

# HOW DO LANDFILLS WORK?

GRADES 6-8

This activity was designed as a companion for the music video “Human Landfills.”

## BACKGROUND

Humans are the only creatures that deliberately pollute, and many times we start to view garbage as something that just disappears after it is picked up by garbage trucks. We forget that hazardous materials and other waste don't just go away when we pay someone else to take care of it.

The average American generates 4.3 pounds of trash every day, which adds up to 1570 pounds each year. While some of this trash is recycled or burned, most of it finds a permanent home buried underground in landfills. As trash decomposes in a landfill it can release harmful chemicals that may affect the soil it's buried in, or the chemicals can move with the groundwater and spread to water sources that humans use. Engineers and scientists seal the trash with manmade structures as well as with the soil, so it won't be able to leak and harm wildlife or humans.

Overconsumption often leads to excessive and thoughtless disposal of items into places like landfills. Learning about the amounts of objects we use and the life cycle of each object will start us thinking in terms of conservation techniques like recycling, reusing, and – most importantly – using less. We need to respect the earth, the animals, the air we breathe, and our own bodies as we think about what happens to waste.

## OBJECTIVE

Students will learn how a sanitary landfill is made and operates, and some of the associated pollution problems that will prompt them to better understand the importance of and possible methods of conservation. Students will create their own classroom landfill and observe it for two months.

## MATERIALS

- One 5-gallon container and lid  
(examples on right)
- Clear plastic bag large enough to fit  
in the container
- Enough clay to cover container bottom
- Soil and gravel to put in the container
- Scissors
- Waste scraps to put in your container  
(explained in procedural Step 5)
- Water to sprinkle on landfill
- 3 bricks
- Utility knife
- Disposable gloves



## LANDFILL EXAMPLES

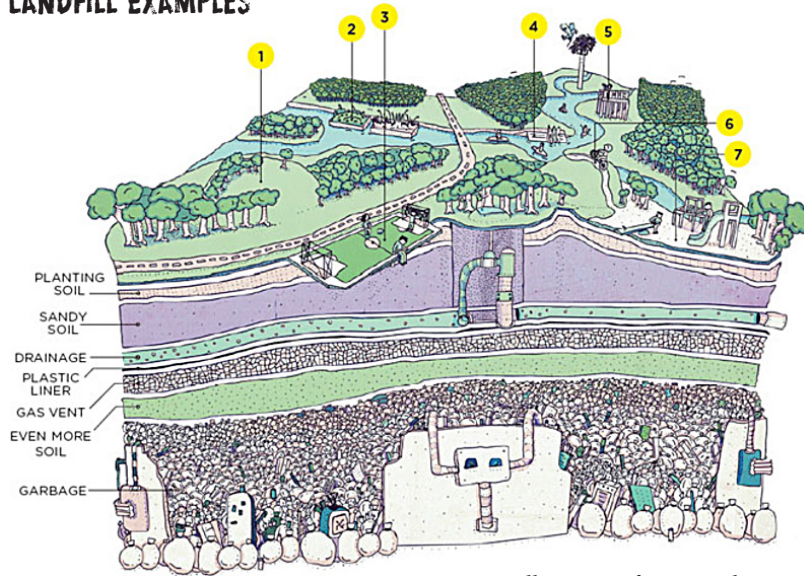


Illustration from wired.com

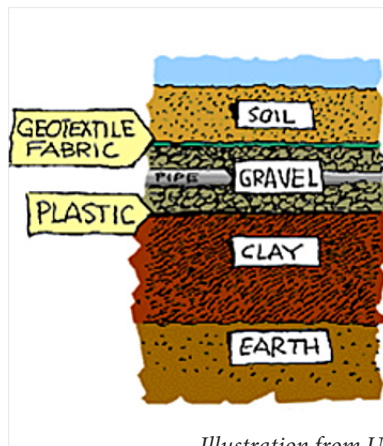


Illustration from Urban Science website

### DID YOU KNOW...

That hogs used to act as garbage disposals in New York City?

Long ago there were no garbage trucks or city dumps. In the 1700's, people threw their garbage out of their houses into the streets. Hogs roamed the streets eating the garbage.

Times have changed. Today several systems are in place to dispose of garbage. They range from burning to burying it in sanitary landfills. The current design of landfills does not promote the rapid breakdown of wastes but does help to reduce their environmental impacts. In the state of New York, all new landfills have a plastic and clay liner at least 10 feet thick under the garbage, and a four foot thick cover over the top. These layers minimize the immediate environmental impacts of landfills but exclude the water, air, and temperature changes needed to rapidly degrade waste. Still, some degradation takes place slowly over time.

## INSTRUCTIONS

In this activity, students will explore one of our modern disposal methods: the sanitary landfill. Use the following procedure to construct a small-scale replica of a sanitary landfill.

1. Using a utility knife, cut four 3-inch holes out of the bottom corners (or, if using a round container, four holes equally spaced apart as close to the edge as you can get) of a 5-gallon container.
2. Cover entire bottom of container except newly cut holes with a thin layer of clay.
3. Place a plastic bag inside the container. Pull the corners of the bag out through the holes in the bottom of the container. This will act as the leachate collection system.
4. On top of the plastic liner, place a 10-inch layer of gravel and soil and pack it down.
5. Fill the container daily with layers of small pieces of food scraps, leaves, paper, glass, aluminum, steel, and/or plastic. A good rule of thumb is one inch of waste covered by 1/4 inch of soil. Remember to always cover the waste with soil and pack it down lightly. Sprinkle a small amount of water on the landfill after each layer of waste and soil is added.

6. Repeat Step 5 daily until the mini-landfill is three-quarters full. Cover with four inches of soil. Place the container on three bricks so there will be space under the container for the corners of the plastic bag to fill with leachate.
7. Water lightly every few days to simulate rain.
8. Use the lid to cover the container and let it sit for at least two months.
9. After two months have passed, collect the leachate that ended up in the corners of the plastic bag. Wearing gloves, empty the contents of the mini-landfill to see which items decomposed and which did not.

### REFLECTION/RESPONSE

Ask students to record their observations in answering the following questions:

- Which items decomposed completely?
- Which items decomposed partially?
- Which items do not appear to have decomposed at all?
- What does the mini-landfill smell like?
- What does the leachate look like?

Have the class brainstorm the pros and cons of placing waste in landfills. Pros might include: the garbage needs to go somewhere, landfills can handle large amounts of waste, landfills keep waste away from where people live, landfills keep other places waste-free, landfills can be designed to protect the environment, and are sometimes converted into “green spaces” after closed. Cons might include: landfills take up space making it impossible for people and wildlife to use the land, landfills are ugly, they can create unpleasant odor and attract pests, things that end up in landfills are usually no longer available for people to use, and sometimes landfills leak into our groundwater supply.

Discuss some of the possible hazards that might result from an improperly designed landfill.

Discuss how a landfill violates the principal of natural decomposition (light and air are not available inside a landfill and very little moisture is allowed inside, so it is difficult for natural decomposition to occur).

Ask students to brainstorm different ways the world might look in the future if we start incorporating conservation into our lifestyles versus continuing to dispose of the amounts of waste that we do now.

To learn more about landfills, see: <http://www.newton.dep.anl.gov/askasci/gen01/gen01699.htm>

### DEFINITIONS

#### **Municipal Solid Waste (MSW) Landfills:**

Places that accept the garbage generated in our homes. This waste can be made of all types of materials that we throw away. However, MSW landfills generally do not accept materials that are considered hazardous, or they process hazardous materials separately. The by-products from landfills are methane and leachate.

**Methane (CH<sub>4</sub>)** is a greenhouse gas that remains in the atmosphere for approximately 9-15 years. Methane is over 20 times more effective in trapping heat in the atmosphere than carbon dioxide (CO<sub>2</sub>) over a 100-year period and is emitted from a variety of natural and human-influenced sources. Human-influenced sources include landfills, natural gas and petroleum systems, agricultural activities, coal mining, stationary and mobile combustion, wastewater treatment, and certain industrial processes.

**Leachate** is the liquid that comes from the trash and mixes with rainwater. Leachate and methane can be dangerous to people and to the environment. In a landfill, each day's trash is covered with a layer of soil to control rodents, odor, and scavenging birds. Landfills are lined with a thick plastic liner and clay to keep leachate from the garbage from leaking into the ground and mixing with groundwater/drinking water supplies.



Here are some pictures of leachate:



Leachate on its way to the ocean, 2010  
From *Waimanalo Gulch Landfill Spill Report*



Leachate seeps to the land surface.



Illinois EPA employees in leachate

## ADDITIONAL RESOURCES

List of landfills in Iowa: [http://iowa.localguides.com/ypcyellow/landfills.html?utm\\_source=google\\_state&utm\\_medium=cpc&utm\\_campaign=ypc&gclid=COHTiYmakLICFSdgMgodURkAgQ](http://iowa.localguides.com/ypcyellow/landfills.html?utm_source=google_state&utm_medium=cpc&utm_campaign=ypc&gclid=COHTiYmakLICFSdgMgodURkAgQ)

For ideas about how everyone can try to reduce consumption, visit: <http://www.astc.org/exhibitions/rotten/action.htm>

To learn more about the life cycle of trash, see: <http://www.advanceddisposal.com/garbage-101/education-zone/life-cycle-of-trash>

To see the typical anatomy of a landfill, check out these websites:  
[http://www.wm.com/about/community/pdfs/Anatomy\\_of\\_a\\_Landfill.pdf](http://www.wm.com/about/community/pdfs/Anatomy_of_a_Landfill.pdf)  
<http://www.advanceddisposal.com/garbage-101/education-zone/learn-about-landfills>

For more information about reducing, recycling, and the contents of landfills, see:  
<http://www.ncpublicschools.org/docs/accountability/testing/eog/reading/20080417gr5set6.pdf>

For classroom presentations on recycling, or to request more materials, this site offers a list of Iowa's education centers: <http://www.iowarecycles.org/content.asp?ID=5125>

To learn more about what happens after an object is thrown into a recycling pile, see:  
<http://www.deq.state.or.us/lq/pubs/docs/sw/curriculum/RRPart0406.pdf>

Activity adapted from the Association of Science-Technology Centers Incorporated and the Smithsonian Institution Traveling Exhibition Service: <http://cwmi.css.cornell.edu/TrashGoesToSchool/HowDoLandfills.html>