



Title: What Happens to Trash in a Landfill?

Grades: Middle School

Subjects: Social Studies, Science, Health, Language Arts

Time: 50 minutes

Objectives:

- Identify and describe the problems and concerns people have about burying trash in landfills and justify their position on the matter.
- Explain why the process of decomposition is very slow inside a landfill.
- Evaluate the EPA's five methods of integrated solid waste management and determine whether the EPA's recommendation concerning landfills is justified.

Standards:

Geography Standard 15: Understand how physical systems affect human systems.

- Benchmark # 4: Understand relationships between population density and environmental quality (e.g., the denser the population the greater the amount of waste produced and the need to dispose of it safely).

Geography Standard 16: Understand the changes that occur in the meaning, use, distribution and importance of resources.

- Benchmark # 2: Know strategies for wise management and use of resources (e.g., community programs for recycling and reuse).
- Benchmark # 5: Understand the role of technology in resource acquisition and use, and its impact on the environment (e.g., the more resources used in manufacturing results in more waste that needs to be disposed of in a safe manner).

Geography Standard 18: Understand global development and environmental issues.

- Benchmark # 2: Understand the possible impact that present conditions and patterns of consumption, production and population growth might have on the future spatial organization of Earth.
- Benchmark # 4: Understand why different points of view exist regarding contemporary geographic issues (e.g., some communities find the recycling and incineration of waste too costly or impractical, and use a landfill solution as one of their primary methods of disposal)

Technology Standard 3: Understand the relationship among science, technology, society and the individual.

- Benchmark # 3: Know ways in which technology has influenced the course of history (e.g., improvements in sanitation and waste management- garbage dump vs. sanitary landfill).

Health Standard 2: Know environmental and external factors that affect individual and community health.

- Benchmark # 3: Know ways local, state, federal and international efforts to contain an environmental crisis and prevent recurrence (e.g., solid waste contamination).

Language Arts Standard 8: Use listening and speaking strategies for different purposes.

- Benchmark # 5: Use grade level appropriate vocabulary in speech (e.g., specialized language).

Materials:

- Pencils and journals
- Soil
- Sand
- Piece of gardening fabric, large enough to fit inside the box.
- Corrugated box, at least 24 inches deep



- Leak proof container and cover, large enough to contain the box
- Collection of inorganic material: aluminum foil, plastic sandwich bags, bottle caps, wood shavings, paper scraps, etc.
- Collection of organic materials: plant leaves, coffee grounds, tea bags, rotting cranberries, blueberries, onion skins, chips, crusts of bread, pastry crumbs, etc.
- Two craft sticks
- Heavy book or weight for compacting layers
- Modeling clay
- Kitchen trash bag
- Scissors
- Rubber tubing

Overview: The average US citizen generates approximately one ton of trash annually, but seldom gives it any thought once they throw it away. This trash ends up in the waste stream where it is collected and hopefully, disposed of in a manner that least impacts the environment. This process is known as solid waste management.

The Environmental Protection Agency has designed a plan for this process, which they refer to as “integrated solid waste management”, and has identified five ways to properly handle waste materials: a) source reduction and reusing, b) recycling, c) composting, d) burning and converting it to energy, and e) burying it in a sanitary landfill. The EPA emphasizes that there is no definitive approach to waste management and encourages communities to combine these five methods to effectively address the issue.

In most communities across the country waste materials end up in at least one of three locations: a) a materials recovery facility, b) a waste-to-energy facility, or c) a landfill. A landfill is a long-term disposal solution that buries trash in as safe and sanitary manner as possible. The EPA has identified eight categories of waste that Americans typically toss into the trash and which inevitably end up in the landfills. These categories include: paper, yard trimmings, food scraps, plastics, metals, textiles-rubber-leather, glass and wood.

Once trash is deposited in a landfill it remains there for a very long time. Landfills are not designed to break down trash, just to hide it from sight. Almost no light, air or moisture reaches the trash buried in a landfill. Since all of these factors are needed to decompose material, the waste does not biodegrade very quickly. The EPA recommends land filling as a last resort in the waste management plan, after all other methods have been exhausted; however many communities find the other options too costly or impractical, and use a landfill solution as one of their primary methods of disposal.

Kid’s Speak: People throw away all sorts of materials every day, and seldom think about where they go or what happens to them. The most common types of waste items include: paper, yard trimmings, food scraps, plastics, metals, textiles – rubber-leather, glass and wood. Unfortunately, because of the way landfills are designed, the conditions needed for the trash to break down and decompose are not present. As a result trash buried in a landfill stays there for a very long time.

Eco-Fact: Fifty–five percent of the waste Americans throw away each year ends up in a landfill.

Procedures:

Before Conducting the Lesson:

- Review the EPA’s five methods of integrated solid waste management and discuss its position on use of landfills. (The EPA emphasizes that there is no definitive approach to waste management and encourages communities to combine these five methods to effectively address the issue. The EPA recommends land filling as a last resort, after all other methods have been exhausted.) Explain that waste disposal is regulated at the local level and that communities decide how to



manage waste. Many communities find the recycling and incinerations options too costly or impractical, and use a landfill solution as one of their primary methods of disposal.

- Use the diagram from a previous lesson to review with students the structure of a landfill and the function of each of its components. Refer to the pie chart to review the types of materials typically found in a landfill.
- Introduce the term biodegradability. Explain that one concern people have about landfills is that the waste buried there does not decompose quickly due to the lack of light, air and moisture, and as a result large tracts of land are continually being filled with trash. Others feel it is important to make sure landfills are carefully designed and monitored so that contaminants do not seep out of the landfill and enter drinking water supplies. Discuss the pros and cons of this issue with the students and ask them to take a position.
- Explain to students that the class is going to make a model of a landfill to attempt to simulate conditions in a landfill as closely as possible.

Conducting the Lesson:

- Place the materials out in the open where students can observe the construction of the model landfill. Have volunteers serve as members of the construction team. As the construction process begins have students record in their journals what is happening at each step, including the types of waste that is selected for disposal.
- The first volunteer will poke ten to twelve tiny holes into the bottom of the box. The student will cover the bottom of the corrugated box with a layer of clay. Ask students the purpose of this step. (To provide a barrier so moisture does not seep out of the model landfill.)
- The second volunteer will cut the plastic trash bag so that it will fit inside the box, reaching to all four sides. The volunteer will line the box with the plastic. Ask students the purpose of this step. (This will simulate the liner of an MSW landfill.) The student will cut a hole in the side of the box large enough to fit the rubber hose into, but not so large that there is space around the outside perimeter of the hose.
- The third volunteer will place the rubber hose in the box so that one end sits on the plastic and the other extends outside the box. This hose can be secured and sealed using a little of the left over clay. The student will add a four-inch layer of sand. Ask students the purpose of the sand and the hose. (The sand is to absorb moisture and the hose to collect excess moisture that cannot be absorbed. The student volunteer will compact the sand with a book or other available weight, being careful to pack the material firmly so no air can get into the landfill. The student will cover the sand with a layer of gardening fabric. Ask students what the fabric simulates. (This is the geotextile layer, the last layer of the liner system.)
- The fourth volunteer will add four inches of soil. The student will compact the soil in the same way as described above.
- The next two volunteers will identify two areas inside the model to serve as cells. These areas should be parallel to one another. They will layer one cell with organic material (e.g., plant leaves, rotting berries, coffee grounds, a potato chip, cookie crumbs) and the other with inorganic material (paper, aluminum foil, sandwich bag, candy wrapper, straw, bottle cap, etc).
- The seventh volunteer will cover the cells with two inches of soil and compact it down in the same way as described above. Ask students the purpose of this step. (This is to prevent any odors from developing, materials from escaping or attracting any pests).



- The next two volunteers will then repeat step six, cover that layer of waste with two inches of soil and compact the top layer. The students will label each of the craft sticks with the words organic and inorganic and mark the locations of the buried waste by placing them on top of the landfill model. Ask students why they should not plant the sticks in the model. (This may allow air to enter the landfill.)
- Set the box inside a leak proof container and place it in a sunny area either inside or outside of the classroom where it won't be disturbed until needed. If the model is left inside one volunteer should occasionally sprinkle water over the landfill to simulate a rainy day. If taken outside, it should be covered in inclement weather and at night, to prevent it from being disturbed.

After Conducting the Lesson:

- Students will develop a hypothesis as to what they believe will happen:
 - To the waste that has been deposited in the model landfill.
 - To the water used to simulate rainfall.
- Record the hypotheses and discuss them in a whole group session.
- Students will consider and discuss the following questions:
 - Would you want to have a landfill located in your community? Why or why not?
 - What can be done that will address people's concerns about landfills, and minimize, or possibly eliminate the need for landfills in the future?
 - Is the EPA justified in recommending a landfill as the last resort in a community's solid waste management plan? Why?

Adaptations: Students can be divided into small groups of two or three and make group models of landfills.

Extensions:

- Students can monitor their landfills for any signs of seepage, odors, etc.
- In several weeks students can excavate their landfills to determine the levels of decomposition of the waste, and verify their hypotheses.