are getting the message at an early age. Continue to encourage and support their efforts,


along with the teachers and local government programs that are trying to teach them environmental responsibility.

- Encourage your local government, employers, and employees to continue to view environmental responsibility as sound long-term economics. Join organizations that promote recycling.
- Reuse jars and containers, swap magazines and books, donate or sell used products.
- Crush plastic bottles and boxes before recycling to permit your recycler to carry more materials before needing to empty the truck.
- Take old tires, used oil, and household hazardous wastes to designated collection sites; watch your local newspaper for announcements of collection dates, or contact your local government for locations.
- Find out if your local solid waste management organization sells or gives away mulch made from municipal yard waste.
- Get involved. But before you advocate, become better educated on the current issues. Technology is not static. Learn about innovative ideas and approaches — the Air & Waste Management Association is a good place to start. Encourage your local government and waste-service providers to innovate. Inspire them to try new things that might both save money and improve environmental protection.

FOR MORE INFORMATION

about landfills and integrated waste management, read A&WMA's fact sheets on municipal waste, recycling, hazardous waste, and hazardous waste management in the U.S., and the information booklet on pollution prevention. In addition, A&WMA offers the *Municipal Solid Waste Management: The Integrated Approach* videotape for a nominal fee.

This Environmental Fact Sheet is one in a series developed by the Air & Waste Management Association's Public Information Committee. The Association also produces educational materials for schools and the general public. For more information, phone (412) 232-3444.

 Printed on recycled paper

Date of publication - October 1995