

Make Every Day Green

LESSON FIVE

Landfill vs. Dump

Grade Levels: 3-5

Sunshine State Standards

- **Body of Knowledge: The Nature of Science**
 - Big Idea 1: The Practice of Science
- **Body of Knowledge: Life Science**
 - Big Idea 17: Interdependence
- **Body of Knowledge: Earth & Space Science**
 - Big Idea 6: Earth Structures

Key Concepts

- To have students think about where their garbage goes and to help them comprehend the problems associated with waste management.
- To better understand how a sanitary landfill works, and recognize the necessity of reducing waste.
- Students will demonstrate the understanding of the *Sanitary* landfill as a waste management method by constructing a model.

Vocabulary

- **aquifer:** Porous, water-bearing layer of sand, gravel, and rock below the Earth's surface; reservoir for groundwater.
- **groundwater:** Water that infiltrates into the Earth and is stored in usable amounts in soil and rock below the Earth's surface.
- **leachate:** A liquid that results from water collecting contaminants as it trickles through wastes, or soil containing agricultural pesticides or fertilizers.
- **percolate:** To drain or seep through a porous and permeable substance.
- **sanitary landfill:** A specially engineered site for disposing of solid waste on land, constructed so it will reduce hazard to public health and safety.
- **open dump:** An uncovered space once used for depositing municipal refuse.

Background

Garbage, where does it all go and what happens to it when it gets there? If you ask your students where does it go, most will answer, "It goes away." In Broward County, trash doesn't just go away. It either gets recycled or burned and converted into energy.

Waste that is neither recyclable nor processable at the Waste-to-Energy plants goes to the Broward Interim Contingency (BIC) landfill. Hazardous waste materials and household garbage are not accepted. For materials that are hazardous, Broward County has a free electronics recycling program and several drop-off locations for household hazardous waste. The BIC landfill can accommodate approximately 2.8 million tons of material and has a current demand of 40,000 to 50,000 tons of material a year. The entire parcel of land is 588 acres, but the active landfill area is approximately 52 acres with a permitted landfill area of over 250 acres. According to the Broward County Solid Waste Operations Division, at the current rate of disposal, this facility is expected to be completely operational for 50 or more years.



Sanitary landfills (built after 1991) are lined with a thick plastic and clay layers and have leak monitoring systems in order to protect our groundwater. A liquid waste material called leachate is generated within the landfill. Leachate is caused by the decomposition of the refuse and the percolation of rainwater through the waste material. The contained leachate is sent through pipes to above-ground storage tanks, and is ultimately pumped to a regional wastewater treatment plant. Extra environmental safeguards include a leachate detection system which is monitored continuously; and monitoring wells around the site which are sampled semiannually to test the groundwater quality.

Time

45 minutes construction and introduction, observation of deposition: one week.

Materials

- 2 plastic colanders
- 2 disposable cake pans
- 2 half gallon ice cream bucket of garden soil

- small plastic funnel
- 1 rubber band (yarn or twist-tie can be substituted)
- Strong tape (like duct tape)

- small piece of nylon stocking
- red tissue paper
- small pieces of typical home-generated garbage



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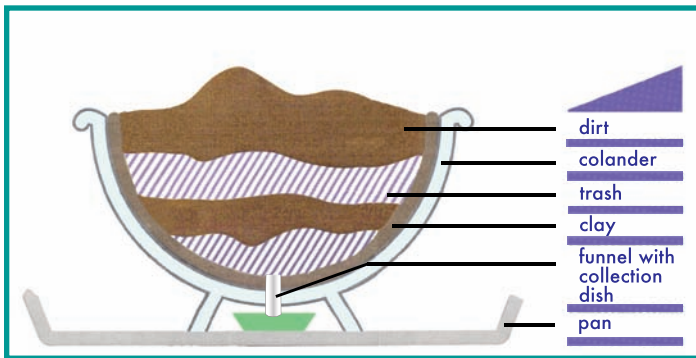
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Procedures

After completing "What goes in a Garbage Can," students are aware of the amount of trash people make, what sort of things people throw away, and that garbage can be reduced by sorting out items that can be reused or recycled.

To make the sanitary landfill:

1. Ahead of time, teacher should bore hole in the center of one plastic colander with an electric drill. This is where you attach the plastic funnel.
2. Line the colander with flattened modeling clay. Pat out clay into a thin layer. This represents the liner of a sanitary landfill.
3. Attach the piece of nylon stocking to one end of the plastic funnel with a rubber band. Poke a hole into the clay layer at the bottom of the colander, at the very center. Attach the funnel to this opening. This will be your monitoring well. The leachate that collects at the bottom of the clay liner can be siphoned off and examined.



To make the dump:

4. Follow the directions as in the sanitary landfill, but do not line the second colander; it represents the old fashioned dump.
 - You may want to add a layer of colored crepe paper to represent toxic waste (the color bleeds out).
5. Place cake pans under both colanders to collect the seepage of the leachate. The cake pan represents the aquifer and ground water.

6. Have students add different types of garbage items:
 - A metal barrette or paper clip
 - Newspaper
 - Plastic
 - Apple slices
 - Aluminum foil
 - Coffee grounds
7. Place trash and soil in colanders in alternating layers until they are filled. Keep a list of all the items placed in each landfill, or keep an example of each piece of trash.
8. With the sanitary landfill, cover the top with another layer of dirt, but leave the dump's contents exposed.
9. When storing model landfills, keep them in a dark room or at least away from direct sunlight to simulate landfill conditions.
10. Have students water or "rain" on each landfill twice weekly and observe the changes that take place. Pay particular attention to the seepage or leachate accumulation in each cake pan. The seepage from the unlined landfill can be observed as it collects in the bottom of the pan. This observable phenomenon helps children understand how ground water can be contaminated. The lined landfill should not have any seepage.
 - Where did the "rain" water go in this landfill? To find out, you will have to siphon leachate out of the bottom of the clay liner using the "monitoring well." Remove the collection dish from underneath the funnel. Observe the leachate and discuss what you have found. In modern landfills, leachate is collected and properly disposed of to prevent groundwater contamination.
11. After a period of time (check each week), open each landfill and see how many items you can find and identify. What changes have taken place? What would have happened to the leachate if it was not siphoned off or trapped in the pan?



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Reflection/Response

- Which items, if any, decomposed? Why?
- How much leachate did each landfill generate? Where did it end up?
- What are the consequences of a dump?
 - Students can test the leachate collected from the dump and the sanitary landfill.
 - In order to do this, ask them to remove the leachate that has collected in the base at the end of each week. Then run a battery of tests on the liquid.

Test for the following properties:

- Measure the acidity or alkalinity of the solution (pH) with litmus paper.
- Suspended solids: drain it through a coffee filter.
- Dissolved solids: boil off the liquid and examine and weigh the residue.
- The leachate can be tested biologically:
 - Planting test plots of seeds and watering them with the leachate from the dump and the sanitary landfill.
 - Plant seeds watered with distilled waters to be the “control”.
 - Compare the number of seeds that germinate.



Extension

- Once the landfill is full and officially closed, a clay “cap” is put over it to keep water out. This also effectively seals out air. What will happen to the trash if no water or air can get into the landfill?
- You may want to add a third colander-landfill with a clay cap to your experiment and observe what changes may take place.
- Put examples of items made from materials used centuries ago (wood, leather, glass, iron, etc.) and items made from modern materials (plastic, Styrofoam, aluminum, etc.) in separate jars of water.
- Observe what happens to these items over time. How could disposing of modern waste in water, like oceans and lakes, affect the environment?