

MRF in Action

Objectives

Students will be able to:

- ➔ identify ways materials can be separated and sorted at recycling centers or a materials recovery facility (MRF), including the following five ways: 1) conveyor belts, 2) blowers, 3) flotation, 4) magnetism, 5) manual pickers.

Method

Students will simulate five separation techniques used by recycling centers or materials recovery facilities including the four automated processes that are introduced in this activity. All five techniques may or may not be used locally.

Materials

A large bag full of clean recyclables to include:

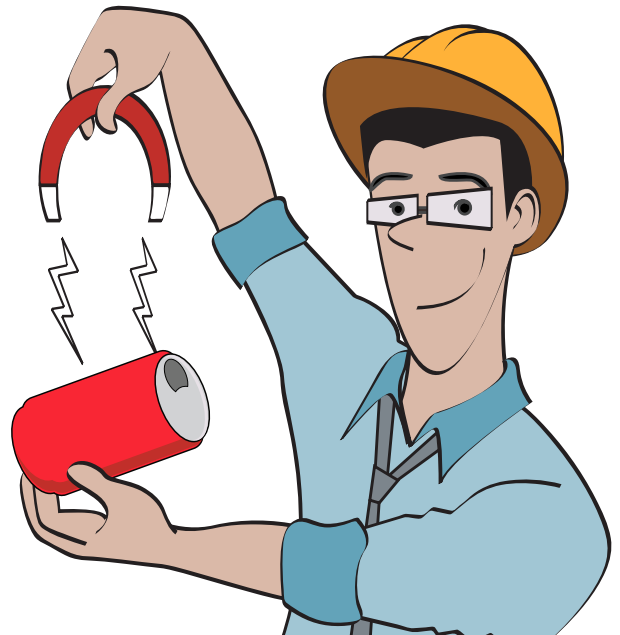
- many types and sizes of paper
- assorted plastic bottles and containers
- aluminum cans
- steel cans
- paperclips
- a glass jar

Other materials to include:

- a large magnet
- a large plastic tub with lid
- water
- a stop watch or clock
- safety goggles and a fan

Time

1-2 hours



Vocabulary

- commingle
- contamination
- ferrous metal
- curbside recycling
- materials recovery facility (MRF)
- drop off center
- recyclable
- recycling center

Background

The collection of recyclables is the first part of the recycling cycle. Some homeowners may place their recyclables in bins at the curb. The driver may sort the materials into different compartments of the truck curbside or place the commingled materials all mixed together into the truck. This is referred to as curbside collection.

Recyclable materials may also be collected via drop off. In this system, citizens must collect their own recyclables and transport them to a collection point. Collection can take place at a staffed or unstaffed location.

The second part of the recycling cycle is to process the material collected. Many communities transport collected recyclables to a materials recovery facility (MRF – commonly referred to as a “murf” or recycling center). This recycling center sorts and processes recyclables. It may take commingled

recyclables such as aluminum and steel cans, plastic jugs, glass bottles, and newspapers and separate them by hand or place them on a conveyor belt for mechanical processing.

Often the material is placed on a conveyor belt where magnets pull out ferrous metal, vacuums or blowers pull out plastic, paper is separated by a trommel screen that shakes or a sticky conveyor belt, and electrical currents force out aluminum. Glass usually falls off the end of the conveyor belt at the end or is separated by a trommel screen also. Workers constantly ensure that materials are effectively sorted during the entire process. Newer MRFs may have optical scanners.

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

Procedure

1. Have a bag of clean materials ready, including the examples listed in the “Materials” section of this activity.

NOTE: The following simulations should be performed as a demonstration calling forward students individually and in small groups to assist.

2. Distribute copies of the student sheet, “Recycling Center and MRF Notes,” provided at the end of this activity. Students will record predictions about materials sorted at a recycling center. Ask students how materials might be sorted, such as manually, by conveyor belts, by compressed air, with water (float or sink), and with magnets.
3. Tell the students to then perform or watch the following simulations and record the actual results:

TRIAL 1: Manual Picker

- Educator will collect a pen or pencil from each student.
- Educator lines up pens and pencils across the front edge of a table or desk in an orderly fashion.
- Educator instructs students, When educator says “go” they are to walk forward, find their own pen/pencil and return to their seats.
- Time the procedure.
- Repeat the activity, but this time commingle (mix) all of the pens/pencils into one heap.
- Time the procedure again.

- Compare the times and discuss why there is a difference. Relate this activity to sorting recyclables from other recyclables. Explain that most recycling centers and MRFs use manual and mechanical methods to sort recyclables. Many modern MRFs conduct a negative sort using pickers, meaning people are only picking out contamination.
- Discuss how contamination by either non-recyclables or items not recycled at a specific MRF may impact the process.

TRIAL 2: Conveyor Belt and Trommel Screen Simulation

- Empty the clean materials from the bag onto the lid of the plastic container. Gently shake the lid while flat to show how some MRFs use conveyor belts and trommel screens to move the materials and separate them.
- Ask the students to imagine the lid was sticky and was on an incline. What would happen to the material then? Record the results.
- This method is often used to separate out paper and glass.

TRIAL 3: Blower Simulation

- All the participants should wear safety goggles.
- Set the fan on the desk.
- Place various recyclables on the desk in front of the fan. Turn the fan on low. What happens to each object? Record the results.
- Turn the fan on high. What happens to each object? Record the results.
- How do the results differ?
- Discuss how some recycling centers and MRFs use blowers to sort plastic and paper.

TRIAL 4: Flotation Simulation

- Fill the large plastic tub 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.
- This is often used as a way to separate the different types of plastic.

TRIAL 5: Magnetic Removal Simulation

- Test a few materials for magnetic properties. Record the results. Relate this to how recycling centers and MRFs use magnets to sort ferrous metals.
- Heap the recyclables in one pile, and attempt to ‘pull out’ the ferrous metals using only one magnet. Magnets separate out steel cans but not aluminum cans.

- The mechanical way a MRF can separate out an aluminum can is through an eddy current. An eddy current is the opposite of a magnet. Instead of being attracted to an object, it pushes it away. This magnetic force is used to push aluminum cans off the conveyor belt.

TRIAL 6: What's left?

- Review with the students what has been mechanically separated out and how. Then discuss what might be left?
 - Often times glass is the last thing left on the conveyor belt because it's been broken into little pieces and is heavy. These small pieces of glass called cullet often just fall into a bin at the end of the conveyor system.
4. Do students think that all these methods are used at all recycling centers? Ask students to investigate what is happening in their community and at other recycling centers and MRFs in their area, if any.
 5. Have students compare their predictions with the actual results.
 6. Discuss the advantages and disadvantages of each procedure used (manual, conveyor belts, blowers, flotation systems, and magnets). Include in the discussion the use of how the two processing systems (mechanical and manual) interact.

Assessment

Have students describe a recycling center and materials recovery facility (MRF), and identify five sorting techniques used to separate recyclable materials for further processing.

Technology Connections

Refer students to RecycleBank's animated video about how commingled material is separated out mechanically.

<http://www.recyclebank.com/live-green/the-cycle/>

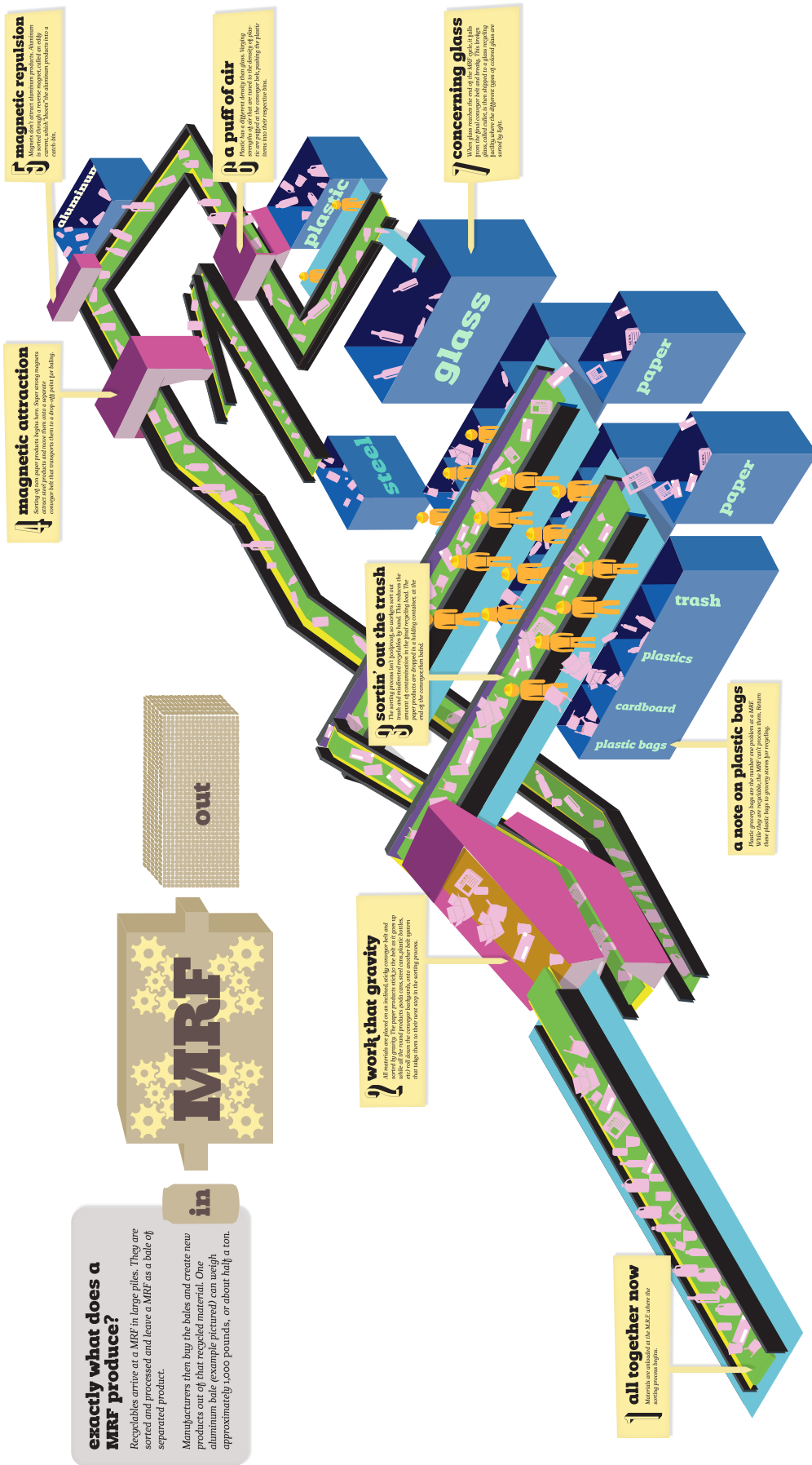
Websites to consult:

- U.S. Environmental Protection Agency Office of Solid Waste (<http://www.epa.gov/osw>)
- Earth 911 (www.earth911.org) environmental glossary and search by zip code for local recycling opportunities
- 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)
- Web site of the City or County government that handles solid waste

Enrichment

- Identify the materials collected in your community for recycling, and research how they are collected and sorted.
- Visit a local recycling center and MRF if one is operating in or near your community.



Student Activity Sheet – Recycling Center and MRF Notes

Trial 1: Manual

Experience using line option: Easy/Difficult _____

Experience using pile option: Easy/Difficult _____

Trial 2: Conveyor Belt/ Trommel Screen Simulation

| Material | Prediction (Will or Will Not Separate) | Actual |
|----------|---|--------|
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |

Trial 3: Blower Simulation

| Material | Prediction (Will or Will Not Blow) | Actual |
|----------|---------------------------------------|--------|
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |

Trial 4: Flotation Simulation

| Material | Prediction (Floats or Sinks) | Actual |
|----------|---------------------------------|--------|
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |

Trial 5: Magnetic Simulation

| Material | Prediction (Will or Will Not Be Picked Up) | Actual |
|----------|---|--------|
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |