

TEACHER BACKGROUND

(revised Dec 2016)

Introduction to Recycling

What is Recycling?

Recycling is the process of taking something that was used by a consumer or post-industrial user and remanufacturing it into something new again.

Why should we recycle?

There are a lot of reasons why it's important for us to recycle. Recycling has both environmental and economic benefits.

- **Recycling helps to conserve natural resources** such as land, trees, and minerals. The more paper we recycle the fewer number of trees that need to be replenished. It also helps to prevent the excess mining of ores such as aluminum found in the earth by recycling the same resource over and over again.
- **Recycling helps to save money.** In some U.S. states a “pay-as-you-throw” program is used in which citizens’ pay more for trash collection if they produce more trash. The lower the amount of trash collected the lower the bill. Reduced waste disposal may often reduce landfill costs as well. It can also help the manufacturer who makes those products save money when they sell their products to us, the consumer.
- **Recycling conserves energy.** It takes more energy to make something out of raw materials than something that has already been used. For example, to make paper from trees uses approximately 7,000 gallons of water whereas, it only takes 360 gallons to use recycled paper fiber¹.
- **Recycling saves landfill space.** There is one landfill in Wake County that accepts trash from the surrounding neighborhoods and businesses. About 1,400-1,600 tons of municipal solid waste (MSW) goes into the landfill each day. By recycling you help to conserve space inside the landfill for those items that cannot yet be recycled.
- **Recycling provides jobs for people.** Jobs such as recycling collectors and manufacturers that process recycled materials are important to the conservation of resources. According to the N.C. Division of Environmental Quality there are over 532 recycling businesses in North Carolina.¹
- **Recycling provides alternate materials.** Everyday things can be made with recycled materials such as plastic lumber benches, road safety markers, asphalt and much more.

When did recycling first begin?

The first written record of recycling came from Japan where old paper was pulped into new paper. In the United States, the concept of recycling began during war times around World War

¹ (2010) <http://www.re3.org/facts.htm>

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II. During the war there was a need for materials like rubber, paper, metals, glass, and fats to help in various ways.

What types of things can we recycle?

In the U.S. each state or town has its own unique list of items for recycling. Why? Often it has to do with the facility where the materials (e.g. paper, plastic) go to be sorted and transported for use by the factories making the products. Typically, the standard materials that get recycled are paper, glass, plastic, aluminum, and steel. Other items that get recycled or “re-purposed” in Wake County are electronics, tires, batteries, wood pallets, white goods (i.e. stoves, refrigerators), and household hazardous wastes(HHW) such as oil, paint, and batteries. Many of the items that cannot go into our trash such as chemicals or electronic equipment are required to be recycled because of the danger those items can cause once disposed of inside a landfill.

What does the 3-arrow symbol stand for in recycling?

Most often we hear that it stands for the three R's- reduce, reuse, and recycle.

This is a common misconception related to the meaning of the arrows.



According to the [Environmental Protection Agency](#) each arrow represents the three-step process in recycling: 1) collecting recyclables, 2) re-manufacturing new products from recyclables, and 3) buying new recycled products.

- Items are first **collected** by curbside or at drop-off convenience centers. The items then go to a **sorting facility called a MRF**, or Material Recovery Facility. A MRF is a specialized facility that receives, separates, and prepares recyclable materials for end-use.
- After sorting, each material is shipped off to its next destination which will begin the **remanufacturing** process.
- Once the material has been remanufactured (or recycled) it will be sent to the factory that will use it to produce a specific product. For example, a giant roll of aluminum that will be used to form new beverage cans.
- Consumers then **buy** that recycled product at grocery and department stores.

The phrase “**Closing the Loop**” refers to the buying of products with recycled-content materials which finishes the loop made by the three-arrows in the symbol.

The three-arrow symbol does not always indicate that a product is made FROM recycled content. It may simply be a reminder to recycle or indicate that the product is recyclable where facilities exist. There may also be labels on the product that describe the amount of post-consumer material included in the product. **Post-consumer content** is material that has been used by consumer hands or that which people have used and collected to be recycled. The other percentage of recycled content is referred to as **pre-consumer** material. This refers to the factory remnants that are left over or other scrap items reclaimed from a factory floor. Pre-

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consumer materials are those materials that never come in contact with the hands of consumer. Some examples of recycled-content products include: newspapers, bathroom tissue, or notebook paper made from recycled paper; aluminum cans, pie tins, or bleacher seats made from recycled aluminum cans; fleece jackets, toys, t-shirts, lumber, and playground equipment made from recycled plastic bottles.

What does “cradle-to-grave” or “cradle-to-cradle mean”?

Cradle-to-grave is a term used in reference to solid or hazardous waste. It’s the manufacturing of a product (“cradle”) that becomes waste at the end of its usefulness (or “end-of-life”) which is then disposed of in landfills. In other words, a new product is “born” (the cradle) and after it’s no longer useful and cannot be recycled or repurposed in some way, goes to its “grave”. An example would be the making of a disposable plastic party cup that once used, cannot be recycled into something new.

Cradle-to-cradle: this is a term that refers to the creation of a product (“cradle”) with the product being recycled or reprocessed at the end of its usefulness in order to make the same product or one with similar material (“cradle”). An example would be the making of a plastic bottle for beverages which then would be recycled into carpet fibers the next time around.

For more specific information related to recycling visit the NEED Project’s free online Info Books at: <http://www.need.org/Guides-Title.php>

Museum of Solid Waste and Energy Book-

<http://www.need.org/needpdf/Museum%20of%20Solid%20Waste%20&%20Energy.pdf>

Talking Trash Info Book - <http://www.need.org/needpdf/Talking%20Trash.pdf>

Trash Flipbook - <http://www.need.org/needpdf/Trash%20FlipBook.pdf>

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Compost Background



What is compost?

Composting is a way to recycle plant and animal material into a soil-like product and can keep food waste and/or yard waste from going to the landfill. Composting happens when the right mixture of ingredients are brought together.

Three groups of ingredients are needed to make compost:

- “Greens” (fruits and vegetables) – nitrogen sources
- “Browns” (plant materials such as leaves, grass clippings, and paper) – carbon sources
- Environmental factors - soil, water, and air

When these three groups of ingredients are combined in the right way healthy compost is made. Items such as meat and dairy products do not make good compost ingredients because they will create odors as they decompose that could possibly attract wildlife and other pests to the compost pile.

Is compost the same thing as soil?

- Compost is **NOT** a type of soil but rather an amendment (i.e. additive) to soil.
- Soil is formed from the breakdown of rocks and minerals over a very long period of time while compost is made from the breakdown of organic plant matter.
- **There are many different types of soil but, the 3 basic components of soil are: sand, humus, and clay.** Each one has its own unique properties.
- **Sand** has the largest particle size, followed by humus, and then clay. The larger the particle size of the soil the bigger the space around that particle to allow water to soak in and air flow.
- **Clay** has the greatest capacity to hold water, whereas sand has the lowest capacity. Although clay has the greatest capacity to hold water, it actually absorbs water at a much slower rate than the others.
- **Humus** is a rich organic material that typically has a mixture of sand and clay. Humus makes a good soil (“top soil”) to use with plants and gardens. Poor soils are those that contain mostly clay or sand.

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How do we make compost?

There are two important types of household composting:

backyard composting and vermicomposting. Neither method is better over another however, extra care may be needed for the red wiggler worms in vermicomposting.

Backyard composting usually involves mixing together items such as sticks, leaves, grass clippings, wood ashes, and small amounts of plant-based food waste. Backyard compost piles must be watered and turned over on a regular basis to keep the compost process active. Water and oxygen are also vital to the decomposition process.

Vermicomposting uses red wiggler worms (usually in enclosed bins) to turn plant-based food waste into plant food. As the worms eat the leftover food, their excrement (i.e. “worm poop”) turns into nutrient-rich compost. Small organisms such as insects and microbes also live in compost piles to aid in the breakdown of material.

What are some of the uses of compost?

Compost is valuable because it can be added to soils to help in plant growth. Rich in nutrients and microorganisms, compost can be added to nutrient deficient soils. Composting is a natural way to amend soils, rather than adding chemical fertilizers. Compost also helps soils retain water moisture and help to keep pests away.

How long does it take for our food scraps and yard trimmings to decompose?

It all depends on the size of the pile and how well it is managed. Most backyard composters will take several months to fully decompose.

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Landfill Background

What is a landfill?

A **sanitary landfill** is a carefully designed structure built to hold a variety of wastes that we dispose of each day. Some common types of landfills are municipal solid waste (MSW) landfills and construction & demolition debris (C&D) landfills. **Municipal solid waste** is the everyday garbage that residents and businesses throw away including kitchen scraps, clothes, and furniture.

How much garbage do we throw away in Wake County?

Wake County's population generates enough total waste to average a little more than 1 ton per person per year². On an average day about 1,400-1,600 tons of trash is disposed in Wake County.

How is a landfill built and is it dangerous to our health?

Modern landfills are highly designed and operated facilities that are built to minimize health hazards, environmental damage, and biological nuisances (e.g. too many birds flying near the trash). A MSW landfill contains layers and liners to make sure that the soil, groundwater, and environment are safe for our health. First, there is a compacted clay layer that is approximately two feet deep followed by 2 plastic synthetic liners – a thin plastic membrane and a geo-net mat on top. This provides greater stability and protection from the liner being punctured by any sharp objects. On top of the liners, leachate collection pipes are placed around the landfill floor to collect any liquid, followed by gravel, another drainage layer and soil. Due to the way a landfill is constructed and maintained, very little decomposition occurs within a landfill. Garbage inside a landfill is “entombed” which means that no air, light, or water is allowed to reach the trash. The result is called anaerobic decomposition. **Anaerobic decomposition** (see fig. 1) slows the breakdown of trash because of the removal of oxygen. This form of decomposition creates landfill gas which contains about 50% methane and 50% carbon dioxide and other gases. All landfills must monitor methane levels and take steps to avoid hazardous buildups of this gas. Most landfills burn the methane by a process called flaring or capture it to produce energy. Methane is considered a greenhouse gas however, once burned or flared-off, prevents the harmful gases from entering earth's atmosphere. **Methane is a renewable energy source** producing about half the energy of natural gas. Another by-product of landfill disposal is **leachate**. The leachate is a liquid that has passed through waste picking up contaminants along the way. Plastic Liners stop leachate before it can seep into the earth. Leachate collection pipes gather this contaminated liquid and send it to a central location. It can then be treated onsite or delivered to a wastewater treatment plant for treatment.



Fig. 1
Anaerobic decomposition on newspaper (dated 1987)

² Wake County Solid Waste Management Division, <http://www.wakegov.com/recycling>

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All About Plastics Background

What is plastic made of?

Plastic is basically made out of petroleum and/or natural gas. Other chemicals may be added to make a specific type of plastic. Plastics are made of **polymers** which is a chemical substance created by many individual **monomers**. Put simply, plastic is a giant chemistry experiment that works with different elements and chemicals. For more detailed information on the making of plastic visit http://www.americanchemistry.com/s_plastics/index.asp .

Why is there numbers on many plastic items we use?

Numbers are found on almost every type of plastic product that's manufactured. It is often found inside the 3-arrow recycling symbol and usually located on the bottom of the item. Currently, there are seven different types of plastic made using the plastic resin code numbers #1-#7. This plastic identification code started in the 1980's as a way to help manufacturers know the type of plastic an item was so it could be recycled properly. All plastics are not created the same because they use different polymers to make each one.

#1 – PETE (Polyethylene Terephthalate)

#2 – HDPE (High-Density Polyethylene)

#3 – PVC (Polyvinyl Chloride)

#4 – LDPE (Low-density Polyethylene)

#5 – PP (Polypropylene)

#6 – PS (Polystyrene; aka Styrofoam® as patented by Dow Chemical Co)

#7 – (Other) a mixture of various types

Recyclers needed to know what type of plastic is being collected in order to process it correctly and citizens use it as a way to know which types their facility will accept. See the American Chemistry Council website for more details:

http://www.americanchemistry.com/s_plastics/doc.asp?CID=1571&DID=5976

How are plastics recycled?

Plastic recycling differs from one recycling facility to another. Some may only collect # 1, #2, and #4 while others may collect all seven. Plastic items such as bottles will be melted and extruded through a machine that makes long thin threads. The threads will be dyed and used to manufacture clothing or carpet fibers. Thicker types of plastic such as #5 food containers or plastic grocery bags will be melted and poured into molds to be made into toys, lumber, or other durable goods.

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Is there a new kind of plastic that biodegrades?

Some newer plastics called bioplastic have been made to be an “environmental-friendly” alternative while others are considered photodegradable. **Bioplastics** are made from organic material such as vegetable oil or corn starch. A popular known bioplastic is called PLA or Polylactic Acid. Bioplastics are considered to be biodegradable and can be disposed in a compost pile. However, there is still much debate as to whether or not bioplastics are a better alternative than traditional plastics. This type of plastic cannot easily be recycled and falls under #7 in other plastic types. Six-pack beverage can rings are considered **photodegradable** because their structure will begin to weaken when exposed to direct sunlight. This special property given to plastic rings was created in response to the concern over aquatic animals getting caught inside the rings. Once the plastic is weakened by the sunlight the animal can break through without further threat to its life.