

Name: _____ **Date:** _____ **Class/Period:** _____

Activity 2.2: Where does garbage go?

Landfill:

How does it work?	What are the advantages?	What are the disadvantages?

Incinerator:

How does it work?	What are the advantages?	What are the disadvantages?

Ocean Dumping:

How does it work?	What are the advantages?	What are the disadvantages?

Recycling:

How does it work?	What are the advantages?	What are the disadvantages?

Landfills

A landfill is the oldest and most common form of waste disposal. Before building a landfill many factors need to be taken into consideration: topography, groundwater level, amount of precipitation, type of soil and rock, and proximity to surface water bodies, such as rivers and lakes. Very few locations fit the ideal area for a landfill site.

Landfill design needs to be very particular to meet EPA requirements, especially if the land location is not perfect. First there needs to be clay and plastic liners surrounding the site. There also needs to be a drainage system to collect and monitor water as well as another system to collect and monitor gas. Although costs to construct a landfill are moderate, continuous monitoring results in more expenses, even after the landfill stops accepting trash and closes.

Landfills also require an exact operation. Each day trash is brought to the site where it is reduced to the smallest volume possible. This trash is gathered into a “cell” and covered with a layer of compacted soil. This system helps to restrict, but not prevent, rodents, animals, and birds from interacting with the garbage. The conditions of the cells, however, do not allow biodegradable materials to decompose, as the exposure of the garbage to air and water is extremely limited.

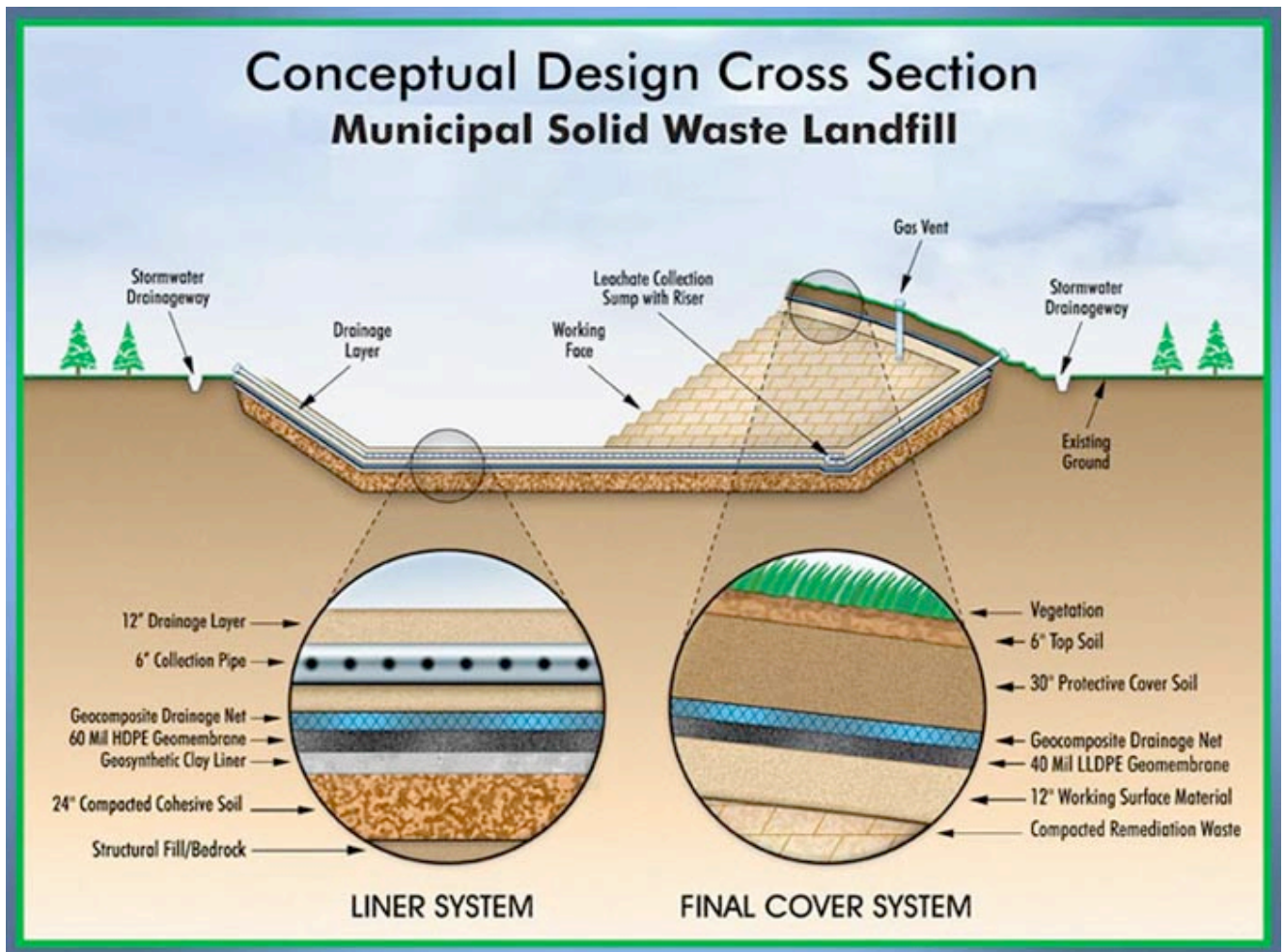
The biggest concern with landfills is water pollution. Leachate is water that has moved through the garbage and contains some of its dissolved elements. Leachate is often highly toxic to both humans and ecosystems, especially if it gets into groundwater or surface water. Advanced monitoring systems can detect the presence of leachate.

Landfills not only help humans by accepting their garbage, but can contribute to the community in other ways. Although landfills produce large amounts of methane gas which is a greenhouse gas and therefore a pollutant, if the gas is collected it can provide a source of energy for the homes in the area. Furthermore, although landfills take up a considerable amount of space, the land is still useable. If properly capped with plastic and clay liners, the site can be converted into a park, offering recreational opportunities.

It is important to note that landfills are not open dumps for garbage. They are a carefully regulated and operated waste disposal system.



Above Right: Shows a park that



Above: Shows a cross section of a typical landfill. Landfill design is very precise, especially for the liner and final cover system. Each of the brick like features above represent a cell of compacted garbage covered with soil.

Incinerators

An incinerator is a garbage disposal method which burns garbage at very high temperatures, around 1,830°F. This reduces the volume of garbage by 95%, leaving ash to be disposed of, usually in a landfill. Although incineration takes energy to reach the high temperatures, it can also generate electrical power from burning the garbage, known as the waste to energy system.

Incinerators are one of the most popular garbage disposal methods in Europe, and were developed using cutting edge technology. There are many different designs for incinerators that vary according to how it is being used and for what kinds of garbage is being burned. They can be used on a small or large scale. Incinerators are relatively expensive to build and have moderate costs to operate. They use minimal amount of land.

Incinerators are regulated primarily through air quality enforcement. The combustion of materials at high temperatures can release nitrogen and sulfur oxides into the atmosphere which can lead to acid rain. Other pollutants can include heavy metals, carbon dioxide, and dioxin, a cancer causing toxin. Modern technology, however, can contain or reduce these pollutants before they enter the environment.

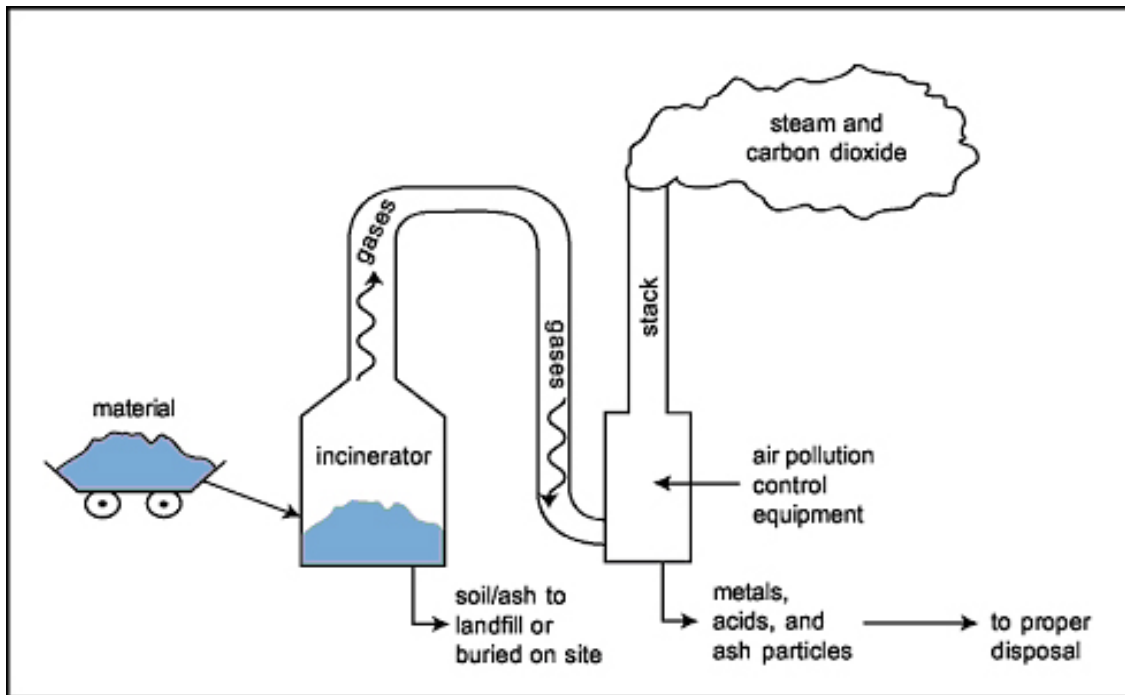
The typical incinerator can handle up to 35 tons of waste per hour and can operate 8,000 hours per year. Few people are needed to operate and maintain this disposal system. As technology continues to advance, incinerators are able to improve pollution control and become more efficient.

Incineration is relatively new but continues to grow as a preferred garbage disposal method. It is quickly becoming the dominant system in many areas. Florida is the leader in municipal incineration, burning nearly 20,000 tons of trash each day! Yet, as incineration increases recycling declines because the most burnable materials are those which can be recycled.

No changes in incineration need to be made across the seasons or during different weather patterns. There are also no strict land requirements to construct an incinerator.



Above Right: Shows an Incineration building in England.



Above: Shows a diagram of the incineration process. This is a simplified representation and details may vary with different types of incinerators.

Ocean Dumping

For a long time, oceans have been viewed as a vast space to dispose of garbage. In the U.S. most of this dumping takes place off of the East Coast in the Atlantic Ocean, however this method of waste disposal remains limited and controversial. The locations of the dumping are not random, but are planned offshore dump sites.

Many different types of garbage are disposed of in the oceans, including natural materials such as mud and sediment from expanding or dredging harbors, estuaries, or rivers. Depositing trash on the ocean floor does not interfere with other ways that we could use the land. Ocean dumping is inexpensive to implement and relatively convenient. Ocean dumping requires minimal technology and human labor.

Garbage disposed of in the ocean impacts the environment. The garbage sites could be a source of nutrients, shelter, and breeding ground for some marine species. The garbage could also release pollutants dissolved in the water, which could harm the ecosystem and animal life. These pollutants could also enter the food chain and become a wide spread issue. The garbage can also disrupt the ecosystem by changing the water's temperature and cause desalinization.

Even though there are particular dumping sites, garbage in the ocean is not contained to a certain location and can travel. This can cause garbage to appear in a location it was not intended.

Ocean dumping is a difficult garbage disposal method to monitor. In 1988, the U.S. passed an Ocean Dumping Ban Act which called for limitations on the disposal of solid wastes and sewage in the ocean.

Today people that use the ocean for recreational purposes are advised to avoid the site areas that were used for garbage disposal.



Above: Shows a picture of a ship carrying garbage to be disposed of in the ocean

Recycling

Recycling takes garbage and reprocesses it into new, potentially useful materials. This disposal method reduces the amount of raw materials and energy resources used to create new products. Although recycling does consume resources and energy, it requires less than making a product from scratch. The rise in recycling as garbage disposal was due to the increase in energy costs and fear of depleting resources. The cost of constructing and operating a recycling system is moderate to high.

Recycling plants only accept select types of garbage. The garbage accepted includes glass, paper, metal, textiles, and plastics. The sorting of these materials is often left to the consumer who must sort the garbage before throwing it away. It is also often the responsibility of the individual to make sure the recyclable materials end up at a recycling facility. The U.S. has low recycling rates compared to other countries, based on poor citizen participation.

Recycling facilities require both technology and manual labor. The system is usually comprised of many conveyor belts in which the materials need to be sorted. The garbage is sorted according to type, weight, and certain properties such as if the item is magnetic.

The process of recycling varies in complexity, depending on the type of garbage. For instance, plastics are difficult to reprocess, and some plastics cannot be recycled. Aluminum cans, on the other hand, can efficiently return to their basic form and be remade into cans. Recycling just creates more products that eventually reenter the system as garbage.

Recycling materials also can release pollutants and impact the environment. Toxins, chemicals, and solid matter can enter the atmosphere and water, degrading the ecosystem.



Above left: Shows a typical recycling plant in the U.S.



Above Right: Shows the symbol that an item is recyclable