



Where Does Our Trash Go?*

Activity E.r

Grades 4 - 6

MATERIALS:

Diagrams of landfills and a waste-to-energy facility for copying or overheads.

OBJECTIVES:

Students will learn the benefits and limitations of three of the four methods of solid waste disposal: sanitary landfills, incineration, and composting. (The fourth, recycling, is discussed in other activities.) Students will learn:

The five points about landfills:

1. They are the most common form of waste disposal.
2. They are constructed on carefully chosen sites and lined to protect the environment, which is why they are called 'sanitary.' Waste deposited in landfills is covered daily with soil.
3. They are different from dumps, which are being phased out in the United States.
4. They are filled by trucks hauling garbage to the site, where it is spread out, covered with soil, and crushed and compacted with heavy equipment. Rainwater and liquids from the decomposing waste combine to create leachate, which collects at the bottom of the landfill. Leachate is pumped out and treated in a sewage treatment facility.
5. They create gases as the organic material decomposes. Half of this gas is methane, which is combustible and can be used as fuel. The rest of the gas is carbon dioxide; it, too, can be recovered and used for industrial purposes.

The four points about waste-to-energy:

1. It is a means to burn, or incinerate, garbage to ashes, which are taken to a landfill.
2. It creates heat to make steam that can drive machinery capable of producing electricity.
3. It reduces the volume of waste that is incinerated by 90 percent.
4. It does not eliminate the need for landfill to dispose of the ash or other non-combustibles, like cement and gravel.

The three points about composting:

1. It makes use of organic materials such as yard waste, food scraps, and other plant and soil materials.
2. It decomposes to create a useful, enriching soil additive called humus.
3. It saves space in landfills by recycling organic material.

PROCEDURE:

1. Read the background information on landfills, incineration, and composting.
2. Use the diagrams to help explain the main points mentioned above.

3. There may be examples of each of these disposal methods in your area or your school yard. Consider a field trip to a nearby landfill or incinerator. Walk through the school yard to see how leaves and other organic materials are decomposing right under our feet.
4. Check the students' knowledge by clarifying the five points about landfills, the four points about waste-to-energy, and the three points about composting.

TEACHER BACKGROUND ON LANDFILLS:

Today a majority of North America's waste is buried in sanitary landfills. The United States and Canada are phasing out "open" dumps because they are harmful to the environment. Dumps allow leachate to enter the groundwater; attract rodents, insects, and other disease-carrying vermin; emit odors; and create a fire hazard. Sanitary landfills contain a specially designed liner, or multiple liners, buried deep in the ground under the entire site. This liner -- think of it as a huge empty swimming pool -- protects the environment around the landfill. To guard against critters, odors, and litter, heavy machinery covers incoming waste with soil each day.

If carefully constructed in a suitable geological location, sanitary landfills are environmentally sound, which is why they are called sanitary. Here's how landfilling works:

Garbage is hauled from households and industries to the landfill site. A fee is paid to the landfill operator based on how much trash the truck carries. This fee is called a tipping fee because the trucks lift their loads to 'tip' them on the face of the landfill.

Waste materials are unloaded, spread out, and compacted by bulldozers. At the end of each day, the waste is covered with earth. Until recently, it was believed that waste decomposed completely in landfills. However, recent studies by Professor William Rathje of the Department of Anthropology at the University of Arizona have proved this to be wrong. In his examination of waste buried for 15 years or more, he has found legible newspapers and even chicken bones with meat still on them.

At an average landfill, waste and soil are alternately layered to a depth of 10 to 30 feet (3.05 to 9.15 meters) and rise above the level of the land by 50 to 100 feet (15.24 to 30.48 meters), depending on permit requirements.

Several layers of waste comprise a cell. A cell is typically one part soil to four parts waste. Cells are built side by side and on top of each other until the landfill is completely filled.

1. Preventing Groundwater Contamination

In open dumps, liquid leaking into the soil from waste materials often contaminates groundwater, lakes, and streams. This may threaten our drinking water.

A sanitary landfill, however, is lined with clay, thick man-made plastics, or both to prevent harmful fluids from leaking into groundwater. This liquid, called leachate, is a mixture of rainwater and other liquids created by the decomposing garbage. Leachate drains into collection pipes at the bottom of the landfill. The leachate can be treated at the landfill or at a sewage treatment plant. Landfill operators sample groundwater at the landfill regularly and send it to laboratories for analysis.

As trash decomposes, gases can be created. Decomposition creates methane, carbon dioxide, and small amounts of hydrogen sulphide. These gases can build up and move around under the ground

and eventually escape into the environment. To prevent this from happening, the gas is vented in a controlled manner or tapped to use as fuel.

2. Completed Cells and Landfills

When a cell is filled, it is closed by covering the layers of dirt and waste with a clay cap and packing it into a solid surface. Soil is then layered over the clay. When a landfill is completely filled, two to five feet of additional impermeable soil is placed over it and grass covering, plants, and trees are planted on top. Completed landfills are monitored for leachate and gas control for 30 years after they close. That is the proposed law as of January 1990.

Landfills remain useful even after they are closed. They can be turned into parks or recreation areas.

3. The Advantages of Sanitary Landfills

Modern engineering allows landfills to protect groundwater and they are less expensive to construct and maintain than waste-to-energy plants.

They accept all types of garbage except hazardous wastes.

They are useful as recreational areas after they are full.

They are necessary to contain residue from every other process of disposal.

4. The Disadvantages of Landfills

They require specific soil types and geological conditions.

They must be accessible and close to communities. (These sites are becoming harder to find.)

They are filling up much faster than originally anticipated.

If not properly designed or managed they can cause pollution problems.

TEACHER BACKGROUND ON INCINERATION

To incinerate means to burn to ashes. The burning takes place in a combustion chamber called an incinerator. When waste is burned, the remaining ashes take up less space in our landfills. If we continue to use landfills at our present rate without replacing them, we'll run out of space very soon. We need to find new disposal methods. Incineration is one way to curb the problem.

Incineration has another benefit. Burning waste creates heat, which may be used to produce steam. The steam can generate electricity for homes and businesses. Burning waste to produce energy is known as resource recovery; incinerators are often referred to as waste-to-energy plants.

Resource recovery saves valuable landfill space and protects groundwater and drinking water. The process takes place inside a building, which traps odors. Vermin and insects are not attracted by the ash by-product.

Two problems still exist: air pollution and ash disposal. Ash from the incinerator must be tested and disposed of in a landfill. Sometimes special landfills are made just for ash disposal. They are called ashfills or monofills. (Ash takes up much less space than the same materials in their original form.) Gases may be emitted by the incineration plant, but can be controlled through complex filter systems and careful monitoring.

1. The Advantages of Incineration

It is an alternative energy source.

It can reduce the volume of waste that is incinerated by nearly 90 to 95 percent.

It traps odors inside; it eliminates vermin and insects.

2. The Disadvantages of Incineration

In order to eliminate gases emitted into the atmosphere, it requires special devices that are costly to build and must be carefully monitored and maintained.

Landfills are needed to dispose of the ash.

Not all materials are combustible, which makes other waste disposal alternatives necessary.

*Source: Browning-Ferris Industries Mobius Curriculum: Understanding the Waste Cycle