

MRF in Action Lesson Plan

Objectives:

- 1) Students will understand basics of solid waste management and remember the 3 R's – in order.
- 2) Students will understand physical properties of recyclables.
- 3) Students will understand the basics of the recycling sorting process.

Background Information

- Solid Waste Management basics
- 3R's – Reduce, Reuse, Recycle
- Physical Properties of matter

Materials Needed

- Mini-MRF kit
- Table in the classroom to set up mini-MRF

Lesson Time

- 45 minutes
- Pre-Activity (20 min or as homework)
- Post-Activity (20-30 min or as homework)

North Carolina Common Core and Essential Standards:

- 4.P.1.1 Explain how magnets interact with all things made of iron and with other magnets to produce motion without touching them.
- 4.P.1.2 Explain how electrically charged objects push or pull on other electrically charged objects and produce motion.
- 4.P.2.1 Compare the physical properties of samples of matter (strength, hardness, flexibility, ability to conduct heat, ability to conduct electricity, ability to be attracted by magnets, reactions to water and fire).
- 4.L.1.3 Explain how humans can adapt their behavior to live in changing habitats (e.g., recycling wastes, establishing rain gardens, planting trees and shrubs to prevent flooding and erosion).
- 4.G.1.2 Explain the impact that human activity has on the availability of natural resources in North Carolina.
- 4.G.1.3 Exemplify the interactions of various peoples, places and cultures in terms of adaptation and modification of the environment.
- 4.G.1.4 Explain the impact of technology (communication, transportation and inventions) on North Carolina's citizens, past and present.

MRF Lesson Partnership

This lesson was developed by the MRF Lesson Partnership, a joint collaboration of the City of Wilmington, New Hanover County, Keep New Hanover County Beautiful, UNCW's Watson College of Education, and the Center for Education in Science, Technology, Engineering and Math (CESTEM).

| Subject | Procedure | Materials | Standards |
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| Review from Waste Audit Lesson (15min) | Q: What happens to the trash once it's in the trash can? Goes to the landfill. NHC landfill is over 70' tall(permitted to 200'); 689 acres; <i>Show poster of landfill.</i> | Photo of landfill/school bus | |
| Three Rs | Q: What are the 3 Rs? 1) reduce = don't use something or use less , 2) reuse = use something again (like a bag, water bottle, etc.) 3) recycle = break it down or melt it, and make it into a new product . | <i>*Photo-Reduce, reuse, recycle.</i> | 4.G.1.3; 4.L.1.3 |
| Intro to Recycling | Show "Life of a Plastic Bottle" series Episode 1: http://youtu.be/SUGw6V_lj4s Episode 2: http://youtu.be/fNFarO81IQM Episode 3: http://youtu.be/dWK6RrYclUA Q: Do you recycle at school? Home? Why do you recycle? | | |

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| | <p>e.g. Making new cans out of old cans uses a lot less energy and water than using new aluminum – and creates a lot less air and water pollution.</p> <p>Q: What can we recycle?</p> <p>A: plastic, paper, cardboard, aluminum, steel, glass</p> <p>Q: What happens to the recycling after it leaves your house/school?</p> <p>Options –</p> <p>City of Wilmington blue carts, New Hanover County’s drop-off sites, Waste Management, Waste Industries, Pink Trash, etc.</p> <p>A: All of the recycling, regardless of hauler, goes to a MRF. <i>Show MRF poster.</i> Material Recovery Facility – the sorting center we saw in the first episode of “Life of a Plastic Bottle”</p> | | |
| Create a Mini-MRF (20 min) | <p>Let’s make a MRF in the classroom!</p> <p>The MRF uses the different characteristics – or physical properties - of recyclables to sort them. What do you notice about these different materials? Differences in weight, feel, shape, hardness, etc.?</p> <p>Students break up into groups to create their own MRF. Encourage students identify the items and make observations about the weight, material type, and other physical properties. For example, weight (light or heavy), melting temperatures (high or low), magnetism (magnetic or not).</p> <p>Each group takes 2-3 minutes to present and explain to the class how (what tools) they would use to sort out each material type.</p> | <p>*Show recyclables visual aid</p> <p>*Show physical properties visual aid</p> <p>Mini MRF kits (one per group)</p> | 4.P.2.1 |
| Demonstrate MRF. Station 1: Drop off Materials | <p>“Drive” the truck into the tipping floor of the MRF (a carpeted area in the room) and empty the contents. <i>Instructor can zoom around a few desks to pretend to pick up recyclables if they need a little more to do.</i></p> | Recycling truck, small recycling carts | |
| Station 2: Manual Sort | <p>MRFs use technology to sort recyclable materials. But people still sort some items out</p> <p>Cardboard is big, bulky and easy to pick out. Plastic bags get stuck in the machines at the MRF, so that’s why we recycle them at the grocery store.</p> | Cardboard, plastic bags, paper, metals. *Show manual sort prompt | 4.G.1.4 |
| Station 3: Paper | <p>Use the fan to move the paper. Why does the paper fly off? It’s lightweight.</p> <p>The paper will be baled and trucked to a facility to make things like new paper or paperboard boxes (tell them to look at their cereal box tomorrow morning; they all say “made with 100% recycled content”)</p> | Fan paper | 4.P.2.1 |
| Station 4: Plastic Density | <p>How do you think plastics are sorted? Plastic comes in all different shapes, sizes, and colors. Look around the room and have students point out a few</p> | | 4.P.2.1 |

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| | <p>examples that are easily visible. Where do plastics come from? What are they made of? Plastic is made with different types of resins (thick liquids that harden into a solid). There are natural resins that come from plants (e.g. amber, frankincense and myrrh) and are used in varnish, glue, and to make rosin that you put on your violin bow. Resins can also be synthetic, or man-made. Plastic is typically made of synthetic resin. Plastics have different physical properties – some float, some sink, for instance.</p> <p>MRFs use a few different types of technology to sort plastics. Some use an optical sensor, which is kind of like a laser beam that can tell how thick something is. Other MRFs use a water tank to sort out which plastic floats and which sinks.</p> | Jar of plastics in water | |
| Station 5/6: Magnets | <p>How can we sort out metals? MRFs use a magnet to sort out materials that have metals such as iron, nickel or cobalt in them. Show the steel can, sometimes called a tin can. Steel is a mix, or an alloy, made of iron and a little bit of carbon. These cans are often lined with tin, so people sometimes call them tin cans. Confused? Remember this – steel cans are attracted to magnets. Aluminum cans (hold one up) aren't.</p> | Magnets Steel cans Aluminum cans | 4.P.1.1 |
| | <p>To separate aluminum cans, use positive and negative poles of magnets to repel and shoot the cans onto the conveyor belt.</p> <p>An eddy current, magnets spin around and create an energy field around the aluminum.</p> <p>Use the magnetic repulsion cars to demonstrate.</p> <p>Have 1 student come up to use the “eddy current” to sort out aluminum cans.</p> | Aluminum cans Magnets with cars | 4.P.1.2 |
| Station 7: Glass | <p>Have 1 student hold the bag of glass beads and the empty yogurt container. Which one is heavier? In a MRF, the heavy glass is directed to a glass collection site. The glass will be trucked to a factory to make new glass, countertops, or sometimes it's crushed and used to make roads.</p> | Glass beads Yogurt container | 4.P.2.1 |
| Station 8: Bales | <p>Show the students the baled recyclables. Just like we saw in the videos, every material (except glass) is baled up, like hay.</p> <p>After the materials are baled up, they are shipped to factories around the state, country or around the world to be made into something new.</p> <p>We recycle so we can take materials and make them into something new, instead of letting it take up</p> | Mini bales Carpet, | |

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| | space in the landfill. | notebooks, pencils, golf tees | |
| Review/Wrap Up | What are the 3Rs? How can we sort out recyclables? | | |

Post Activity Ideas

Have students describe a recycling center and materials recovery facility (MRF), and identify five sorting techniques used to separate recyclable materials for further processing. This can be done with the “Sort It Out” worksheet or with a class discussion.

Extension for classes that conducted waste audit in school

Now that you have done a waste audit at school, test it out at home. What can you do to reduce waste at home and make it easier to recycle?

Resources

- How a MRF works, animated video from re3.org <http://youtu.be/7CFE5tD1CCI>
- U.S. Environmental Protection Agency Office of Solid Waste <http://www.epa.gov/osw>
- NC School of Science and Math, Magnetic Effects <http://www.ncssm.edu/learn/magnetic-effects-0>
- Earth 911 - environmental glossary and search by zip code for local recycling opportunities www.earth911.org
- American Forest & Paper Association – interactive recycling game www.afandpa.org/recycling
- 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
- Eddy current in action <http://www.cogelme.com/eng/e-videos.htm>
- Relationship between aluminum and magnets <http://terpconnect.umd.edu/~wbreslyn/magnets/is-aluminium-magnetic.html>

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