

# Landfill

# LANDFILL

## Garbage Snooping

**SUGGESTED GRADE LEVEL:** 2-3

**OBJECTIVE:**

Students will define waste and consider the implications of throwing something away; analyze their family's waste stream and discuss ways of reducing waste.

**BACKGROUND:**

We all produce a lot of garbage but are often unaware of what happens to this waste. We all have a responsibility for waste management.

In Tompkins County, we throw away about four pounds of household trash every day. This household trash includes food waste, yard waste, packaging and other items we chose to throw away.

In 1992, recycling became a law in New York State. This regulated the **disposal** of trash across the state... from homes, offices, cities and towns.

**TIME:**

60 minutes, excluding home garbage study.

**MATERIALS:**

*Garbage Record for a Week* survey, gove, scale, plastic sheet, detective badges, note to parents

**PROCEDURE:**

1. Tell students that the governor and lawmakers for New York State passed the Mandatory Recycling Law of 1992 that sets goals for reducing the amount of trash going to our **landfills** and **incinerators**. To do this, it is essential to know what is being thrown away so that the amount of waste removed from the **waste stream** can be measured. As a

group, the class will investigate throw-away habits of the people of the community.

2. Give each student an official garbage detective badge (Example included).
3. The first thing a detective must do is to make assumptions. Have the students make assumptions about the average household's garbage. What does the typical bag of garbage contain? Make a list. In what proportion are these items found? Have students estimate and list an order. Consider the following: glass, tin cans (actually 99 percent steel), aluminum, paper and plastic.
4. Now it's time for the investigation. Each detective will keep a record of his/her household garbage for one week. This is how it will be done:
  - ❖ Explain the investigation assignment to family members and ask for their cooperation. (See *Note to Parents* included with this lesson.) Ask family members to put all their trash in pre-determined collection areas to help make the job easier.
  - ❖ At the end of each day, empty the contents of the waste containers onto a large sheet of plastic. Do it in the garage or yard for mess control.
  - ❖ Wearing gloves, separate the garbage into categories: plastic, glass, paper, food, tinned items, aluminum, other. Then count and/or weigh, if scale is available, each category. Keep a record on the chart provided (at the end of this lesson). Take special care when handling cans, glass, etc.. If recycling is being done, keep a separate chart for these items.

# LANDFILL

- ❖ Be sure to return all trash and recyclable items to appropriate areas.
- 5. After a week, the detectives will write a summary of their research and present their findings to the class.

## Questions for the Class:

1. What kinds of things did your family throw away?
2. Were you surprised at the amount that was thrown away? Explain.
3. How did your findings compare to others in the class?
4. Were items thrown away that could have been reused or recycled?

## EXTENSION ACTIVITIES:

1. The records of family garbage kept by students can be used as an evaluation tool. Have students state one action that may be taken to reduce the family's waste stream, practice this action, and repeat the investigation after a month to see if students have reduced their family's waste stream.
2. Have the class produce a large chart indicating what they found during their Garbage Snooping.
3. All living creatures produce some sort of waste, but their ways of disposing of it vary greatly. Humans are very wasteful compared to other creatures on earth. Often we are unconcerned with what happens to our waste and unaware of the impacts it can have on the environment. By looking at how animals and plants minimize the amount of waste they produce, as well as the ways in which they

deal with their garbage, we can learn some important lessons about efficiency and waste disposal.

- ❖ Have the students research an animal of their choice to learn about its habitat, way of living, the kinds and amount of waste it produces, and its methods of dealing with this waste. The students could write and illustrate stories based on what they have learned and present them to the class.
- ❖ Ask each student to draw two pictures: one of their house and the other of a wild "animal's house." Have the students share their pictures with the class and start a discussion on where garbage fits into each picture. Do animals have garbage? Who produces more garbage, people or animals? What are some differences and similarities between waste generated by people and animals? Why do people throw away so much more than animals? How do people get rid of their garbage? Where does it go? What could people do to be more like animals regarding the production and disposal of waste?

# LANDFILL

## Dear Parents,

Our class is participating in a school project about waste reduction and recycling. We will learn how to recycle, reuse materials, and reduce the waste that is thrown away. For this project, your child will determine what your family throws away and will consider ways to reduce the amount of garbage you produce.

Please help your child be a Garbage Detective. Your child has been given the following instructions for performing this activity:

1. Ask family members to put all their trash in pre-determined collection areas to help make the job easier. For health reasons, do not include food items, yard wastes, or bathroom trash in the items collected.
2. At the end of each day, empty the contents of the waste containers onto a large sheet of plastic in the garage or yard for mess control.
3. Wearing gloves, separate the garbage into categories: plastic, glass, paper, tinned items, aluminum, other. Then count and/or weigh, if a scale is available, each category. Keep a record on the chart provided. Take special care when handling cans, glass, etc.. If recycling is being done, keep a separate chart for these items.
4. Be sure to return all trash and recyclable items to appropriate areas.

After a week, the detectives will write a summary of their research and present their findings to the class. Recycling some of what we otherwise throw away is an easy habit to form. By finding out what materials can be recycled in our community and changing some buying habits, your family can help reduce waste in New York. We hope you will encourage your child by making this a family project. And thanks for reducing, reusing and recycling!

# LANDFILL

## Garbage Record for a Week

Type of Garbage	Count (# of items)	Weight (in pounds)
Plastic		
Glass		
Paper		
Food		
Tinned items		
Aluminum		
Other		



**SOURCE:**

South Carolina Department of Health and Environmental Control. 2001.

*Action for a Cleaner Tomorrow: A South Carolina Environmental Curriculum Supplement.*

# LANDFILL

## Hauling It Away

**SUGGESTED GRADE LEVEL:** 4-5

**OBJECTIVE:**

Students will understand that their trash has to go somewhere, see that there are limited disposal options and examine some of the problems of managing so much waste.

**BACKGROUND:**

Collecting, transporting and disposing of waste is expensive. We are running out of places to take waste and building new landfills is costly.

New York has about 28 permitted municipal solid waste landfills. Some of these will close over the next several years because they will fill up.

**TIME:**

Several class periods.

**MATERIALS:**

This lesson will use guest speakers.

**PROCEDURE:**

1. Invite the school **custodian** and **waste manager** to class. Before their visit, have the class develop a list of questions to ask, such as
  - ❖ How often is trash picked up?
  - ❖ What is the cost of removal?
  - ❖ Has that cost changed recently? Why?
  - ❖ How much trash is produced each week?
  - ❖ What is the composition of the trash?
  - ❖ What has the school done to reduce the amount of garbage it produces?
  - ❖ What can students do to help?
2. Find out about local waste hauling and management businesses. How many are there? How many residents and businesses do they serve? If possible, ask a local waste hauler to come talk to the class. Some questions to ask the waste hauler are:
  - ❖ How many trucks do you own/operate?
  - ❖ What kind of trucks are they?
  - ❖ How much does that kind of equipment cost?
  - ❖ Why is the equipment designed the way it is?
  - ❖ How many truckloads of trash do you collect each day?
  - ❖ How is the refuse measured? In tons or cubic feet (Weight vs. Volume)?
  - ❖ How many houses and/or businesses do you collect from each day, week and month?
  - ❖ Where is the trash taken?
  - ❖ How many miles do you cover each day? Each year?
3. Interview someone or invite a guest speaker to visit the class to discuss voluntary recycling programs or recycling businesses in your area.
4. On the basis of the interviews, have the class discuss the costs involved in collecting and disposing of waste. Include equipment, mileage, salaries, etc. incurred in a waste hauling business.
5. Discuss the reasons waste haulers may or may not be interested in curbside recycling. What added expenses would there be to their businesses? Who would pay these costs?

# LANDFILL

6. Discuss the differences between city and rural disposal services. Most urban areas have curbside pickup while many rural areas have drop-off sites where people take their garbage. (Curbside pickup is only economical in highly populated areas where one truck can serve many households in a short amount of time. In rural areas, manpower and transportation costs make curbside pickup too expensive to be practical. In New York, this varies on a county-by-county basis. Explain to students that these economic factors also have a direct influence on why a county may choose to implement a drop-off curbside recycling pickup.)
7. In most areas, people pay a municipality or county government for garbage disposal service. This is a flat fee where everyone pays the same amount regardless of the amount of trash thrown away. **Ask:** How would you change your habits if you had to pay separately for each bag of trash you threw away? (Some areas of New York, such as Tompkins County, have a system that charges households by the bag or pound. These programs are called “pay as you throw” trash tag systems. For more information call 273-6632)

## EXTENSION ACTIVITY:

- ❖ Take a guided tour of your local landfill. Is it a state of the art, lined landfill?
- ❖ Visit the Tompkins County Recycling and Solid Waste Center for a tour of their facility.
- ❖ Invite TCSWMD to your classroom for a Recycling and 4R’s Presentation.

## SOURCE:

South Carolina Department of Health and Environmental Control. 2001.

*Action for a Cleaner Tomorrow: A South Carolina Environmental Curriculum Supplement.*

# LANDFILL

## Look in Your Garbage Can

**SUGGESTED GRADE LEVEL:** 4-5

**OBJECTIVE:**

Students will see what the average family of four throws away every day and discover what steps can be taken to reduce the amount of garbage a family generates by reusing, recycling and by composting yard and food wastes.

**BACKGROUND:**

How many things will you throw away today? An empty cereal box? Your lunch bag? Some papers from school? When you stop and think about it, you may be surprised at how much trash you toss out.

Not counting recycling, in 2001 New Yorkers threw away over 1,000 pounds of trash. This is far more than people in most other countries. In New York, about 40 percent of this garbage ends up in one of the 28 operating landfills in the state. The rest of it either goes to landfills in other states (~40%) or is combusted at waste-to-energy (WTE) plants (~20%).

In New York on the average, each person is responsible for about four pounds (3.83 kilograms) of waste daily. This figure includes **industrial** and agricultural wastes. An average of four pounds of residential **garbage** (waste collected from the home) is generated per person each day in New York. The average family garbage can contains predictable types and amounts of waste. Much of this waste is unnecessary, some is reusable and recyclable and some can be used to create nutrient-rich compost.

About 80 percent of everything we throw away is recyclable in some way. In New York, over 42 percent of our total waste is recycled. In 1987, the Solid Waste Management Plan established a 50% waste-reduction/recycling goal by 1997. This 50% goal is broken down into two categories: 8-10% waste-reduction goal and 40-42% recycling goal. Although the state has met its recycling goal overall, there are still many communities where recycling is just beginning to make a difference.

**TIME:**

One class period.

**MATERIALS:**

Heavy cardboard or construction paper, colored marking pens.

**PROCEDURE:**

In this activity, students will examine what is in the average family garbage can according to weight.

1. Using heavy cardboard, cut seven separate pieces to construct a garbage can( see diagram). Each piece will be sized according to one of the seven categories of waste and will be labeled with a category and percentage of garbage by weight. Each piece may be brightly colored.
2. Ask students to think about what is in their garbage cans. Ask them to name various categories of this waste.
3. Place all seven pieces of your version of the *Garbage Can diagram* face down on a table. Divide the students into seven groups and have a student from each group choose a piece. Have the student show and read what is on the card and then tape it up on

# LANDFILL

the board. (As students select pieces they will assemble the whole *Garbage Can* on the board.) In the individual groups have students research their selected category of waste. Use the following facts as a guide for each selected garbage category. Some discussion questions are included.

## Paper

About 40 percent by weight of everything we throw away is paper.

- ❖ In the United States, we cut down more than 4 billion trees a year to make paper and cardboard for newspapers, magazines, packaging, junk mail, toilet paper, boxes, etc.
- ❖ If every American recycled just one-tenth of their newspapers, we could save about 25 million trees a year.
- ❖ Recycling of paper and paperboard reached a record 32 million tons in 1995. Paper constitutes about 50 percent (or about one-half) of the nation's municipal waste by volume.

**Ask:** What are some of the things that we throw away that are paper? Some examples are:

- ❖ Cereal boxes (these are paperboard, open one, if the inside is gray it was probably made from recycled newspaper, look for the wording on the box to indicate it was made from recycled materials);
- ❖ Newspaper;
- ❖ Magazines;
- ❖ Business and personal letters.

## Glass

About 7 percent of everything we throw away is glass. (6.2 percent according to the EPA Waste Update 1996.)

**Interesting Fact:** Of the 46 billion bottles and jars produced in 1981, only one in 15 was eventually crushed to bits and melted down along with fresh material to make new jars and bottles. Today, we recycle about 25 percent of the glass produced for packaging.

Examples of some things we throw away that are glass:

- ❖ Food jars;
- ❖ Household cleaners and toiletry bottles (i.e. mouthwash containers);
- ❖ Beverage containers.

## Metal

7.6 percent of everything we throw away is metal.

**Interesting Facts:** If you buy soft drinks in aluminum cans, chances are better than one-in-two (+50 percent) that your can was made from other cans. Today we recycle about 40 percent of metals generated.

The time between a can leaving the factory and dropping into the melting furnace once more may be as little as six weeks.

Examples of some things we throw away that are metal:

- ❖ Old household equipment and appliances;
- ❖ Cans (aluminum, tinned and bi-metal);
- ❖ Metal caps from jars and bottles.

# LANDFILL

## Food Waste

Up to 6.7 percent of everything we throw away is food waste.

**Interesting Fact:** The world's largest composting pile, the Netherlands' VAM, or Waste Treatment Company, produces approximately 125,000 tons of compost a year. This is sold for farm and garden uses.

Examples of some things we throw away that can easily be used in a compost pile:

- ❖ Coffee grounds;
- ❖ Egg shells;
- ❖ Nut shells;
- ❖ Vegetable and fruit peels.

## Plastic

9.1 percent of everything we throw away is plastic.

**Interesting Fact:** There are many kinds of plastic. (See the attached breakdown of plastics for details.) This is one of the reasons plastic requires sorting before recycling. If all plastic containers were made from the same type of plastic, they would be much easier to recycle but this is not practical. Six resins account for 97 percent of the plastics used in packaging. Today, we recycle only 5.2 percent of the plastics generated.

Examples of some things we throw away that are plastic:

- ❖ Shampoo and dish-washing soap containers;
- ❖ Plastic wrap;
- ❖ Produce bags and meat packaging.

## Yard Wastes

About 14.3 percent of everything we throw away is yard waste.

**Interesting Fact:** Compost piles can reach 140 – 160 degrees Fahrenheit in the center. In cold weather, steam will rise from the pile.

In New York State, yard wastes are banned from being disposed of with regular household waste. Tompkins County and many municipalities offer services for composting yard waste.

Examples of yard waste that should be composted:

- ❖ Grass and hedge clipping (although it is a good practice to leave grass clippings right on the lawn when possible);
- ❖ Wood ash;
- ❖ Garden weeds.

## Other

About 16.9 percent of everything we throw away does not fall into the other six categories.

Examples of what "other" may be:

- ❖ Rubber;
- ❖ Textiles (clothing);
- ❖ Wood.

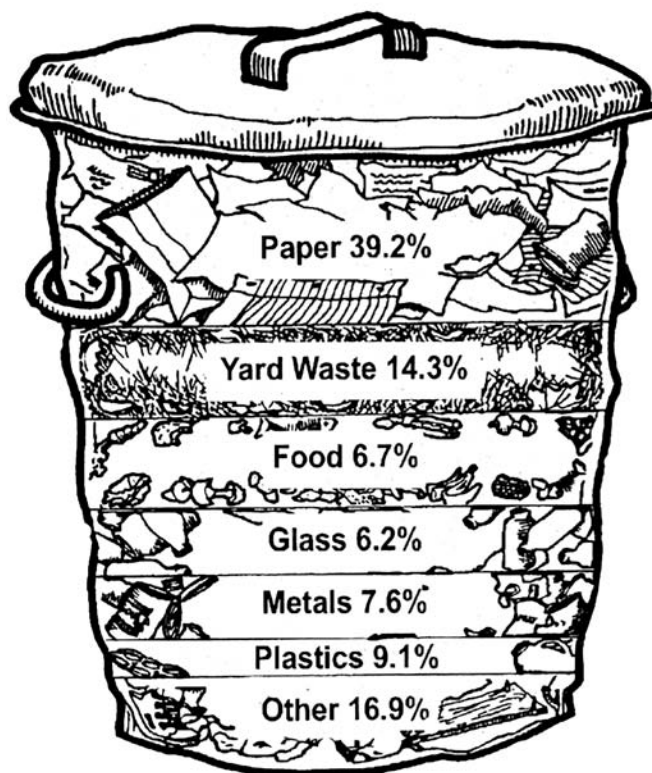
# LANDFILL

## Questions for the Class:

1. List the content of the average family garbage can.
2. If each person throws away an average of four pounds of garbage from their household and school every day, how much is each family throwing away each day? Each class?
3. Where does the family garbage go?
4. What are some ways to reduce the amount of garbage being thrown away from each home and school?

## EXTENSION ACTIVITIES:

1. New York has both urban and rural areas. How is the trash different in these areas? How is it the same? How is it disposed of differently? Have students research and discuss.
2. Have students become "Garbologists" for a day. Have them investigate the contents of their family garbage can to discover what our trash tells about us. Write a paragraph about what we eat, what we buy and our life-style.



## SOURCE:

South Carolina Department of Health and Environmental Control. 2001.

*Action for a Cleaner Tomorrow: A South Carolina Environmental Curriculum Supplement.*

# LANDFILL

## Plastics Breakdown

Number	Codes	Descriptions
1	PETE	<b>Polyethylene Terephthalate (PET,PETE):</b> PET is clear tough, and has good gas and moisture barrier properties. Commonly used in soft drink bottles and many injection molded consumer product containers. Other applications include strapping and both food and non-food containers. Cleaned, recycled PET flakes and pellets are in great demand for spinning fiber for carpet yarns producing fiberfill and geo-textiles. Nickname: Polyester.
2	HDPE	<b>High Density Polyethylene (HDPE):</b> HDPE is used to make bottles for milk, juice, water and laundry products. Unpigmented bottles are translucent, have good barrier properties and stiffness, and are well suited to packaging products with a short shelf-life such as milk. Because HDPE has good chemical resistance, it is used for packaging many household and industrial chemicals such as detergents and bleach. Pigmented HDPE bottles have better stress crack resistance than unpigmented HDPE bottles.
3	V	<b>Vinyl (Polyvinyl Chloride or PVC):</b> In addition to its stable physical properties, PVC has excellent chemical resistance, good weatherability, flow characteristics and stable electrical properties. The diverse slate of vinyl products can be broadly divided into rigid and flexible materials. Bottles and packaging sheet are major rigid markets, but it is also widely used in the construction market for such applications as pipes and fittings, siding, carpet backing and windows. Flexible vinyl is used in wire and cable insulation, film, floor coverings, synthetic leather products, coatings, blood bags, medical tubing and many other applications.
4	LDPE	<b>Low Density Polyethylene (LDPE):</b> Used predominately in film applications due to its toughness, flexibility and relative transparency, making it popular for use in applications where heat sealing is necessary. LDPE is also used to manufacture some flexible lids and bottles. It is used in wire and cable applications.
5	PP	<b>Polypropylene (PP):</b> Polypropylene has good chemical resistance, is strong, and has a high melting point making it good for hot-fill liquids. PP is found in flexible and rigid packaging to fibers and large molded parts for automotive and consumer products.
6	PS	<b>Polystyrene (PS):</b> Polystyrene is a versatile plastic that can be rigid or foamed. General purpose polystyrene is clear, hard and brittle. It has a relatively low melting point. Typical applications include protective packaging, containers, lids, cups, bottles and trays.
7	OTHER	<b>Other:</b> Use of this code indicates that the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.

# LANDFILL

## Making A Simulated Landfill

**SUGGESTED GRADE LEVEL:** 4-5

### **OBJECTIVE:**

Students will understand the difference between a dump, a landfill (yesterday's technology), today's engineered landfill and a compost pile, and understand the reason why products do not biodegrade easily in a landfill.

### **BACKGROUND:**

As the hazards of open dumping (throwing trash in large open areas or pits) have become better known, dumping garbage has been made illegal. In New York, there are laws against dumping that carry stiff penalties and fines.

Landfills, such as local county landfills and municipal landfills, are also regulated by law. In Tompkins County, there are no operational landfills. Solid waste produced by county residents is sent to an out-of-county landfill.

There are several different landfill types. Early landfills were little more than just organized open dumps. All types of waste were disposed of together, often with dangerous results for the environment. Little was done to protect landfill **leachate** – the liquid that accumulates at the bottom of a pile of waste – from entering the ground and groundwater systems. Many of these landfills are pollution problems today and must be dug up and cleaned. This is very expensive.

Modern landfills are designed to protect the environment and public health by keeping wastes from seeping out of the landfill and into soil and water.

There are strict rules that characterize a landfill. Open burning is not allowed. Wastes are spread out, compacted and frequently covered with several inches of soil to reduce odor and to control litter, insects and rodents.

Landfills are constructed with heavy plastic and clay liners that are designed to prevent any of the liquid contents of the landfill from leaking out. The leachate that settles at the bottom of landfill waste is collected in pipe systems, prevented from entering our soil and water, and is removed for treatment. Pipes also allow methane gases that form within landfill waste to be released or recover without causing dangerous explosions.

When landfill cells, or sections, are filled, they are capped and sealed.

Landfills meeting today's tough standards of environmental protection are expensive to build. Many landfills that do not meet requirements are being forced to close. Overall, the number of landfills in this country is getting smaller. However, the size of new landfills is getting larger. The estimated cost of building and maintaining a landfill that meets EPA requirements is nearly \$125 million.

### **The Myth of Biodegradability in the Landfill**

We used to think that after we discarded trash and it was hauled to the landfill that parts of it would eventually **biodegrade** – that is, it would rot and disappear completely. But it just doesn't happen.

That's not to say that many of the contents of our trash can't biodegrade. In a sense, everything in the world is biodegradable. Given enough time, air, sunlight and other elements, your family's house and possessions would all break down and

# LANDFILL

wear away... eventually. However, it would take thousands or even millions of years for this to occur.

Things that are buried in a modern landfill, where there is little if any air or sunlight, do not break down easily. In fact, burying things in a landfill tends to preserve trash rather than eliminate it. This is because landfills have systems of protective liners engineered to keep harmful leachate from **contaminating** the ground and entering our water systems. These liners and covers of clay and soil prevent the biodegrading process from occurring. Because landfills are collections of trash that may contain substances that can harm the earth, landfill contents are sealed up tightly.

Counting on the trash you throw away to biodegrade is a myth. However, if you dispose of items that can easily biodegrade, such as food waste and yard waste, in a disposal system intended for biodegradation, such as a **compost pile**, they will biodegrade quickly.

**TIME:**  
Ongoing.

**MATERIALS:**  
Three shoe boxes, one milk jug, scissors, organic and inorganic items, soil, water, plastic wrap or garbage bags, twist-ties, landfill diagram.

**PROCEDURE:**  
(Note: You may find that the best placement of your simulated landfills is outdoors. Be careful to select an area of the playground that is out of high traffic areas so that your experiment will not be disturbed. Also notify the grounds-keeping staff so that they will not throw your project away.

The open dump simulated in the shoe box will make a mess and the box itself may break down. This is the point of the exercise. Open dumps are messy and unsightly, and do not provide a protective layer between the trash and the ground. The same is true for the landfill model.)

## Making an Open Dump

1. Have the group assemble a variety of **organic** and **inorganic** items for disposal. Include items such as plastic containers, metal screws, newspaper and food waste. (Use items such as orange peels or other fruits and vegetables to prevent attracting pests.)
2. Have students create a list of the items.
3. Have students take a cardboard (not plastic) shoe box (without a top) and label it, **Open Dump**, then take it outside to an area that will remain undisturbed. Cover the bottom of the box with about three inches of soil and pack the soil down. Then heap the wastes in. Sprinkle with water. Place the Open Dump on a plastic garbage bag that has been spread open. Every other day, sprinkle with about a half a cup of water. Leave the dump open to the sun and air.

# LANDFILL

## Making a Landfill

1. Have the group assemble a variety of organic and inorganic items such as plastic containers, metal screws, newspaper and food waste (use items such as orange peels to prevent attracting pest).
2. Have students create a list of the items.
3. Have students take a cardboard box about the size of a large shoe box (without a top and label it, **Landfill**). Cover the bottom of the box with about three inches of soil and pack the soil down. Then heap in half of

the wastes. Add another layer of soil and garbage, and then top with a layer of soil several inches thick. Place the landfill box in a plastic garbage bag, sprinkle with water and seal with a bread tie. Take the landfill outside where it can remain undisturbed. Every other day open the landfill to let in air, and sprinkle it with about a half a cup of water and reseal the plastic bag.

### SOURCE:

South Carolina Department of Health and Environmental Control. 2001.

*Action for a Cleaner Tomorrow: A South Carolina Environmental Curriculum Supplement.*

# LANDFILL

## Mini Landfill

**SUGGESTED GRADE LEVEL:** 5-6

**OBJECTIVE:**

- ❖ Students will learn the process of decomposition in a landfill.
- ❖ Students will learn which items are biodegradable and which will not deteriorate over time.

**BACKGROUND:**

Every day, garbage is dumped into landfills. After being dumped and compacted, the garbage is covered with clean soil. The process of covering garbage with soil actually contributes to breaking it down into smaller and smaller pieces. The only types of garbage that will decay in the landfill are the biodegradable ones.

**TIME:** Ongoing.

**MATERIALS:**

Two identical pieces of each of the following per each shoe box:

- ❖ Food scraps
- ❖ Newspaper
- ❖ Cloth
- ❖ Glass
- ❖ Cardboard
- ❖ Aluminum foil
- ❖ Plastics
- ❖ Copper wire

**And**

- ❖ Cardboard shoe boxes, 1/student or 1/group of students

- ❖ Foil or plastic to line the shoe boxes
- ❖ Toothpicks, about 20/shoe box
- ❖ Index cards, about 20/shoe box
- ❖ Water
- ❖ Soil from outside (**not potting soil**)
- ❖ *Mini Landfill worksheet*, 2/student
- ❖ *Mini Landfill discussion questions* (see following)

**PROCEDURE:**

1. Line the shoe boxes with aluminum foil or plastic.
2. Fill the shoe boxes half-full with soil (not potting soil because it is sterilized).
3. Bury two identical rows of waste, marking the location of each item with index card labels on toothpicks.
4. Water the soil and put the boxes in a sunny location. Keep the soil moist but do not soak.
5. Distribute 1 worksheet/student. Have students use the back of the worksheet to write down the date and items placed in their landfill.
6. After 10 days, have students carefully remove the waste items from **one row** of the landfill and examine them and answer questions on the worksheet.
7. Continue to maintain mini-landfill for 10 more days.
8. Carefully remove the waste items from the remaining row of the landfill and examine them. Students answer questions on the worksheet.
9. Follow up investigation with *Mini Landfill Discussion Questions*.

# LANDFILL

Name \_\_\_\_\_

## Mini Landfill Worksheet

1. The items which decomposed the most were:

---

---

---

---

2. The following items decomposed a little:

---

---

---

---

3. These did not change at all:

---

---

---

---

4. Why do you think some items are decomposing more quickly than others?

---

---

---

---

# LANDFILL

## Mini Landfill Discussion Questions

1. Which items in the mini landfill decomposed the most? *Lists will vary.*
2. Were the decomposed items natural or manmade? *Natural.*
3. What characteristics are shared by the items that decomposed quickly? *Answers will vary: they are natural, organic...*
4. Some items did not decompose. What do you think will happen to them? They are not biodegradable, decomposition will take a very long time.
5. What are the alternatives to burying these non-decomposable items in a landfill? *Reduce, reuse, recycle.*
6. Did mold form on the landfill? If Yes, why did this occur? Mold spores are present in the soil. The landfill provided the necessary environment (warmth, moisture, food source) for their growth.
7. What do you think happens to waste left out in the desert? Unless it is eaten by scavengers (crows, vultures, etc.) it is preserved. Without moisture, there are no microorganisms to decompose the waste.
8. Suppose that your landfill was made with sterilized potting soil. Would waste have decomposed so quickly? Why? No, sterilized soil contains no microorganisms.
9. Did you notice any spaces around the waste items as you dug them up? What caused the spaces to form? If this happened in a real landfill, how could it affect the future use of the land after the landfill closed? Decomposition of the waste items resulted in the formation of the spaces. Some of the waste material is converted into food energy by the organisms that eat it. Therefore the end product of decomposition contains less matter (and takes up less space) than the waste items.

### SOURCE:

New York State Department of Environmental Conservation's  
*"RW" Goes to School, A Teachers Guide.*

# LANDFILL

## The Throwaway Three: A Skit

**SUGGESTED GRADE LEVEL:** 3-5

**OBJECTIVE:**

To inspire students to think about how much waste we produce and how we dispose of it. The skit introduces the concept that there is no such thing as throwing “away” our trash.

**BACKGROUND:**

The skit shows students that people have historically gotten rid of solid waste successfully by throwing it out, burying it, or burning it, but none of these methods solve modern urban garbage problems. The discussion should attempt to reinforce this concept. One way this can be done is to discuss the characters in the skit: how they disposed of their garbage and why their methods of doing so were either satisfactory or unsatisfactory.

Our solid waste disposal options include reducing, reusing, recycling, composting, incinerating, and landfilling. None of these options can stand alone. We must look at individual regions or communities and decide what are the best solutions for each. Any place we live, we can **reduce, reuse, recycle, compost, and rebuy**. It is important to do these things to conserve our natural resources and to become a wise user. **Incineration** may be important in areas where there is a severe space problem or where other options don't exist. It has a place in some solid waste plans because it produces energy and reduces the volume of garbage. **Landfills** will always be needed, but maybe not in every community, because we continue to produce items that are not or cannot be disposed of in other ways.

**TIME:**

One or two class periods.

**MATERIALS:**

See list of props (listed in the skit).

**PROCEDURE:**

This skit presents the growing amount of trash in the world. As the skit progresses, each player throws more trash on the pile in the middle of the room so that a high stack is created. Someone suggests one way to solve the problem is to recycle. A discussion of ways to solve the problem of too much garbage and trash might follow the performance (see Background notes, above).

**Monkey:** Threw garbage down. No problem developed because no large concentration of monkeys existed and the garbage decomposed.

**Cave dweller:** Threw it. Tossing out garbage began to be a problem, but it was easily solved by taking the garbage out of the city.

**Briton:** Threw it. A problem grew because more and more people moved to the cities, thus producing more trash than they could get rid of in the city.

**Settler:** Had very little garbage, mostly decomposable.

**Colonist:** Threw it, burned, buried it. Greater trade resulted when people did not use goods until they wore out, but then more things to be discarded began to accumulate.

# LANDFILL

**Industrialist:** With a greater concentration of people in the cities than ever before and more buying because machine-made goods were cheaper, much more was thrown out.

**Scientist:** The big change to synthetics plus the use of enormous amount of natural resources are causing tremendous trash problems.

Look at your own community's waste or your classroom waste to see what disposal options you can take advantage of. Discuss the idea that we can't "throw away" our trash; there is simply no such place as "away". Care is always required to prevent our trash from having bad effects on our lives. We are literally running out of some natural resources so that any form of disposal of certain goods is self-defeating.

**Questions to discuss:**

- ❖ Where do hazardous items such as batteries and toxic chemicals go?
- ❖ What have we learned from our past disposal practices?
- ❖ Why is it such a problem now?

# LANDFILL

<p><b>Person 1</b> This is the tale of the Throwaway Three, Of humans and their garbage throughout his-to-ry: Now they're very nice people, just like you and me, Who all have a problem, as you will soon see— What shall they do with their garbage and trash?</p>	<p><b>Props</b></p>
<p><b>All</b> Why, throw it! Or bury it! Or burn it to ash!</p>	
<p><b>Person 2 – 90,000 B.C. (Monkey)</b> I represent people when we lived in a tree. I get rid of garbage so easily! It's a snap! It's no problem-to me or to him We just let go, plop! Down through the limbs.</p>	<p>Monkey masks Banana peel</p>
<p><b>Person 3 – 50,000 B.C. (Cave dweller)</b> I am a cave dweller who lives on the ground. What do I do with old stuff all around? Why, burn it like meat; burn it up in the fire; Or bury it like bones, in the muck and the mire.</p>	<p>Skins</p>
<p><b>All</b> Yes, throw it, or bury it, or burn it to ash! That's how we always get rid of our trash!</p>	
<p><b>Person 1 – 200 B.C. (Roman)</b> I am a Roman who lives in the town. Our laws won't allow me to just throw it down. I have to drag it away for a mile And then I can dump it, forget it, and smile!</p>	<p>Roman helmet Bag of trash</p>
<p><b>Person 2 – 1200 A.D. (Briton)</b> I am a Briton, wary and quick: Down on our street it can get pretty thick. When housewives up there want to pitch out their goo, They just heave it out there and yell: "Gardy-loo!" (person 1 stands on chair and yells) It will stay there and stay there until the next rain, Or until our fair London should burn down again.</p>	<p>Stack of trash</p>
<p><b>All</b> Oh, what do we do with our garbage and trash: We throw it, or bury it, or burn it to ash!</p>	

# LANDFILL

<p><b>Person 3 – 1630 (Settler)</b>          I am the settler. I came without much          But everything else I must make with my hands.          So I don't throw out much – I use all I can.          Cloth scraps become quilts; I reuse my bent nails.          It will be a long time 'fore the next trade ship sails.</p> <p><b>Person 1 – 1700 (Colonist)</b>          I am a colonist: now life's not so tough.          We have trade between cities that brings lots of stuff          And some things are made by our townfolks today,          I could buy a new harness, throw this one away.          We have pigs and hogs running loose in our street,          If I toss it out there, they'll eat it up neat!          Or I might bury it right over there.          Or I might burn it: nobody would care.          You see; New World is the same as the Old!          We trash-makers come from the time-honored mold.</p> <p><b>All</b>          What are we still doing with garbage and trash?          You guessed it! Throw it away, or bury it, or burn it to ash!</p> <p><b>Person 2 – 1890 (Industrialist)</b>          I'm the industrialist new on the scene,          I mass-produce goods with my trusty machine.          This sweater, handmade, took a week in days of yore,          But now in one hour, I can make forty-four.          I make things so cheaply, you can now afford two,          And throw out twice as much trash as you need to do.</p> <p><b>Person 3 – 1950 (Scientist)</b>          I am the scientist in the new post-war age.          We've learned a few tricks while the shortage raged          When we couldn't get natural stuff to process          We invented synthetics to replace the rest.</p> <p><b>Person 2 (Industrialist)</b>          Rayons and nylons, acrylics and plastics.          For furniture and clothing and even elastics;          Forget your old wool, silk, and cotton;          Real wooden toys and washboards are forgotten.</p>	<p><b>Props</b></p> <p>Coonskin hat          Leather</p> <p>Pilgrim hat</p> <p>Engineer's cap          (one handmade;          two machine-          made)</p> <p>Lab coat</p> <p>Nylon stockings          Plastic bag and          container</p>
--	---

# LANDFILL

<p><b>Person 3</b> (Scientist)          Our new stuff will last 'til forever, you see          Even when it's worn out to you and me          Permanent pressed, pre-sized and pre-shrunk          When dingy and old, it's still permanent "junk"          (Person 1 yells "Junk")</p> <p><b>Person 2</b> (Industrialist)          We make instant menus that come in a PACK.          You just boil the food in its own plastic sack          Or our TV dinner in its tinfoil tray          It's quick; you don't wash it; just throw it away!</p> <p><b>Person 3</b> (Scientist)          We make lots of TVs and clothes dryers, too.          Don't ask for trade-in; you're kidding, aren't you?</p> <p><b>Person 2</b> (Industrialist)          Our new cars all change with each model year,          Don't try to repair them, the cost is too dear,          Besides, we don't bother to make last year's parts          For Skylarks, or Novas, or Cougars or Darts.</p> <p><b>Person 3</b> (Scientist)          It's the New Thing, The NEW that America Craves.          So out, out with old stuff, away to its graves.</p> <p><b>Person 2</b> (Industrialist)          So what if there're more of us buying goods?          So what if they won't rot away as they should?</p> <p><b>Person 1</b> (Native American)          Now wait just a minute! You cannot fail          To include me in your historic trash tale.          Native Americans lived simply, on prairies, in woods,          We made no high trash piles, nor mass-produced goods.          Let me be your critic, now where you stand;          And tell you how you're defiling our land.</p>	<p><b>Props</b></p> <p>Perma-pressed shirt</p> <p>Plastic bag TV dinner</p> <p>Broken small appliance</p> <p>Toy car</p> <p>Native American headband</p>
---	--

**SOURCE:**

Cornell Waste Management Institute. 1991. *Trash Goes to School*.  
 (<http://cwmi.css.cornell.edu/TrashGoesToSchool/TrashIntro.htm>).

# LANDFILL

## Town Meeting: What to do With Our Waste?

**SUGGESTED GRADE LEVEL:** 5-Adult

### **OBJECTIVE:**

In this lesson, Students will simulate a public hearing where different options are considered for solving the community's problem of shrinking landfill capacity. Students will role-play different interest groups in the community, expressing their opinions and voting from the position of their interest groups.

By doing so, students will realize that there are many perspectives and no one right answer. Students will experience a democratic interdisciplinary approach to community decision-making.

### **TIME:**

60-90 minutes.

### **MATERIALS:**

- ❖ Interest group cards or pieces of paper with the name of each interest group written on them.
- ❖ A list of the proposals written on the board or a large piece of paper.
- ❖ Paper and pencils for interest groups to write their statements.

### **PROCEDURE:**

1. The teacher or other adult should play the mayor and facilitate the meeting.
2. The mayor reads the opening statement and list of proposals, under consideration.
3. Divide the class into seven groups.
4. Pass out an interest group card to each group. (For older students, you may want to just give students the name of their interest group and let them figure out what their interest would be.)
5. Explain that students are now members of their interest group in the community, and that they should discuss the issues and how the different proposals put forth would affect them.
6. Each group should come up with a statement regarding their concerns, interests which plan or plans they support and three reasons why.
7. Each group should choose a spokesperson who will deliver the group's statement and answer questions.
8. Have the spokespersons from each group sit at the front of the classroom facing the audience. One at a time, spokespersons should state which group they represent, deliver the group's statement and take three questions (or more if you have time) from the audience.
9. With students still part of an interest group; take a secret vote to decide which plan the community will choose.
10. Take another vote with students voting as themselves.

# LANDFILL

## Discussion

After the vote, students can discuss what it was like to play a role that may or may not have reflected their own values. Students can compare their simulated public hearing and decision-making process with real public hearings in their community. Discuss what issues in your community are up for public hearing. Students can observe and/or participate in a real public hearing at city council or county board meetings.

## Teacher Opening Statement

(Script)

"I WOULD LIKE TO WELCOME THE CITIZENS AND FRIENDS OF OUR FAIR TOWN, Whaler's Cove, to this public hearing. Like many communities, we are anticipating a garbage crisis. At the current rate of generation, our present landfill, the Whale Bone, will reach capacity in five to seven years.

As you know Whaler's Cove is located near the ocean, has a population of 50,000, is known for its natural beauty, clean air, and good schools. Our economy is dependent on a light industrial base, tourism, fishing, and commercial services. In the last ten years our population has doubled, putting an unexpected strain on our landfill and other community services. Tonight we are here to conclude a series of meetings on our garbage crisis and vote on a proposal."

## Proposals Under Consideration

1. EXPAND THE EXISTING LANDFILL.  
Double the size of the existing Whale Bone Landfill. This expansion would bring the boundaries of the landfill within 300 yards of Jonah Elementary School and within 500 yards of the ocean.

2. SITE A NEW LANDFILL. Land values have tripled in the last ten years. The amount of open space available in the county is rapidly shrinking. There is a strong movement in the county to preserve existing open space.
3. RECYCLING AND COMPOSTING. An all-out effort to provide education, incentives, and regulations to encourage widespread recycling and composting. Presently there is a pilot curbside recycling program in part of the town and the local community garden has composted for several years.
4. BUILD AN INCINERATOR. An incinerator could reduce the amount of garbage to be land filled by 30-40 %. Incinerators are expensive to build. New incinerators have pollution controls but some air pollution and toxic residue still results.

## Interest Groups

1. GARBAGE HAULER  
Your family has collected garbage in Whaler's Cove and the surrounding area for 50 years. You are concerned with providing good service to you customers at reasonable rates. You are quite certain that all of the proposals will cost you more to pick up the same amount of trash. Traditionally you have charged a set fee per household. If the amount of trash you pick up is reduced through recycling and composting, or if your tipping fees increase to pay for a new landfill or incinerator, you might consider charging people by the can. You started a pilot curbside recycling project last year. You would like to do more recycling, but this would mean hiring another crew and buying more trucks.

# LANDFILL

## 2. INCINERATOR PLANT VENDOR

You think incinerators are the way to go. Pollution controls have come a long way. Higher smoke stacks mean the smoke is distributed over a larger distance. Incineration reduces the amount of waste by 30-40%. You think the issue of toxic residues in the ash is a public education problem. People should be educated to put toxics in their proper place and not in the household trash. An added benefit of incineration is that burning trash can generate steam to turn turbines and produce some electricity.

## 3. CITIZENS RECYCLING AND COMPOSTING COALITION

You are a group of organic gardeners and environmentalist who have joined forces. You favor source reduction of trash, aggressive recycling, and efforts to educate the public. Your group proposes a ban on extra packaging; curbside recycling collection; recycling containers on every street; home compost bins given out at discount prices; free compost and recycling workshops; composting and recycling in school, more community garden sites with a community compost area, and an ordinance banning yard waste from being disposed of in the landfill.

## 4. LANDFILL OPERATOR

You are worried that your profits will suffer if people create less trash. You think siting another extra-large landfill in the area is the best solution. After all, people will always have trash and will need a place to put it. You do not think the public is willing to go through the extra hassle of recycling and composting; they just want to get rid of

their trash. You think present-day landfills are safe and efficient. You can even capture the methane given off and produce small amounts of electricity. You remember the days of open dumps and dumping trash in the ocean. Landfills only use up space for a time, when full they are covered and can be turned into parks and open space. You have been in the landfill business for a long time. The only problem you see with landfills are citizens with a "N.I.M.B.Y." (not in my back yard) syndrome.

## 5. MUNICIPAL COMPOSTING PLANT VENDOR

You know that not everyone wants to compost at home. You propose to provide a valuable service to people and the community by charging them to pick up their organic materials; making compost and selling the finished compost back to the community. You would be providing the community with a high quality, locally produced compost at a competitive price and reducing the amount of material sent to the landfill by 20-30%. One large central facility would be better than having people compost at home; it could be permitted and regulated. Municipal composting has worked successfully across the U.S. and is used in some countries in Europe. Eventually the central facility might handle organic wastes from restaurants and agriculture.

# LANDFILL

## 6. HEALTH INSPECTOR

You are in charge of public safety and health. You would be responsible for permitting and regulating a landfill, incinerator or municipal composting facility. Air pollution and toxic residue from incinerators and ground water contamination from landfills, even the newer ones, have come to your attention in recent years. Municipal composting is still fairly new in the country. Regulations are still being drafted and you're not sure if composting on a large scale will work. You compost at home and the "gardener in you" thinks it would be nice if everyone composted, but the "health inspector" in you worries that home composting will not be done properly, and will lead to neighborhood complaints and rodent problems.

## 7. HOME OWNERS' ASSOCIATION

You are a member of the Sea Side Homeowners' Association and live next to Whale Bone Landfill. You enjoy your community's natural beauty, clean air, good schools, and rising property values. You are concerned with providing a healthy, unpolluted environment for your children to grown up in. Being a busy, working parent you are not sure how much time you have to deal with garbage. You feel you pay enough in garbage fees and do not want the rates to go up. You feel you pay bureaucrats and garbage collectors enough so that they should be able to find a solution to this problem.

### **SOURCE:**

Marin County Hazardous and Solid Waste Management Authority Office of Waste Management, *"Composting Across the Curriculum – A Teacher's Guide to Home Composting."*

# LANDFILL

## Trash Trivia Game

**SUGGESTED GRADE LEVEL:** 4-6

**OBJECTIVE:**

To learn facts and figures about recycling and solid waste disposal.

**TIME:**

One class period.

**MATERIALS:**

- ❖ Trash Trivia Game Questions (each question on its own strip of paper)
- ❖ Answer Key
- ❖ Timer
- ❖ Score sheets or blackboard
- ❖ Pencil or pen
- ❖ Recycled pencils

**PROCEDURE:**

1. Divide into teams.
2. A member from one team picks a game question. The team reads the question aloud and then has 30 seconds to answer the trivia question.
3. If team members answer correctly, they take another turn. If not, the other team takes a turn.
4. Each team gets one point for each correct answer.
5. The team that wins receives recycled pencils.

## Trash Trivia Game Questions

(Copy and cut questions so they are on individual strips of paper.)

1. Which country has 6% of the world's population and produces half of the world's garbage?
  - A. The Soviet Union
  - B. China
  - C. The United States
2. How many trees must be cut down to provide paper for one edition of the Sunday New York Times?
  - A. 62
  - B. 628
  - C. 75,000
3. How many trees are saved when one ton of paper is recycled?
  - A. 5
  - B. 17
  - C. 100
4. How many tons of dangerous waste is produced by American industries each year?
  - A. 3 thousand
  - B. 1 million
  - C. 250 million
5. What percentage of landfills in the United States were closed between 1984 and 1988?
  - A. 30%
  - B. 5%
  - C. 50%
6. What is New York's largest export?
  - A. Food
  - B. Waste paper
  - C. Shoes

# LANDFILL

7. How many pounds of glass does each person in the United States use each year?
  - A. 100
  - B. 10
  - C. 50
8. How much of Japan's waste stream was recycled in one very effective program?
  - A. 30%
  - B. 50%
  - C. 80%
9. When you buy \$11.00 of groceries, how much of that money pays for the product packaging?
  - A. 10 cents
  - B. \$1.00
  - C. \$5.00
10. What percentage of our garbage is plant matter and can be composted?
  - A. 25-30%
  - B. 80%
  - C. 3%
11. By what year should all communities in New York State have started mandatory recycling programs?
  - A. 1980
  - B. 1992
  - C. 2000
12. How many tons of solid waste does New York State produce in one day?
  - A. 270
  - B. 2700
  - C. 27,000
13. Should we put all our waste in a landfill?
  - A. Yes. Out of sight, out of mind.
  - B. No. Everyone should dig a hole in his or her backyard.
  - C. No! Fewer and fewer communities are allowing landfills to be built. Land is in demand for housing and recreational use. Many communities are concerned about groundwater pollution, which can seep from a landfill site.
14. Name something that is made from recycled glass.
15. In how many weeks is the average aluminum can re-melted and back on the supermarket shelves?
  - A. 2
  - B. 30
  - C. 6
16. Why should you recycle your glass and metal containers?
17. How much can you pay for packaging when you buy a product?
  - A. Up to half the total cost
  - B. 75% of the total cost
  - C. 3% of the total cost
18. What percentage of trash is made up of discarded packaging wastes?
  - A. 70%
  - B. 30-40%
  - C. 5%
19. Which requires less energy: producing aluminum cans from recycled aluminum or from bauxite ore?
  - A. Both ways use the same amount of energy.
  - B. Recycling uses more energy than mining ore.
  - C. 9-95% less energy is used when aluminum cans are recycled.

# LANDFILL

20. How many tons of solid waste does the world currently produce each year?
  - A. 7
  - B. 1000
  - C. 1/2 - 1 billion
21. How many pounds of solid waste per person in the United States are put in landfills each year?
  - A. 1500
  - B. 100
  - C. 500
22. How many tons of paper that could be recycled does the U.S. throw away each year?
  - A. 40 million
  - B. 1 million
  - C. 1 billion
23. Name an item that could be reused but is normally thrown away.
24. If you can buy a can of soda pop, what should you do with the can after you have finished the soda?
  - A. Crumple it up and throw it on the ground. It will rot in a while.
  - B. Throw it in a trash can with other paper wrappers and garbage.
  - C. Put it with other cans to be recycled, or return it for the deposit.
25. What two things should you keep out of your compost?
  - A. Apple cores
  - B. Eggshells
  - C. Aluminum cans
  - D. Meat scraps
26. From what natural resource is new paper made?
  - A. Grass
  - B. Trees
  - C. Stones
27. What creature is not supposed to be in your compost pile?
  - A. A worm
  - B. A mouse
  - C. A spider
28. Where is compost naturally found?
  - A. In the air
  - B. In the soil
  - C. Under the bed
29. Why shouldn't we dump our wastes in the ocean?
  - A. Garbage will breakdown faster if it's put in a landfill.
  - B. Waste pollutes the ocean and harms animals and plants that live there.
  - C. It makes tidal waves.
30. What can you do with the compost you make from your kitchen and yard wastes?
  - A. Send it to a landfill.
  - B. Use it to enrich the soil in your garden.
  - C. Feed it to your dog.
31. If we recycle the aluminum trash that Americans throw away every three months, we could:
  - A. Rebuild the entire U.S. airline fleet.
  - B. Save a lot of energy.
  - C. Conserve valuable resources.

# LANDFILL

32. If we recycle we:
- A. Won't need any more landfills or incinerators.
  - B. Can reduce the amount of waste going to the landfills and incinerators by 25-50%.
  - C. Don't need any other disposal method.
33. Recycling:
- A. Doesn't produce any pollution.
  - B. Often costs money.
  - C. Causes lots of pollution.
34. Incineration:
- A. Can solve all our solid waste problems.
  - B. Serves as part of the solid waste solution in some communities.
  - C. Only has negative environmental effects.
35. How can we send less green waste to landfills?
- A. Composting in our backyards.
  - B. Changing our yard management practices, for example leaving grass clippings on the lawn.
  - C. Teaching our neighbors to compost.
36. What can we do with wastes that can't be composted, reused or recycled?
- A. Dump them on the roadside.
  - B. Burn them in an incinerator.
  - C. Bury them in a landfill.

# LANDFILL

## Answer Key

1. C. The United States
2. C. 75,000
3. B. 17
4. C. 250 million
5. A. 30%
6. B. Waste paper
7. A. 100
8. B. 50%
9. B. \$1.00
10. A. 25 – 30%
11. B. 1992
12. C. 27,000
13. C. No! Fewer and fewer communities are allowing landfills to be built. Land is in demand for housing and recreational use. Many communities are concerned about groundwater pollution, which can seep from a landfill site.
14. Bottles, bricks, construction materials, road-building materials, fiberglass insulation
15. C. 6
16. Much less energy (work) is used to make a bottle or can from recycled materials than from raw materials. Glass is originally made from sand and aluminum cans are made from mineral ore. Reduces waste and they can theoretically be recycled over and over.
17. A. Up to half the total cost
18. B. 30 – 40%
19. C. 9-95% less energy is used when aluminum cans are recycled.
20. C. ½ - 1 billion
21. A. 1500
22. A. 40 million
23. Yogurt container, Styrofoam packaging, plastic bag, rubber tire, coffee can, glass bottle.
24. C. Put it with other cans to be recycled, or return it for the deposit.
25. C. & D. Aluminum cans and meat scraps
26. B. Trees
27. B. A mouse
28. B. In the soil
29. B. Waste pollutes the ocean and harms animals and plants that live there.
30. B. Use it to enrich the soil in your garden.
31. A. Rebuild the entire U.S. airline fleet.  
B. Save a lot of energy.  
C. Conserve valuable resources.  
(All three answers correct)
32. B. Can reduce the amount of waste going to the landfills and incinerators by 25-50%.
33. B. Often costs money.
34. B. Serves as part of the solid waste solution in some communities.
35. A. Composting in our backyards.  
B. Changing our yard management practices, for example leaving grass clippings on the lawn.  
C. Teaching our neighbors to compost.  
(all three answers are correct)
36. Both B. & C. Burn them in an incinerator or Bury them in a landfill.

# LANDFILL

## Mix And Match Waste Game

Try to match the words on the left column to the descriptions in the right column.

1. Compost pile	A. When natural materials break down and become soil.
2. Conservation	B. Dirty.
3. Decomposition	C. A place to put vegetable peels, leaves, and grass clippings where they will decompose to humus.
4. Environment	D. Chemicals and some industrial and household wastes that are harmful to all living things.
5. Leachate	E. Wise use of our natural resources to avoid waste.
6. Natural resources	F. The dirty water that collects after rain runs through a landfill.
7. Polluted	G. Things we depend on in our environment that are supplied by nature, such as air, water, soil, and wildlife.
8. Recycling	H. A place where garbage is properly buried to protect water and the surrounding environment.
9. Reuse	I. The world around us.
10. Sanitary landfill	J. Collecting and using materials to make new products.
11. Toxic waste	K. Using items more than one time, i.e. peanut butter jars to hold buttons or nails.
12. Waste-wise	L. Using our heads about conserving, recycling, and any problems we might have dealing with solid waste.
13. Solid waste	M. Everything we throw away, i.e. glass, metal, plastic, and kitchen
14. Resource recovery plant	N. A Place where waste is burned and energy is produced.

**Answers:** 1-C, 2-E, 3-A, 4-I, 5-F, 6-G, 7-B, 8-J, 9-K, 10-H, 11-D, 12-L, 13-M, 14-N

**SOURCE:**

Cornell Waste Management Institute. 1991. *Trash Goes to School*.  
(<http://cwmi.css.cornell.edu/TrashGoesToSchool/TrashIntro.htm>).

# LANDFILL

## Waste Disposal - Simulated Landfills

**SUGGESTED GRADE LEVEL:** 4

### **OBJECTIVE:**

By making a simulated open dump, traditional landfill and sanitary landfill, students will observe the differences among them and contemplate their effect on the environment. They will also discover how landfills work. Specifically, students will recognize how landfills differ from illegal open dumps.

### **BACKGROUND:**

(See attached *Subtitle D Landfills*)

Leachate is the liquid that accumulates at the bottom of a pile of waste. It may find its way into the groundwater system.

### **TIME:**

One class period for concept development and twenty days for observations.

### **MATERIALS:**

A variety of organic and inorganic waste, 2 large cardboard shoeboxes, scissors, 1-gallon plastic milk jug, 4 garbage bags, 10 lbs. soil, watering can with water.

### **PROCEDURE:**

#### **Leading Question:**

What is the best method for solid waste disposal?

1. Discuss the new requirements for sanitary landfills and compare them to procedures used prior to the 1980's at open dumps. Ask for student hypotheses about why current

specifications are required. (Early procedures for disposing of waste often polluted the environment.)

2. Explain that the class will construct mini-landfills and a mini-open dump in order to observe what happens in each.
3. With all materials before the class, call individuals to come forward and separate the waste items into "organic" and "inorganic" piles. Others make lists of items in the two piles. (Include plastic items, paper scraps, metal items, fabric, food scraps such as fruit peels, newspaper, etc.)
4. Then call on individuals to come up and do the following steps:
  - a. **Open Dump:** In a large cardboard shoebox, place 3 inches of soil to cover the bottom of the box. Pack it down. Heap in organic and inorganic wastes. Sprinkle with water; label it "Open Dump". Place outside on top of garbage bag. Ever other day sprinkle with ½ cup of water. Leave it open to the sun and air. Observe over time.
  - b. **Traditional Dump:** In a large cardboard shoebox, place 3 inches of soil to cover the bottom of the box. Pack it down. Heap in wastes. Add another layer of soil, another layer of garbage, then top with a layer of soil 3-4 inches deep. Label the box "Early Landfill." Place it in a plastic garbage bag, sprinkle with water and seal with a twist tie. Take it outside where it will remain undisturbed. Every other day open the landfill to sprinkle with ½ cup of water. Observe over time.

# LANDFILL

- c. **Sanitary Landfill:** Take a gallon-size plastic milk jug and cut out near the top around 3 sides to create a large opening. (The heavy plastic represents the landfill's liner.) Place a heavy garbage bag inside covering the bottom. (This represents another protective layer.) Add 2 inches of soil and pack it down. Heap in organic and inorganic wastes, add another layer of packed soil, another layer of waste, then top with a layer of soil. Seal the cut and top of the jug with heavy-duty tape. Because the top is sealed, this will represent a closed landfill, not an operating one. Label it "Sanitary Landfill" and place it in a plastic garbage bag and twist tie it closed. Take it outside. Open it only to observe. Do not water it.

5. Give a *Landfill Questionnaire* to each student or designated group for discussion or completion.
6. As observations are made over time, write about the findings. Ask open-ended questions such as "What would happen if dangerous chemicals were thrown into an open dump or a landfill?" "What effect would a landfill have on its environment?"

## What Now?

1. Arrange for students to visit a nearby solid waste disposal site.
2. Discuss the advantages of the waste disposal method used there. Are there better methods available?

## SOURCE:

South Carolina Department of Health and Environmental Control. 2001.

*Action for a Cleaner Tomorrow: A South Carolina Environmental Curriculum Supplement.*

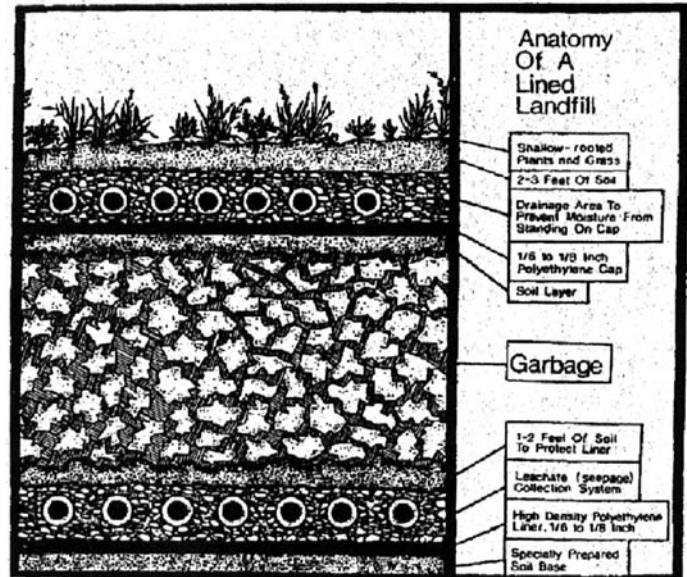
# LANDFILL

## “SUBTITLE D LANDFILL”

### Layers of the Landfill

Today’s sanitary landfill is engineered to protect public health and the environment.

Subtitle D of the Resource Conservation and Recovery Act establishes standards that municipal landfills must meet. A Subtitle D Landfill is layered like this:



**Top Cap** – The top cap of a landfill must be covered with:

- 2 ft. (61 cm) thick soil cover
- Drainage layer
- Flexible membrane layer of 60 mil HDPE plastic\*
- 18 inches (45.7 cm) minimum clay liner ( $1 \times 10^3$  cm/sec max)
- Gas management layer

**Bottom Liner** – The landfill must have a protective bottom liner system that includes:

- 2 ft. (61 cm) protective layer of soil
- Leachate collection system
- Flexible membrane liner (60 mil HDPE plastic\*)
- 2 ft. (61 cm) clay liner ( $1 \times 10^3$  cm/sec\*\*)

New York State landfills about 26.7 percent of its solid waste and has 28 permitted municipal solid waste landfills.

\* Other, similar materials may be substituted for HDPE.

\*\* Refers to the permeability, or speed in which liquids can seep, of the clay. This number means liquids seep very slowly or hardly at all.

### SOURCE:

South Carolina Department of Health and Environmental Control. 2001.

*Action for a Cleaner Tomorrow: A South Carolina Environmental Curriculum Supplement.*