

Recycling Rules

Understanding Recycling and a Materials Recovery Facility

Objectives

Students will be able to identify ways recyclable materials can be separated and sorted at a materials recovery facility (MRF), including these four: conveyor belts, blowers, flotation, and magnetism.

Web-Directed Research

These activities correlate with the Keep America Beautiful “Clean Sweep U.S.A.” web site targeted to grades 6-8, and are designed to expand on the objectives in this lesson. The web site can be found at www.kab.org/cleansweepusa.

1. Define a “**materials recovery facility**”. Describe the “**recycling loop**”. Have students site online sources.
2. Select one recycled material (e.g., paper, plastic, aluminum, steel, glass, tires, cars, computers, cell phones etc.) and report on it. What is the recycling rate? What new products are made from the recycled material? List other facts that make it valuable to recycle?
3. Find the recycling guidelines for their community. Who is responsible for recycling and recycling education? What are considered contaminants?
4. Find out how recyclables in their community are collected and sorted. Where is the closest materials recovery facility? What does it take to site a materials recovery facility? Are they regulated? Who regulates them?

Web sites to consult:

- U.S. Environmental Protection Agency Office of Solid Waste (<http://www.epa.gov/osw/>); state municipal solid waste data (<http://www.epa.gov/epaoswer/non-hw/muncpl/states.htm>); and electronics recycling campaign (<http://www.epa.gov/epaoswer/osw/conserve/plugin/>)
- Earth 911 (www.earth911.org) environmental glossary and search by zip code for local recycling opportunities
- California Integrated Waste Management Board Waste Prevention World (<http://www.ciwmb.ca.gov/wpw/>)
- Alcan Aluminum Corporation (www.recycle.alcan.com/aluminum/)
- American Forest & Paper Association (www.afandpa.org/recycling) and interactive recycling game
- Steel Recycling Institute (www.recycle-steel.org)
- Glass Packaging Institute (www.gpi.org)
- Can Central (<http://www.cancentral.com>)
- Plastic recycling (www.PlasticsResource.com and www.napcor.com)
- National Soft Drink Association (www.nsd.org), and www.bottlesandcans.org
- International association of electronics recyclers (www.iaer.org)
- Web site of the City or County government that handles solid waste

In-Class Activity

Method

Students will simulate four separation techniques used by materials recovery facilities (MRFs). While all of these techniques may or may not be used locally, all four are presented here.

Materials

A large bag of clean “garbage” (many types and sizes of paper, assorted plastic containers, aluminum cans, aerosol and other steel cans), paperclips, bits of wire, a large magnet, a wide shallow dish pan, water, a large box lid, a stop watch or clock, and a fan.

Vocabulary

commingle, ferrous metal, materials recovery facility (MRF), recyclable

Procedure

Background:

Many communities transport collected recyclables to a materials recovery facility (MRF, commonly referred to as a “murf”). A MRF is a facility for sorting, separating, and processing trash and recyclables. A MRF may take commingled recyclables such as aluminum and steel cans, plastic jugs, glass bottles, and newspapers and separate them by hand or use mechanical processing. Some MRFs process discarded waste, and extract and separate recyclables from trash that will be landfilled or incinerated.

Here's an example: Homeowners place their trash and recyclables in bags or bins at the curb. The recyclable materials are either collected all together or separated, depending on the community. The collection truck then hauls the materials to the MRF for further processing. At some MRFs, materials go across a screen, separating light and heavy materials, like glass. An eddy current pulls out aluminum cans. Magnetic separators gather up metals, like steel and tin. Recycled paper is usually hand picked and separated by grade or type of paper. Workers constantly ensure that materials are appropriately sorted during the entire process.

After sorting the recyclables according to the manufacturers' end use specifications, the materials are usually baled and loaded onto trucks for transport. These raw materials go to businesses which perform the next step in the recycling process, manufacturing new products. The new products are then transported to stores for the final step in the recycling process-- purchase by the consumer.

Procedures:

1. Teacher will collect a pen or pencil from each student.
2. Teacher lines up pens and pencils across the front edge of a table or desk in an orderly fashion.
3. Instruct students that when teacher says go they are to walk forward, find their own pen/pencil, and return to their seats.
4. Time the procedure.
5. Repeat the activity, but this time commingle (mix) all of the pens/pencils into one heap.
6. Time the procedure again.
7. Compare the times and discuss why there is a difference.
8. Relate this activity to sorting recyclables from trash and from other recyclables.
9. Explain that most MRFs use manual and mechanical methods to sort recyclables.

10. Have a bag of clean “garbage” materials ready, including the examples listed in the “Materials” section of this lesson.
11. Distribute copies of the student sheet, “MRF Notes,” provided at the end of this lesson. Ask students to record predictions about which materials could be sorted at a MRF by conveyor belts, by wind, with water (float or sink), and with magnets.
12. Tell the students to then perform or watch the following simulations and record the actual results:

NOTE: The following simulations should be performed as a demonstration calling forward small groups to assist the instructor.

TRIAL 1: Conveyor Belt Simulation

Empty the clean materials from the bag in a pile onto the large box lid. Gently shake the lid to show how some MRFs use conveyor belts to move the materials and to separate them. Record the results.

TRIAL 2: Blower Simulation

All the participants should wear safety goggles. Turn on the fan. Drop each object in front of the blowing fan. What happens to each object? Record the results. The wind should blow the paper and plastic. Discuss how some MRFs use blowers to sort plastic and paper.

TRIAL 3: Flotation Simulation

Fill a dish pan with water. Choose a few recyclable samples and drop them into the water, one at a time. Does the item float or sink? Record the results. Relate this to how MRFs may use flotation for sorting.

TRIAL 4: Magnetic Removal Simulation

Test each material for magnetic properties. Record the results. Relate this to how MRFs use magnets to sort ferrous metals. You may wish to heap the recyclables in one pile, and attempt to 'pull out' the ferrous metals using only one magnet.

13. Have students compare their predictions with the actual results.
14. Discuss the advantages and disadvantages of each procedure (conveyor belts, blowers, flotation systems, and magnets) that may be used at MRFs. Include in the discussion the use of manual processing systems and how the two (mechanical and manual) interact.

Assessment

Have students describe a materials recovery facility (MRF), and identify four sorting techniques to separate recyclable materials.

Standards of Learning

The North American Association for Environmental Education (NAAEE) Guidelines for Excellence in Environmental Education can be found at <http://naaee.org/npeee/learnerguidelines/8th.html>. The Guidelines for Learning which correlate to this lesson are: Strand 1 A, B, C, D, F, G; Strand 2.3 C, E; Strand 2.4 A, C, D, E; Strand 3, B, D; Strand 4 A, B, C, D.

Notes

Trial 1: Conveyor Belt Simulation

Material:

Prediction:

Actual:

(Will or will not separate.)

1. _____
2. _____
3. _____
4. _____
5. _____

Trial 2: Blower Simulation

Material:

Prediction:

Actual:

(Will or will not be blown.)

1. _____
2. _____
3. _____
4. _____
5. _____

Trial 3: Flotation Simulation

Material:

Prediction:

Actual:

(Floats or sinks.)

1. _____
2. _____
3. _____
4. _____
5. _____

Trial 4: Magnetic Removal Simulation
Material:

Prediction: Actual:
(Will or will not be picked up by a magnet.)

1. _____
2. _____
3. _____
4. _____
5. _____