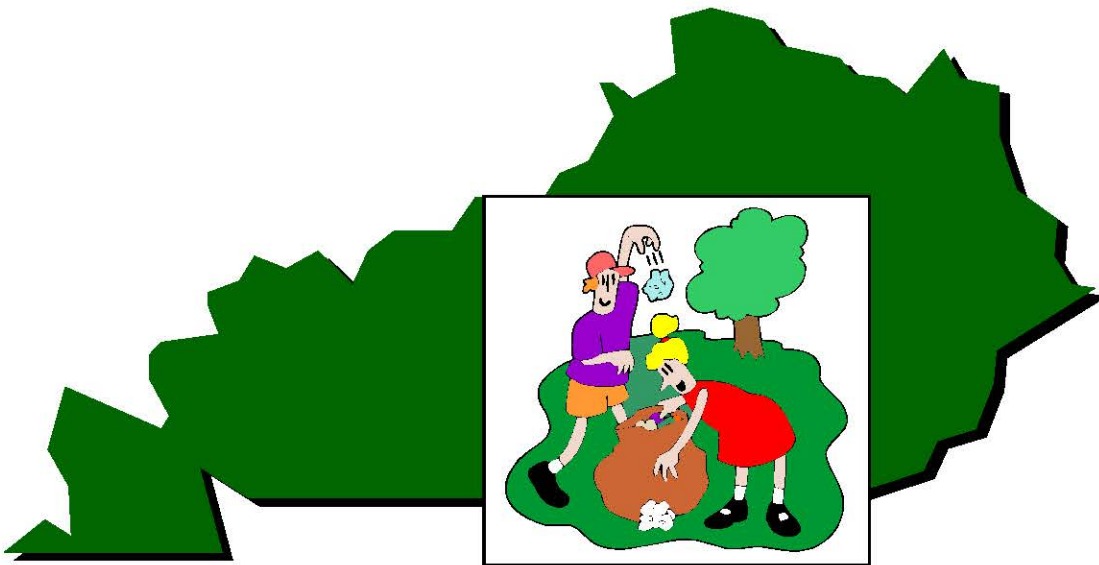


Be a Solid Waste Survivor

A Standards Based, Integrated Curriculum for
Teaching Solid Waste Issues in Kentucky



A Publication of

The Kentucky Environmental Education Council

In cooperation with

**The Kentucky Department of Education
The Kentucky Division of Waste Management
Kentucky PRIDE
Solid Waste Coordinators of Kentucky
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Glossary of Terms

Teacher Fact Sheets

Teacher Fact Sheet

Solid Waste

What is Solid Waste?

Young or old, everyone produces solid waste (otherwise known as trash), whether it is old newspapers, potato chip bags, shampoo bottles, cut grass, food scraps from the dinner table, old appliances, or even the kitchen sink. Each person in the United States generates about 4.5 pounds (EPA, 1998) of solid waste each day, which is often collected by a municipality and is known as municipal solid waste. This kind of waste primarily comes from people's homes, but it also comes from some factories, businesses, and schools.

As our population has grown, so has the number of products we use and the total amount of solid waste we generate. Consequently, the composition of garbage continues to change with more plastics, more office paper, and less glass filling up trash cans around the country.

How do we Manage Solid Waste?

No single method can manage all our nation's garbage. The U. S. Environmental Protection Agency (EPA) recommends the use of a waste management hierarchy, which ranks methods of waste management in order of preference. Although mentioned briefly here, each method is explained in separate fact sheets. Please refer to these other fact sheets for more information regarding the benefits, challenges, trends, and opportunities of each waste management system. EPA's waste management hierarchy includes:

- **Source Reduction:** Source Reduction, also known as waste prevention, is the preferred method of waste management because the best way to manage garbage is to prevent it in the first place. As the name implies, this method prevents waste at the source by decreasing consumption and reusing products. It also includes using nonhazardous substitutes to reduce the level of toxicity in the waste stream. For example, using a durable cloth lunch bag or reusing the same brown paper bag instead of a new brown paper bag each day prevents waste, or using baking soda to clean kitchen and bathroom counters rather than a chemical detergent prevents the disposal of toxins.
- **Recycling including Composting:** If waste cannot be prevented, the next best way to reduce it is to recycle or compost it. Recycling refers to a series of activities where discarded materials are collected, sorted, processed, converted into raw materials, and used to make new products. Composting is the decomposition of organic materials such as yard trimmings and food scraps by microorganisms. The byproduct of this process is compost—a soil-like material rich in nitrogen and carbon that can be used as a plant fertilizer supplement. Both of these processes use waste as a raw material to create new and valuable products.
- **Disposal: Combustion and Landfills.** Trash that cannot be reduced, recycled, or composted must be disposed of. Combustion is the burning of waste in specially designed facilities provide the added benefit of energy recovery (waste to energy facilities). Source reduction and recycling can remove items from the waste stream that might be difficult to burn, cause potentially harmful emissions, or make ash management problematic. Landfills are also major components of waste management. A landfill is a large area of land or an excavated site that receives waste. Combustion facilities and landfills are subject to environmental controls that require them to be properly maintained so there is no waste runoff that might contaminate drinking water supplies. The portion of waste requiring combustion and land disposal can be significantly reduced by examining individual contributions to garbage and by promotion the wise use and reuse of resources.

Key Points

- Americans generate about 4.5 pounds of garbage per person each day, which amounts to more than 220 million tons per year.
- EPA advocates a solid waste hierarchy, organizing waste management options in order of preference: source reduction, recycling, and composting, and combustion and landfilling.
- Facing a variety of challenges from rising waste generation rates and costs to closing disposal facilities—community leaders and businesses are devising ways to prevent waste and increase efficiency.

What are the Benefits of Waste Management?

It might seem hard to believe now, but people once dumped trash out windows onto the streets, left it in local ravines or quarries, or burned it in fields and open dumps. In fact, throughout time, people have made garbage “go away” in different ways, regardless of environmental or aesthetic impacts. As one can imagine, these activities created serious sanitation problems for a community. Open dumps produced noxious odors, attracted rodents and pests that spread disease, and polluted drinking water supplies.

Federal, state, and local laws now control how solid waste is managed and disposed of. These regulations set standards for trash disposal. As a result of regulations, many communities have state-of-the-art landfills and combustion facilities that minimize ground and surface water contamination and air pollution. At the same time, they provide a safe and convenient way to remove trash from homes and neighborhoods.

Waste management can also create jobs and provide an economic boost to some cities and counties. Whether workers are collecting garbage, constructing disposal facilities, managing recycling programs, or developing new technologies, the waste management industry employs hundreds of thousands of people nationwide.

Solid Waste Facts

- Each year, Americans discard more than 8 million old or broken appliances such as clothes dryers, refrigerators, and televisions.
- One third of all the garbage discarded by Americans is packaging.
- The average home may have up to 100 pounds of household hazardous waste stored throughout the house.
- Americans generate 1.6 million tons of household hazardous waste each year.

(Sources: Keep America Beautiful; Natural Resources Defense Council, 1996, EPA)

What are the Challenges of Solid Waste Management?

Despite the improvements that have been made to solid waste landfills and combustion facilities over the years, the general public still does not want to live near a disposal facility. With varying public opinion and the Not in My Backyard (NIMBY) mentality, community leaders often find it difficult to find new sites for waste management facilities.

Balancing all of the management options in the solid waste hierarchy can be a major challenge. Many communities have invested resources in source reduction and recycling in an effort to reduce the amount of trash that must be landfilled or combusted. Yet reducing waste ultimately involves changing behaviors—purchasing environmentally friendly products when possible, and participating in recycling and composting programs.

Household Hazardous Waste

Leftover household products that contain corrosive, toxic, ignitable, or reactive ingredients are considered “household hazardous waste.” Examples of products that could become household hazardous waste include certain cleaning products, pesticides, motor oil, oil paints, adhesives, and batteries.

Unlike municipal solid waste, special care must be taken in disposing of household hazardous waste to minimize the impact on human health and the environment.

The best ways to reduce household hazardous waste are to use up all of the products or share them with someone else until they are used up, properly recycle them, or dispose of them according to your community’s solid waste regulations.

If you are unsure of what to do with these products, contact your local environmental or solid waste agency.

What are Some Emerging Trends?

Communities continue to seek ways to reduce waste. One recent trend is to charge residents for garbage collection services based on the amount of trash they throw away, known as “Pay-as-you-throw” (PAYT). By paying the garbage services in the same way as electricity, water and other utilities, residents have a direct incentive to reduce the amount of trash they generate and to recycle more.

Additional Information Resources

Visit the following Web sites for more information on municipal solid waste:

- U.S. Environmental Protection Agency (EPA): <www.epa.gov>
- U.S. EPA Office of Solid Waste site on municipal solid waste: <www.epa.gov/epaoswer/non-hw/muncpl/facts.htm>
- U.S. EPA Office of Solid Waste site on household hazardous waste: <www.epa.gov/epaoswer/non-hw/muncpl/hhwpubs.htm>

Teacher Fact Sheet

Natural Resources

What are Natural Resources?

Natural resources are useful materials from the Earth, such as coal, oil, natural gas, and trees. People depend on natural resources for basic survival and use them as raw materials to manufacture or create a range of modern conveniences. Water and food provide humans with sustenance and energy, for example, and fossil fuels generate heat as well as energy for transportation and industrial production. Many of the same natural resources are used by people are important to plants and wildlife for survival as well.

Virgin versus Recovered Resources

Resources used for the first time are considered virgin resources, and their extraction, processing, and use requires a great deal of energy and can create pollution. Resource recovery is a practice that conserves natural resources by extracting used materials (e.g., paper, glass, and metals) and energy from municipal solid waste and reprocessing them for reuse. For example, a company can create plastic from oil, a virgin natural resource, or it can use recovered plastic, it is actually saving materials that would otherwise become waste, helping to prevent the depletion of natural resources, conserving energy, and preventing pollution that would have been created in the extraction and processing of oil from the ground.

Biodiversity

Biodiversity refers to the variety of organisms that live on Earth. Supporting so many different organisms requires the conservation of the natural resources they need to survive. Using natural resources can not only deplete the Earth of the resources themselves, but by destroying critical habitats, it can also drive some species to extinction, ultimately reducing biodiversity.

Key Points

- Natural Resources are vital to all forms of wildlife and the ecosystems in which they live.
- Human beings use natural resources for such modern conveniences as electricity, transportation, and industrial production, as well as being survival.
- Rapid population growth a higher standard of living and technology all contribute to increased use of natural resources.
- Extracting, processing, and using natural resources can cause environmental problems, such as the disruption or destruction of ecosystems; a decrease in biodiversity; and land, water, and air pollution.
- Using renewable natural resources impacts the environment less than using nonrenewable resources because their supply can be regenerated.
- Using recovered resources prevents natural resources from being wasted.
- Using recovered rather than virgin resources decreases greenhouse gas buildup, which can result in global climate change.
- Resource recovery and conservation, as well as buying recycled products, are emerging trends that reduce consumption of natural resources.

In addition to the benefits already discussed, using recovered resources reduces threats to biodiversity. Natural resource extraction, along with other human activities, increases the rate at which species of plants and animals are now vanishing. Diminishing the Earth's biodiversity has a substantial human cost because wild species and natural ecosystems are important resources. For example, some economists estimate that the lost pharmaceutical value from plant species extinctions in the United States alone is almost \$12 billion. Reducing the land disturbance and pollution associated with virgin materials extraction by using recovered materials, therefore, helps stop the degradation of the Earth's ecosystems.

Renewable versus Nonrenewable Resources

Some natural resources are nonrenewable and some are renewable. Nonrenewable resources are those that become depleted more quickly than they naturally regenerate. One example of a nonrenewable resource is mineral ore. Once mined and used completely, it is gone forever, for all practical purposes, because it will take millions of years to regenerate. Renewable resources can be replenished at approximately the same rate at which they are used (for example, sun and wind, which can be used to provide energy).

What are the Benefits of Natural Resources?

Renewable resources offer a number of environmental and economic benefits over nonrenewable resources. One obvious benefit is the infinite supply of renewable resources—they cannot be depleted. Another benefit of using renewable resources is self-reliance. A country that can provide its own renewable resource, such as solar-powered electricity, need not rely on other countries for an energy source. Additionally, renewable resources offer communities relief during periods of recovery from natural disasters. When communities lose standard services that require the use of natural resources (e.g., electric power or natural gas), renewable resources, such as wind and solar energy systems are used to provide these services until the usual methods of achieving service can be restored. Following the 1992 Hurricane Andrew, for example, a south-Miami subdivision continued to have working streetlights because they were all photovoltaic (PV)-powered. The areas became neighborhood-gathering spots for a community left without electricity following the storm. In several cases, home equipped with PV systems were able to keep minimal services running and became emergency shelters for surrounding residents without power.

What are the Challenges of Using Natural Resources?

Extracting, processing, and using natural resources creates air, water, and land pollution, which can cause global environmental problems. For example, carbon dioxide, which is produced from deforestation, and from burning coal, oil, and natural gas, is a critical greenhouse gas. Many scientists believe that the buildup of greenhouse gases in the atmosphere can cause global climate change. Over time, this condition could pose serious dangers around the world, prompting such disasters as flooding, drought, and disease.

Renewable or Nonrenewable—or Both?

Some resources can be considered both renewable and nonrenewable. Trees are considered a renewable resource because their supply can be replenished (e.g., more trees can be planted). If, however, an entire forest of 400-year-old trees is cleared and a new-growth forest is planted, the supply of old-growth trees has not been replenished. It takes many generations for an old-growth forest to mature, and so, old-growth trees are considered nonrenewable. Trees are a complex resource because as a forest, their environmental and economic contributions often depend on their age. For example, clearing a forest of 200-year-old Redwoods, unlike clearing a forest of new growth pines, diminishes high levels of biodiversity only developed in old-growth forests.

Products Made from Natural Resources

People use an abundance of resources to survive in a continually developing world. Globally, however, some people live simpler lifestyles than others and therefore use fewer resources. The following table lists some natural resources and the products and services people produce from them.

Natural Resource	Product / Service
Trees	Paper, furniture, fuel
Cotton plant	Clothing
Oil/Petroleum	Plastic, fuel
Gas	Fuel
Coal	Fuel
Iron Ore	Steel Products
Bauxite ore	Aluminum products
Gold	Jewelry, dental material
Copper	Wire, coins, electrical
Manganese	Steel, cast iron
Cobalt	Steel, jet engine parts
Platinum	Stainless steel, gems
Diamonds	Jewelry, mechanical

In addition, extracting and using resources can disturb relationships within ecosystems. For example, the effects of clearing an old-growth forest for wood can destroy habitats used by many animals, forcing them to find homes elsewhere. If these animals leave an ecosystem, further disturbances can occur with plant and animal populations that depend on these species.

Additionally, with the absence of tall trees in the forest, lower vegetation would lose shade provided by the upper canopy, resulting in increased exposure to sunlight and decreased moisture. Changes in an ecosystem's climatic conditions will eventually change vegetation type, which will alter the kinds of animals that can exist in that community. Over time, if enough ecosystems are affected, an entire community type can change (e.g., over-harvested fields can turn into deserts).

Population growth, increasing affluence, technological change, and urbanization are all responsible for rapidly rising resource consumption all over the world. The relationship between the population growth and increased resource use varies among developed and undeveloped nations. For example, according to the Department of Energy, residents of the industrialized world comprise only 20 percent of the world's population, yet consume 86 percent of its iron and steel, and 76 percent of its timber. Despite the inconsistent relationship between resource use and developed and undeveloped nations, it is apparent that worldwide, more people use more resources. With population, technology, and lifestyle demands growing exponentially, people are using increasing amounts of many natural resources.

What are Ecosystems?

Ecosystems are self-regulating communities of plants and animals that interact with one another and with their nonliving environment. Examples of ecosystems include ponds, woodlots, and fields.

Organisms within an ecosystem are connected by energy. Individuals in a community feed on each other, thus transferring energy along a food chain or food web. In a food chain, energy is transferred from one organism to another in a linear form. For example, the sun provides fuel for a fig tree, which provides sustenance for wasps. The wasps are a food source for spiders, which are eaten by birds. More complex food webs can be thought of as a network, involving energy transfers among several organisms.

Emerging Trends

Increasing demands for natural resources have spurred new method for conserving existing resources. More and more companies are developing new and innovative technologies that use recycled materials as raw materials in the manufacture of products. Some steel producers, for example, use minimills and a manufacturing process that uses virtually 100 percent recovered scrap steel as the raw material.

How can you help?

An increasing number of individuals are also practicing conservation methods by using less—such as buying products with less packaging. Certain lifestyle changes, such as composting food scraps rather than buying fertilizer also preserve natural resources. Other suggestions for ways to practice conservation of natural resources are as follows:

- Reduce waste by reusing paper grocery and lunch bags or eliminate waste by using cloth bags.
- Donate old toys, clothes, furniture, cars and other items to organizations such as the Salvation Army rather than throwing them in the garbage.
- Close the recycling loop by purchasing recycled-content products and packaging.

Additional Information Resources

Visit the following Web sites for more information on natural resources and solid waste:

- U.S. Environmental Protection Agency (EPA): www.epa.gov
- U.S. EPA Office of Solid Waste composting site: www.epa.gov/epaoswer/non-hw/compost/index.htm
- World Resources Institute: www.wri.org
- Natural Resources Defense Council: www.nrdc.org
- United States Department of Energy's National Renewable Energy Laboratory: www.nrel.gov
- United States Department of Energy's Center of Excellence for Sustainable Development: www.sustainable.doe.gov

Teacher Fact Sheet

Source Reduction

What is Source Reduction?

Americans crave convenience—but at what cost? American households have more discretionary income than most households worldwide, spending more on products that create more waste. Over the last 40 years, the amount of waste each person creates has almost doubled from 2.7 to 4.46 pounds per day (that is almost 1,628 pounds per person per year)! Though reusing, recycling, and composting are all important methods of reducing the amount of waste produced, the most effective way to stop this trend is by preventing the production of materials that could become waste.

Source reduction, also known as waste prevention, is the practice of designing, manufacturing, purchasing, or using materials (such as products and packaging) in ways that reduce the amount or toxicity of waste. Source reduction can help reduce waste disposal and handling costs because it avoids the cost of recycling, municipal composting, land filling, and combustion. It also conserves natural resources and reduces pollution.

Preventing waste before it is generated is a common-sense way to save financial and natural resources, as well as reduce pollution. That is why the U.S. Environmental Protection Agency (EPA) encourages consumers, businesses, and governments to make source reduction their first priority in waste management practices. For waste that cannot be prevented, recycling is the next best choice. (See the Teacher Fact Sheet titled Recycling).

Waste is generated throughout the life cycle of a product—from extracting raw materials, to transporting materials, to processing and manufacturing goods, to using and disposing of products. Manufacturers that reuse materials in the production process or that use less material to manufacture products can decrease waste dramatically. Other ways that manufacturers practice source reduction include:

- Reduce the amount of packaging in the manufacture of items.
- Reduce the amount of toxic components in a product or use smaller quantities of items with high toxicity.
- Reuse parts in the manufacture of a product.
- Redesign products to make them more modular. This allows broken or unusable components to be replaced rather than discarding the entire item.

In addition to reducing the amount of materials in the solid waste stream, reducing waste toxicity by selecting nonhazardous or less hazardous materials for manufacturing is another important component of source reduction. Using less hazardous alternatives for certain items (e.g., cleaning products, pesticides), sharing products that contain hazardous chemicals instead of throwing out leftovers, reading label directions carefully, and using the smallest amount of a chemical necessary are some ways to reduce waste toxicity. (See the Teacher Fact Sheet on Solid Waste for information on safe household practices).

Key Points

- Source Reduction, also known as waste prevention, means reducing waste at the source. It can take many different forms, including reusing or donating items, buying in bulk, reducing packaging, redesigning products, and reducing toxicity.
- Source reduction also is important in manufacturing. Light weighting of packaging, reuse, and remanufacturing are all becoming more popular business trends. Purchasing products that incorporate these features supports source reduction.
- Source reduction can save natural resources, reduce pollution, reduce the toxicity of our waste, and save money for consumers and businesses alike.
- Incorporating source reduction into daily practices can require some challenging but worthwhile lifestyle changes.

Source reduction is a challenge requiring creativity and ingenuity, but devising ways to prevent waste can be very satisfying and even fun! There are many ways consumers can practice source reduction. Here are just a few examples:

- Choose products that do not use excessive packaging.
- Buy remanufactured or used items
- Buy items in bulk rather than multiple, smaller packages to decrease the amount of packing waste created.
- Maintain and repair durable items.
- Reuse bags, containers and other similar items.
- Borrow, rent, or share items that are used infrequently.
- Donate items instead of throwing them out.
- Leave grass clippings on the lawn (grasscycling) or use them for backyard composting.
- Rake fallen leaves for composting rather than bagging them and throwing them away.

As a classroom activity, ask students to provide examples of other creative way they can reduce waste.

Source Reduction Facts

- Since 1977, the weight of 2-liter plastic soft drink bottles has been reduced from 68 to 51 grams each. That means that 250 million pounds of plastic per year has been prevented from becoming part of the waste stream.
- When McDonald's reduced its napkin size by 1 inch, the company prevented 12 million pounds of paper from being thrown away each year. In 1999, McDonald's switched to lighter weight packaging for two of their sandwiches, conserving 3,200 tons of boxboard containers.
- State Farm Mutual Auto Insurance converted to electronic cameras for their claims processing, saving more than 50 tons of instant and 35 mm film.

(Source: EPA, 1996, 1999)

What are the Benefits of Source Reduction?

Reducing waste at the source is the ultimate environmental benefit. It means waste does not have to be collected, handled, or processed in anyway, which prevents pollution, saves energy, and saves money. In addition, by reducing consumption, fewer products are manufactured thus reducing the impacts that manufacturing can cause. For example, by manufacturing less, greenhouse gas emissions are reduced, which can make a difference in preventing global climate change.

Preventing waste also can mean economic savings for communities, businesses, schools, and individual consumers. Many communities have instituted "pay-as-you-throw" waste management systems in

which people pay for each can or bag of trash they produce that requires disposal. When these households reduce their waste at the source, they create less trash and, consequently, pay a lower trash bill.

Businesses also have an economic incentive to practice source reduction. Manufacturing costs can decrease for businesses that reduce packaging, which can mean a larger profit margin and savings that can be passed on to the consumer.

Schools also can share in the economic benefits of source reduction. Buying products in bulk frequently means a savings in cost. Often, what is good for the environment is good for the pocketbook as well.

What are the Challenges of Source Reduction?

Practicing source reduction is likely to require some change in daily routines. Changing some habits may be difficult, but the environmental returns on the effort can make it worthwhile. For example, while using disposable utensils might be convenient, using durable flatware saves resources and requires only slight more effort (for cleaning). On the other hand, if waste is not reduced, the economic and social costs of waste disposal and the environmental impacts throughout the life cycle of products will continue to grow, and it will become increasingly harder to make decisions about waste management.

Even if consumers decide to change their consumption habits, products with minimal packaging and nontoxic ingredients are not always available. Balancing the immediate convenience of easily available products with the long-term benefits of waste prevention will be an ongoing challenge.

What are some emerging Trends in Source Reduction?

Many companies are becoming more involved in source reduction by remanufacturing and reusing components of their products or the entire product. A toner cartridge for a laser printer is an example of a product that once was disposable but now is manufactured to be reused. Many products are manufactured to use “modular,” or replaceable, units.

One manufacturer of photocopy machine takes back and remakes equipment from more than 30,000 tons of used photocopiers. Parts from returned machines that meet internal criteria for manufacturing are reprocessed into new products. Parts that do not meet remanufacturing criteria and cannot be repaired are often ground, melted, or otherwise recycled into basic raw materials. The company estimates annual savings of several hundred million dollars in raw material, labor, and disposal as a result of design changes and product return programs.

Other companies are also taking advantage of more environmentally preferable ingredients as ways to reduce the weight of packaging. Some supermarkets across the country have instituted shelf-labeling programs to highlight products with less packaging or less toxic ingredients. Purchasing these items shows manufacturers that consumers encourage and support source reduction.

How can you HELP!

Students can play an important role in protecting the environment by practicing source reduction. Here are some simple practices to help prevent waste:

- Donate old clothes and other household items so they can be reused or sold for reuse.
- Consider taking a thermos of juice to school instead of individual disposable containers.
- Use concentrated products to get more product with less packaging.
- Use double-sided copying and printing features.
- Buy pens, pencils, toothbrushes, and other items with replaceable parts.
- Use a durable lunch container or bag instead of a disposable one.
- Consider using environmentally preferable cleaning products instead of those that contain potentially toxic ingredients.
- Consider buying items that have been remanufactured or can be reused, such as toner cartridges for the printer or tires for the car.
- Encourage companies to reduce unnecessary packaging and the use of hazardous components in products. Many companies offer toll-free numbers and Web sites for these comments.
- Compost cafeteria food waste and use the finished compost to mulch the plants and trees around the school grounds.

Additional Information Resources

Visit the following Web sites for more information on source reduction and solid waste:

- U.S. Environmental Protection Agency (EPA): <www.epa.gov>
- U.S. EPA, Office of Solid Waste site on source reduction: <www.epa.gov/epaoswer/non-hw/muncpl/reduce.htm>
- U.S. EPA, Office of Solid Waste site on global climate change and waste reduction: <www.epa.gov/globalwarming/actions/waste/index.htm>
- Reuse Development Organization: <www.redo.org>

Teacher Fact Sheet

Recycling

What is Recycling?

Recycling is a series of activities that includes the collection of items that would otherwise be considered waste, sorting and processing the recyclable products into raw materials, and remanufacturing the recycled raw materials into new products. Consumers provide the last link in recycling by purchasing products made from recycled content. Recycling also can include composting of food scraps, yard trimmings, and other organic materials.

How does Recycling Work?

Many people already recycle items like paper, glass, and aluminum. While these efforts are a vital part of the process, the true recycling path continues long after recyclables are collected from household bins or community drop-off centers. Collecting, processing, manufacturing, and purchasing recycled products create a closed circle or loop that ensures the overall success and value of recycling.

Collection

How and where recyclables can be collected vary by community. Some communities collect from residences, schools, and businesses; four primary methods are used:

- Curbside collection programs are the most common. Residents set recyclables, sometimes sorted by type, on their curbs to be picked by municipal or commercial haulers.
- Drop-off centers are locations where residents can take their recyclables. These centers are often sponsored by community organizations.
- Buy-back centers are local facilities where recycled-content manufacturers buy their products back from the consumers to remanufacture the used products into new products.
- Deposit/refund programs require consumers to pay a deposit on a purchased product. The deposit can be redeemed when the consumer brings the container back to the business or company for recycling.

Processing

After collection, some recyclables are “processed” prepared for delivery to manufacturing facilities. Processing usually includes making sure the materials are sorted properly and that contaminants (i.e., nonrecyclables) are removed. Recyclables are then usually sent to a materials recovery facility (MRF, pronounced “murph”) to be further sorted and then processed into marketable commodities for remanufacturing. Recyclables are bought and sold just like any other commodity, and prices for the change and fluctuate with the market. Each MRF has individual requirements about what materials it will accept, but most accept newspapers, aluminum cans, steel food cans, glass containers, and certain types of plastic bottles.

Manufacturing

Once cleaned and sorted, the recyclables move to the next part of the recycling loop—manufacturing. More and more of today’s products are being manufactured with recycled content.

- Recycled cardboard and newspaper are used to make new boxes, papers, and other products such as tissues, paper towels and toilet paper, diapers, egg cartons, and napkins.
- Recycled plastic called PET, which is found in soft drink, juice, and peanut butter containers, is used to make new products such as carpets, fiberfill (insulating material in jackets and sleeping bags), bottles and containers, auto parts, and paint brushes. Another kind of recycled plastic, HDPE, which is used in milk, water, detergent, and motor oil containers, can be remanufactured into trash cans, bathroom stalls, plastic

lumber, toys, trash bags, and hair combs. Numbers imprinted on the plastic product indicate has been manufactured and how it can be recycled. Not all communities recycle all types of plastic.

- Recycled glass is used again and again in new glass containers as well as in glasphalt (the roadway asphalt that shimmers in sunlight), road filler, and fiberglass.
- Recycled aluminum beverage cans, one of the most successful recyclables, are remade into new cans in as little as 90 days after they are collected. Recycled aluminum building materials.
- All steel products manufactured in the United States contain 25-30 percent or 100 percent recycled steel, depending on the manufacturing process used.

Recycling Facts

- By recycling 1 ton of paper, we save: 17 trees, 7,000 gallons of water, 380 gallons of oil, 3 cubic yards of landfill space, and enough energy to heat an average home for 6 months.
- Manufacturers can make one extra-large T-shirt out of only five recycled plastic soda bottles.
- Americans throw away enough aluminum every 3 months to rebuild our entire commercial air fleet.
- When one ton of steel is recycled, 2,500 pounds of iron ore, 1,400 pounds of coal, and 120 pounds of limestone are conserved.
- Recycling aluminum cans saves 95 percent of the energy required to make aluminum cans from scratch.
- The amount of aluminum recycled in 1995 could have built 14 aircraft carriers.

(Sources:: Weyerhaeuser Company, 1999; Steel Recycling Institute, 2000; American Forest and Paper Association, 2000; R.W. Beck, 1997; The Can Manufacturers Institute, 1997; Anchorage Recycling Center, 2000; Recyclers' Handbook by Earthworks Group, 1997; EPA, 1997)

Purchasing Recycled Products

The market for recycled materials is the final part of recycling loop. Recycled products must be bought and used in order for the entire recycling process to succeed.

Recycling and composting activities divert about 62 million tons of material from landfills and incinerators. In 1997, this country recycled 28 percent of its waste, a rate that has almost doubled over the past 15 years. Of that 28 percent, here is the breakdown of what the United States recycled that year:

As individuals, businesses, and governments in the United States have increasingly assumed responsibility for wastes, recycling, reuse, and composting have all undergone a phenomenal surge in popularity and success. Analysts project that American will be recycling and composting at least 83 million tons—35 percent of all municipal waste—by 2005.

What are the Benefits of Recycling?

When each part of the recycling loop is completed, the process helps both the environment and the economy. Recycling prevents materials from being thrown away, reducing the need for landfilling and incineration. In addition, the use of recycled materials to manufacture new products prevents pollution caused by the manufacturing of products from virgin materials. Also, using recycled materials for manufacturing decreases emissions of greenhouse gases that contribute to global climate change. Since the use of recycled materials reduces the need for raw material extraction and processing, energy is saved and the Earth's dwindling resources are conserved.

Recent studies indicate that recycling and remanufacturing account for about one million manufacturing jobs throughout the country and generate more than 100 billion in revenue. Many of the employment opportunities created by recycling are in areas where jobs are most needed.

Recycling in Action

For recycling to work, everyone has to participate in each phase of the loop. From government and industry, to organizations, small businesses, and to people at home, all Americans can easily make recycling a part of their daily routine. Below are some ways for individuals to get involved in recycling:

- Learn about and participate in a community-recycling program. Know the collection schedule or drop-off location as well as which items are acceptable. Get involved by volunteering with a homeowner's association or community organization to educate neighbors about the recycling program.
- Empty all fluids and remove all lids from bottles and cans when recycling and do not contaminate recycling containers with trash.
- Participate and encourage colleagues to recycle in the containers provided in your school. Initiate a recycling program in your school if one does not exist.
- Make the effort to find recycling opportunities for items, such as plastic packaging that are not included in your local recycling program.
- Use recyclable products and encourage others to do the same.

What are the Challenges of Recycling?

Despite its success, the potential of recycling in this country is not yet fully realized. Some plastics, for example, such as bottles and containers, are recyclable in almost any community, but others, such as plastic "peanuts" used in packaging, usually can not be included in curbside or drop-off recycling programs. These items still end up in the trash because it is not profitable to collect the tons needed for remanufacture into new products. In addition, the costs of collecting, transporting, and processing recyclables can sometimes be higher than the cost of disposing of these materials as waste. The average cost to process recyclables is \$50, while the average value of those recyclables on the market is only \$30. Processors often compensate for this discrepancy by charging a set fee for each ton of material they receive or by establishing ongoing contracts with communities or haulers. Efforts to better manage waste and recycling programs are under development. Many communities across the country implement financial incentives to encourage people to recycle. Residents are charged a fee based on the amount of solid waste they throw away. The more a household recycles, the less garbage it throws out, and the lower collection fee it pays.

Finally, recycling facilities are not always a welcome addition to a community. As with other waste management operations, recycling facilities are often accompanied by increased traffic, noise, and even pollution. Community leaders proposing the location for a recycling facility can encourage the NIMBY (Not in My Backyard) sentiment.

Is Your School Waste Wise?

WasteWise is a voluntary EPA partnership program that helps businesses, governments, and institutions reduce waste and save money. Since the program began in 1997, WasteWise partners have reduced their municipal solid waste by more than 26 million tons! In 1998 alone, partners saved an estimated \$264 million. Partners include many large corporations, small and medium-sized businesses, hospitals, tribes, and state, local, and federal governments, as well as 87 schools, school districts, colleges, and universities in more than 30 states.

The following are examples of the accomplishments of a few WasteWise partners in the education field, Alden Central School of New York, which educates children from K-12, implemented a comprehensive waste reduction program in all campus buildings. Students and staff eliminated 450 pounds of polystyrene cafeteria trays and dishes by switching to reusable products. They also composted 900 pounds of cafeteria food scraps and 150 pounds of yard trimmings for use as mulch on building grounds. Sligo Adventist School of Maryland also implemented several innovative waste prevention activities including the reduction of more than 1 ton of drink boxes by switching to bulk juice dispensers. Eastern Illinois University reduced the amount of computer paper used on campus by 10 percent and reused 13 tons of office supplies through an internal exchange among employees.

To find out how your school can join the WasteWise program, please call 800-EPA-WISE (372-9473), email at ww@cais.net, or visit the Web site at www.epa.gov/wastewise,

Additional Information Resources

Visit the following Web sites for more information on recycling and solid waste:

- U.S. Environmental Protection Agency (EPA): www.epa.gov
- U.S. EPA, Office of Solid Waste site on recycling: www.epa.gov/eaposwer/non-hw/muncpl/reduce.htm
- U.S. EPA, Office of Solid Waste WasteWise Program site: www.epa.gov/wastewise/index.htm
- U.S. EPA, Office of Solid Waste on global climate change and recycling: www.epa.gov/mswclimate/index.htm
- U.S. EPA, Office of Solid Waste, Kid's Page: www.epa.gov/epaoswer/osw/kids.htm
- U.S. EPA, Region 9 Office's Recycling site for Kids: www.epa.gov/recyclecity
- National Recycling Coalition: www.nrc-recycle.org
- Institute for Scrap Recycling Industries: www.isri.org
- American Plastics Council: www.plastics.org
- Steel Recycling Institute: www.recycle-steel.org/
- Aluminum Association: www.aluminum.org
- Glass Packaging Institute: www.gpi.org
- American Forest and Paper Association: www.afandpa.org
- Institute for Local Self-Reliance: www.ilsr.org
- Rechargeable Battery Recycling: www.rbrc.org
- Polystyrene Packaging Council: www.polystyrene.org

Teacher Fact Sheet

Landfills

What is a Landfill?

A landfill is a large area of land or an excavated site that is specifically designed and built to receive wastes. Today, about 55 percent of our country's trash is disposed of in landfills (EPA, 1998). Items such as appliance, newspapers, books, magazines, plastic containers, packaging, food scraps, yard trimmings, and other wastes from residential, commercial, and some industrial sources can be disposed of in municipal solid waste landfills. Municipal solid waste landfills can also accept some types of hazardous waste, such as cleaning products, paint and chemicals, as well as some industrial wastes from certain businesses. Many states and communities, however, promote the safe collection of these hazardous wastes through local programs.

Key Points

- Landfills are the most common form of waste disposal and are important component of an integrated waste management system.
- Federal landfill regulations have eliminated the open dumps of the past. Today's landfills must meet stringent design, operation, and closure requirements.
- Methane gas, a byproduct of decomposing waste, can be collected and used as fuel to generate electricity.
- After a landfill is capped, the land may be used for recreation sites such as parks, golf courses, and ski slopes.
- Landfills that handle hazardous wastes are specially designed with two sets of liners and two leachate detection systems.

Cross Section of a landfill



In the past, garbage was collected in open dumps. These uncovered and unlined sites allowed leachate, a liquid formed by decomposing waste, to soak into the soil and ground water. Open dumps also attracted rodents and insects, emitted odors, and created fire hazards. Most of these small and unsanitary dumps have been replaced by large, modern facilities that are designed, operated, and monitored according to strict federal and state regulations. Today's landfills eliminate the harmful and undesirable characteristics of dumps to help protect public health and the environment.

In addition to being safer for the environment and neighboring communities, these larger landfills hold more trash than the dumps of the past. In 1998, about 2,300 municipal solid waste landfills were operating in the United States (EPA, 1998). While this number is significantly smaller than the number of landfills 25 years ago, new landfills can accommodate significantly more garbage. This greater capacity is necessary to keep up with the steady growth of municipal solid waste.

How does a Landfill Work?

A typical modern landfill is lined with a layer of clay and protective plastic to prevent the waste and leachate from leaking into the ground or groundwater. The lined unit is

then divided into disposal cells. Only one cell is open at a time to receive waste. After a day's activity, the garbage is compacted and covered with a layer of soil to minimize odor, pests, and wind disturbances.

A network of drains at the bottom of the landfill collects the leachate that flows through the decomposing waste. The leachate is sent to a leachate recovery facility to be treated. Methane gas, carbon dioxide, and other gases produced by the decomposing waste are monitored and collected to reduce their effects on air quality.

Landfills are regulated by federal and state laws. The federal laws dictate where landfills can be located, such as away from unstable land prone to earthquakes or flooding, and require them to be lined and have a leachate collection system. In addition, landfill owners must monitor and collect explosive gases; regularly test nearby ground water; and compact and cover waste with a layer of soil on a daily basis.

Many states require landfill operators to obtain a license and present a plan for how the site will be safely closed, even though the closing date might be 50 years in the future. Furthermore, federal law requires landfill owners to set aside the money to close the landfill properly and support ongoing monitoring activities. Once a landfill is capped (closed), the operator must monitor the site for gas and leachate for a minimum of 30 years after the closing date. In addition to federal regulations, each state has its own landfill requirements, which are often more stringent than the federal laws.

Are there Landfills for Hazardous Waste?

Each year, about 29 million ton of hazardous waste are disposed of in landfills or other land disposal sites. Hazardous waste is toxic, ignitable, corrosive, or reactive, or generated from certain industries or manufacturing processes. When it come to disposing of hazardous waste in landfills, EJPA takes additional steps to ensure environmental safety and human health.

While landfills that accept solid waste have a clay and plastic liner and a leachate system to prevent leakage, landfill owners that accept hazardous waste must take extra precautions. For example, a hazardous waste landfill must two sets of liners, one consisting of special plastic, and the other composed of both plastic and a thick layer of soil material. In addition, a landfill accepting hazardous waste must have two leachate detection systems instead of just one.

Before hazardous waste even reaches a landfill, however, it must be treated differently than solid waste. If hazardous waste is bound for disposal in a landfill, it is regulated under EPA's Land Disposal Restrictions Program. Through this program, hazardous waste must undergo treatment that will destroy or immobilize its hazardous components before it is sent to a landfill. For example, when a business generates hazardous waste, it must either treat that waste itself, or send it to a special facility for treatment, before sending the waste to a landfill.

What are the Benefits of Landfills?

In addition to providing a cost-effective, safe method to dispose of ever-increasing amounts of trash, landfills often provide other services to the community. For example, some landfills collect methane, a gas created by decomposing garbage that can contribute to global climate change, and convert it into an energy source. In addition, after a landfill is capped and a certain amount of time has passed, the land might be reused for parks, ski lopes, golf courses, and other recreation areas.

What are the Challenges of Landfills?

Though regulations have made landfills safer to the public and the environment, public opposition, high land prices, and environmental concerns can make it difficult to find suitable places for new landfills.

Landfills can pose other problems if not properly designed or managed. If a liner leaks, for example, the underlying soil and ground water can become contaminated. Additionally, since landfills are often located in remote areas, waste must be hauled long distances, which might result in environmental impacts from increased truck traffic (e.g., air pollution) and noise from truck traffic and the use of equipment onsite. Additionally, within a given municipality, landfills often compete for local garbage. Competition can lead to reduced support for recycling and other waste reductions programs. Issues also might arise if a landfill is located close to a community. Many people do not want landfills near their homes. The NIMBY (not in my backyard) attitude can make finding a landfill site very challenging.

What are some Emerging Trends?

Increased waste generation requires landfills operators and managers to constantly evaluate and improve current disposal methods. One strategy to speed the rate of decomposition of landfill waste is to recirculate the collected leachate by pouring it over the cells and allowing it to filter through the rotting garbage.

Landfill Facts:

- The first garbage dump was created in 500 B.C. by the ancient Greeks in Athens. Residents were required to take their trash 1 mile away from the city walls to dump.
- Paper takes up as much as 50 percent of all landfill space. Recycling 1 ton of newspapers would save 3 cubic feet of that space.
- In a study of waste buried for more than 15 years, Professor William Rathje of the University of Arizona found legible newspapers and chicken bones with meat still on them, proving that waste does not decompose completely in a landfill.

(Sources: The League of Women Voters' Garbage Primer, 1993; Rubbish! The Archaeology of Garbage by William Rathje, 1990; Anchorage Recycling Center, 2000)

Another trend that is becoming common for landfill operators is collecting methane gas from the landfill and using it as energy source to power the landfill or selling it to a local utility provider, company, or even greenhouses. This process allows landfills to reduce their dependence on precious fossil fuels and save money.

A new trend that is gaining attention is landfill reclamation, in which old cells are excavated to recover recyclable items. This process, in which recovered recyclables, soil, and waste can be sold, reused, or burned as fuel, is a new approach used to expand landfill capacity and avoid the cost of acquiring additional land.

Putting Landfill Gas to Use

1 million tons of waste within a landfill creates 300 cubic feet per minute of landfill gas, or one megawatt of electricity. That is enough to power 700 homes for a year. Removing that much methane gas from the atmosphere is equal to taking 6,100 cars off the road for a year.

Additional Information Resources:

Visit the following Web sites for more information on municipal solid waste landfills:

- U.S. Environmental Protection Agency (EPA): <www.epa.gov>
- U.S. EPA, Office of Solid Waste site on landfills: <www.epa.gov/epaoswer/non-hw/muncpl/disposal.htm>
- U.S. EPA Landfill Methane Outreach Program: <www.epa.gov/lmop>

For more information on the disposal of hazardous waste in landfills, visit:

- U.S. EPA, Office of Solid Waste site on Land Disposal Restrictions: <www.epa.gov/epaoswer/hazwaste/ldr>
- U.S. EPA, Office of Solid Waste site on RCRA Hotline Training Modules (hazardous waste land disposal units): <www.epa.gov/epaoswer/hotline/modules.htm>

The following trade associations can provide information about landfills as well:

National Solid Waste Management
Association
4301 Connecticut Avenue, NW, Suite 300
Washington, DC 20008
Phone: 202/244-4700
Web site: www.envasns.org/nswma

Solid Waste Association of North
America
P.O. Box 7219
Silver Spring, MD 20907-7219
Phone: 301/585-2898
Web site: www.swana.org

Teacher Fact Sheet

Products

How Are Products Made?

Everyone uses a variety of products each day from toothbrushes to notebooks to lunch boxes to video games. Each of these products has an effect on the environment in one way or another. Sometimes merely using (or misusing) a product can affect the health of people and the environment. Some products can affect the environment through the way they are made or disposed of. For example, products made from the virgin natural resources have different effects on the environment than those made from recovered resources. By understanding a product's life cycle---the development, use, and disposal of a product---people can make better decisions about what products to buy and how to use them wisely.

A product's life cycle generally includes design; exploration, extraction, and processing of resources (raw materials); manufacturing; distribution and use; and retirement. If a product is made from 100 percent recovered materials, exploration and extraction of virgin materials is not necessary. If a product is recycled, composted, or reused, people do not have to throw it away. By altering the product life cycle in these ways, people can save energy and resources, and therefore, prevent waste and pollution.

Key Points

- Product life cycle includes design, extraction of natural resources, manufacture, use, and disposal or recycling. If a product is made with recovered materials, raw materials do not have to be extracted from the Earth. If a product is recycled or reused, its life cycle begins anew and has less effect on the environment.
- The extraction of raw materials and the manufacture and disposal of a product can create pollution and waste and can require a great deal of energy resources.
- Durable products can be used many times, while disposable products are usually used only once.
- Product manufacturers are beginning to make more products that have environmentally preferable attributes.

The Product Life Cycle

The following sections describe each stage in the product life cycle, as well as the challenges, benefits, and emerging trends associated with each step.

Design

Product design can involve research, testing, and development. This includes development of synthetic materials, such as plastics, which derive from natural resources.

Some products are designed to be used only once (disposable), while others are designed to be used many times (durable). Engineering and material choices can determine whether a product is durable, disposable, or recyclable.

Over the last few decades, as people's lives have become more complicated and technology has advanced, many consumers have come to desire the convenience of disposable items over the durability of reusable ones. Also, it is sometimes easier to replace items rather than fix them. Thus, more and more items end up as trash in landfills or incinerators.

Products are often conceived and designed with a focus simply on how they will be used and with less concern about the other stages in their life cycle. In the past decade, however, consumers have begun to demand more environmentally preferable products---products that have fewer negative effects on human health and the environment when compared to traditional products. Manufacturers have responded by offering products that are made from recycled-content materials, low in toxicity, and highly energy-efficient. Other products have been designed to conserve water, minimize air pollution or, through a combination of factors, have fewer negative impacts on the environment.

Exploration, Extraction, and Processing

Manufacturers must obtain the materials needed to make their products. If a manufacturer uses recovered materials, the company can obtain them from recycling processors or other similar sources. Virgin resources, however, must be mined (for metals and minerals) or harvested (for wood and other biobased materials) from the Earth. Once they are extracted, they must be processed for use in manufacturing.

The extraction of raw materials generates waste and pollution and requires a great deal of energy. In many cases, the natural resources used in manufacturing are nonrenewable. This means that, eventually, the natural resource will be depleted. As more and more communities offer recycling programs and people use them, manufacturers may be able to use increased recovered materials instead of virgin materials to make products.

Manufacturing

Whether a product is made from virgin or recovered materials, often the factories that manufacture the product are specially designed to use a consistent form of material. If a product is made in a plant designed to process virgin materials, changing to recycled feedstock might not be easy. Changing the kinds of materials used in manufacturing, such as using recycled paper instead of virgin paper, can require changes in technology and equipment and can slow down the pace of production. In the past decade, however, many manufacturing plants have begun retooling and learning to use recovered materials rather than virgin materials, and thus, the variety of recycled-content products has been growing. (See teacher fact sheet titled Recycling).

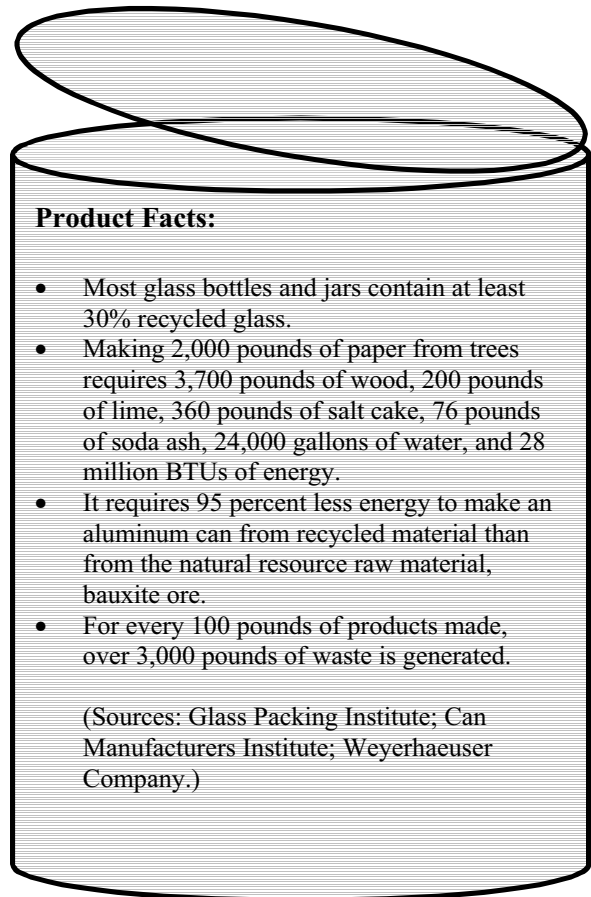
Manufacturing products generates pollution and usually requires a great deal of energy resources.

Using recovered materials can often save energy and reduce pollution. The manufacturing process also generates waste, but at some manufacturing plants, this waste can be reused.

Distribution and Use

People rely on various products to live in a modern society. Most people purchase and use some type of manufactured product everyday because it is easier and more convenient than making the same items from scratch (for example, going to a store and buying a box or bag of rice is much simpler, and more practical, than trying to grow rice in a paddy in the backyard).

After products are manufactured, many must be packaged for transportation and distribution. Often, products are transported long distances across the nation or even internationally before people can purchase and use those items. Products often require packaging to protect them from spoilage, damage, contamination, and tampering during



Product Facts:

- Most glass bottles and jars contain at least 30% recycled glass.
- Making 2,000 pounds of paper from trees requires 3,700 pounds of wood, 200 pounds of lime, 360 pounds of salt cake, 76 pounds of soda ash, 24,000 gallons of water, and 28 million BTUs of energy.
- It requires 95 percent less energy to make an aluminum can from recycled material than from the natural resource raw material, bauxite ore.
- For every 100 pounds of products made, over 3,000 pounds of waste is generated.

(Sources: Glass Packing Institute; Can Manufacturers Institute; Weyerhaeuser Company.)

Think Globally, Buy Locally

One way consumers can help eliminate the need for excessive packaging is to buy products locally. This concept, known as bioregionalism, works on the idea that if consumers buy products made within their own communities, packaging that would otherwise be needed to protect the products during transportation and storage could be eliminated.

transportation, storage, and sale. Sometimes packaging is necessary to inform consumers about product benefits, proper use, and other information. While some products might appear to have excessive packaging, in many cases the packaging serves several purposes, without which the products might not be available as widely or as frequently.

Packaging—when it is discarded—can create a great deal of waste. In communities where common packaging materials are not recyclable, these items must be thrown away, wasting precious resources and potential recovered materials.

Product Retirement

After use, many items or packaging are disposed of in landfills or incinerators, they can no longer provide any benefit. Emissions to air and water from these disposal methods can affect human health and the environment.

If products are recycled, composted, or reused, they continue to serve a purpose, either as a raw material or for the same use they were originally intended. Extending a product's life is a way to save natural resources, prevent waste, reduce pollution, and conserve energy.

The more people recycle and buy recycled products, the more incentive manufacturers will have to make products with recovered content.

Additional Information Resources:

Visit the following websites for more information on designing and purchasing products with the environment in mind:

- U.S. Environmental Protection Agency (EPA): <www.epa.gov>
- U.S. Office of Solid Waste extended product responsibility site:
<www.epa.gov/epaoswer/non-hw/reduce/epr/index.htm>
- U.S. EPA Office of Pollution and Toxics, Design for the Environment Program:
<www.epa.gov/dfc>
- U.S. EPA Office of Pollution Prevention and Toxics, Environmentally Preferable Purchasing:
<www.epa.gov/opptintr/epp>

Teacher Fact Sheet

Composting

What is Composting?

Composting is the controlled thermophilic decomposition of organic materials such as leaves, grass, food scraps by various organisms.

Composting can be divided into three types: backyard, or home, composting; vermicomposting; and heat based composting.

Home composting is the natural degradation of yard trimmings, food scraps, wood ashes, shredded paper, coffee grounds, and other household organic waste by naturally occurring microscopic organisms.

Vermicomposting is the natural degradation of similar household organic waste using naturally occurring microscopic organisms and the digestive process of earthworms. Heat based composting is performed by municipal or commercial facilities that increase the rate of degradation using high temperatures.

Composting in Action

An easy way to understand all the factors that go into composting is with a hands-on demonstration. A school can provide the perfect medium for these demonstrations. Classes could start a composting bin using food scraps from the cafeteria and yard trimmings from ground maintenance. Depending on the scope of the project, the compost could then be sold to the community in addition to being used on the school campus. Tour a local composting facility, if composting cannot be done at school. For more information on how to start a school composting project, go to the Cornell University composting Web site at: www.cfe.cornell.edu/compost/schools.htm Or use these suggested activities to get you started:

- Start a compost pile or bin in the school or as a class experiment.
- Try using compost in place of chemical fertilizers, pesticides, and fungicides. Use compost made by the school or buy it from municipalities or private companies.

Key Points

- Composting is the controlled decomposition of organic materials.
- Composting helps divert a large portion of America's organic trash from landfills and combustion facilities.
- There are three methods of composting: home or backyard composting, vermicomposting, and heat-based composting.
- Invertebrates and microorganisms in compost are key to the breakdown of the organic materials into a rich soil-like product.
- Quality compost is the result of the proper mixture of carbon and nitrogen sources and adequate amounts of moisture, oxygen, and time. Certain food items should be avoided when home composting.
- Compost is a valuable product that can be used as a soil amendment, mulch, or even to decontaminate natural habitats, storm water, and brownfields.
- More than 75 percent of the waste produced in the United States (including paper) is compostable material.

Varying amounts of heat, water, air, and food produce different qualities of compost as a final product. Heat based compost differs from compost produced at ambient temperatures (e.g., a forest floor or home composting) because high temperatures destroy both weed seeds and pathogens. Compost produced by all three systems are crumbly, earthy-smelling, soil-like materials with a variety of beneficial organisms.

How Does Composting Work?

Compost contains both carbon and nitrogen sources, which can be simplified as browns (e.g., leaves, straw, woody materials) and greens (e.g., grass and food scraps), respectively. Adequate sources of carbon and nitrogen are important for microorganism growth and energy. The ideal ratio is 30 parts brown to 1 part green. Odor and other

problems can occur if the ratio or any of the factors discussed below are not right.

The browns and greens can be mixed together to form compost in a backyard bin or in a municipal compost facility. Whether the composting is done on a small scale or large, the composting process is the same. To encourage decomposition throughout the pile, the compost should be kept moist and turned periodically.

The decomposition of organic materials in composting involves both physical and chemical processes. During decomposition, organic materials are broken down through the activities and appetites of bacteria, fungi, and various invertebrates that will naturally appear in compost, such as mites, millipedes, beetles, sowbugs, earwigs, earthworms, slugs, and snails. These insects and microorganisms found in decomposing matter need adequate moisture and oxygen to degrade the organic materials in the most efficient manner.

What are the Benefits of Composting?

As a method of handling the large amount of organic waste created in the United States each day, composting makes good environmental sense. Instead of throwing organic materials away, they can be turned into a useful resource.

In addition, many organic wastes are not ideally suited for disposal in combustion facilities or landfills. Food scraps and yard trimmings tend to make inferior fuel for combustors because of their high moisture content. Decomposition of organic wastes in landfills can create methane, a green house gas that is environmentally harmful because it destroys atmospheric ozone.

Because yard trimmings and food scraps make up about 23 percent of the waste U.S. households generate (EPA, 1998), backyard or home composting can greatly reduce the amount of waste that ends up in landfills or combustors. In addition, compost is a valuable product that can be used as a soil additive for backyard gardens and farmlands or in a highway beautification and other landscape projects.

The benefits don't end there—composting also makes good economic sense. Composting can reduce a community's solid waste transportation, disposal, and processing costs. In many communities, residents pay for each bag or can of trash they put out for pickup. If a household is composting, it will most likely put less in trashcan and will pay a smaller trash bill.

Compost can improve the soil structure of home gardens and farmlands alike by enhancing the soil's capacity to hold moisture and nutrients. This can reduce the need to purchase chemical fertilizers. Adding compost to soil attracts earthworms, which aerate the soil and add additional nutrients. When used as mulch, compost can help prevent erosion by improving soil structure, promoting vegetative growth, and slowing water runoff. Applying compost to soils reduces the likelihood of plant diseases. This is due to the beneficial microorganisms present in compost, which can kill pathogens in the soil. Compost can also be used to decontaminate natural habitats, storm water, and brownfields.

What can go into a Composting Bin?

This list is not meant to be all-inclusive. Some food products should not be included because they can attract pests or compromise the quality of the compost.

Materials to Include

Fruit and vegetable scraps
Tea Bags
Wool and cotton rags
Coffee grounds with filters
Grass / Yard Clippings
Leaves
Egg Shells
Sawdust
Fireplace ash
Non-recyclable paper
Vacuum cleaner lint
Fish scraps

Materials to Exclude

Meats
Dairy foods
Bones
Fats
Pet excrement
Diseased Plants
Grease
Oils (including peanut butter and mayonnaise).

In backyards and on the community level, interest in composting has increased rapidly over the past several years. Yard trimmings programs constitute the large majority of composting operations in the United States. In these programs, community members place their yard trimmings in a separate bag or container at the curb, which is collected and taken to a municipal composting facility. These facilities create large amounts of compost, which, in many cases, is sold back to community members. People can also purchase compost created by private composting companies.

What are the Challenges Associated with Composting?

Creating quality compost requires the right mix of materials and attention to moisture, particle, size, and temperature. Too little moisture will slow the decomposition, but too much can create odor problems. To avoid attracting pests and rodents, composters should monitor the food scraps put in the compost pile. Meat scraps, fats, and oils are difficult items to compost, attract pests, and should be kept away from the compost pile.

While composting increases the rate of natural organic decomposition, it still takes months for compost to mature. If compost is used while it is still “cooking,” the high temperatures could kill the plant life on which it is spread. In addition, using compost before it is ready can encourage weed growth because the high temperatures of the pile have not had a chance to kill any potential weed seeds.

What are Some Emerging Trends in Composting?

A large amount of organic waste is created by institutions, restaurants, and grocery stores—perfect for compost. Across the country, many of these businesses are participating in pilot projects to compost their food scraps and soiled paper products. These businesses cannot only provide a valuable component of compost—organic material—but also can reduce their waste disposal cost significantly.

Compost is also being used as an innovative technology to clean up land contaminated by hazardous wastes, remove contaminants from storm water, facilitate reforestation, and restore wetlands and other natural habitats. Compost has been used to restore soil that is contaminated with explosives, munitions wastes, petroleum, fuel wastes, and lead and other metals. In addition, various biodegradable tableware and dishes are being tested for compostability.

Worms—A Composter’s Best Friend

Vermicomposting is a method of composting using a special kind of earthworm known as a red wiggler (*Eisenia Fetida*), which eats its weight in organic matter each day. Vermicomposting is typically done in a covered container with a bedding of dirt, newspaper, or leaves. Food scraps (without added fats) can then be added as food for the worms. Over time, the food will be replaced with worm droppings, a rich brown matter that is an excellent natural food plant. Vermicomposting requires less space than normal composting methods, and is therefore ideal for classrooms, apartments, and those in high-density urban areas.

Additional Information Resources:

Visit the following Web sites for more information on composting and solid waste:

- U.S. Environmental Protection Agency (EPA): www.epa.gov
- U.S. EPA, Office of Solid Waste site on composting: www.epa.gov/compost
- Cornell University composting site: www.cals.cornell.edu/dept/compost/composting_homepage.html
- U.S. Composting Council Web site: www.compostingcouncil.org

Teacher Fact Sheet

Combustion

What is Combustion?

Recycling, composting, and source reduction are vital activities for effective solid waste management, but 100 percent of people's trash cannot be handled by these methods. The remaining waste must be deposited in landfills or combusted (burned). Because of limited space, landfills are not always a viable option in many cities, making combustors (commonly referred to as incinerators) an important part of a community's integrated waste management system. Burning garbage can decrease the volume of waste requiring disposal by 70 to 90 percent.

Before the late 1970's, many people burned garbage in their backyards and in simple private and municipal combustors. These methods did not burn garbage completely, however, and allowed pollutants to escape into the atmosphere. With the passing of the Clean Air Act, combustor owners were directed to develop more effective methods of pollution control. Today's municipal waste combustors release significantly less pollutants into the air than the "backyard burners" and simple combustors. More than 100 municipal waste combustor plants currently exist nationwide, and nearly 20 percent of the municipal solid waste generated in the United States is combusted.

Key Points

- Municipal waste combustors burn waste at high temperatures to reduce its volume.
- The heat produced by burning waste in municipal waste combustors can be recovered as useful energy.
- Municipal waste combustors reduce the volume of garbage by 70 to 90 percent.
- Ash is a byproduct of combustion that must be disposed of in landfills or reused.
- Air pollution control equipment helps reduce air emissions.
- Specially designed incinerators can be used as a means of handling hazardous waste. The burning process reduces the toxicity of organic compounds in the waste.

How do Municipal Waste Combustors Work?

Municipal waste combustors dispose of trash by burning it at high temperatures. Not all municipal waste combustors are designed alike, but they function in a similar manner. Typically, a facility collects waste in a garbage receiving area or pit, where the garbage is mixed by a crane. The crane operator looks for large items that are not suitable for combustion (e.g., batteries and refrigerators) and remove them from the pit. The crane operator also uses the crane to lift piles of garbage into a large chute. From the chute, garbage falls into a combustion chamber or furnace and then moves along a series of sloping grates that work like conveyor belts. The garbage is burned as it moves forward.

After garbage is burned, some matter remains in the form of ash. There are two types of ash: bottom ash and fly ash. Bottom ash is the heavier, nonburnable material, such as glass and metal, that falls through the grate after burning. Large pieces of metal accumulate in this ash and are extracted from the ash with magnets. Bottom ash accounts for the majority of ash produced by incinerators, about 75 to 90 percent. Fly ash includes lighter particles that rise with hot gases as the garbage is burned and are captured by air pollution control equipment in the stacks. All ash generated by combustion facilities must be tested to determine if it is hazardous. If deemed hazardous, the ash is subject to special hazardous waste disposal regulations. If the ash proves nonhazardous, it may be deposited in landfills specially designed to store it. Currently, studies are under way to investigate ways to reuse ash; for example, to replace soil as a landfill cover (generally applied at the end of each day to minimize odor, pests, and wind disturbances). Ash might also be used in road and building construction and as part of artificial offshore reefs. Whether the leftover ash is recycled or landfilled, it takes up much less space than the same materials in their original form.

Facts about Municipal Waste Combustors

- Fire in the boiler of a combustor is often as hot as flowing lava (between 1,800 and 2,200 degrees Fahrenheit).
- In 1874, a new technology called “the destructor” provided the first combustor of municipal garbage in England.
- The first garbage incinerator in the United States was built on Governor’s Island, New York, in 1885.

(Sources: Integrated Waste Services Association, 2000; Rubbish! The Archaeology of Garbage by William Rathje, 1990)

What are the Benefits of Municipal Waste Combustors?

Most municipal waste incinerators in the United States generate energy in the form of electricity because certain materials, such as paper, plastics, wood, and packaging, make excellent fuels. Producing this energy has about the same environmental impact as energy produced from natural gas and less of an environmental impact than energy produced from oil or coal. In other words, generating energy from municipal waste combustors contributes no more pollution—and sometimes less—than processes generating electricity using natural gas, oil, or coal. Waste-to-energy plants also reduce the need to generate electricity from nonrenewable natural resources such as oil and coal.

What are the Challenges of Municipal Waste Combustors?

Although technologies to control pollution have improved significantly, burning certain materials still produces chemicals that contribute to air pollution. To minimize emissions of air pollutants into the atmosphere, municipal waste incinerators use special equipment (e.g., scrubbers and dust collectors) to remove pollutants. To protect air quality and monitor the hazardous constituents in ash, EPA established regulations that apply to all large municipal solid waste units (those with the capacity to burn more than 250 tons of garbage per day). The regulations significantly reduce toxic air emissions such as dioxin, acid gas, lead, cadmium, and mercury.

Many people do not want incineration sites near their homes. The NIMBY (Not in My Back Yard) attitude makes finding appropriate sites for municipal waste combustors a challenge for many municipalities. There are, however, opportunities for the public to participate in deciding where a combustor will be located. Officials must hold a public meeting to inform the community about the size of the combustor, as well as the amount of waste generation and ash to be discarded.

Hazardous Waste Combustion

In addition to combustion facilities that accept municipal (nonhazardous) waste, specially designed incinerators, boilers, and industrial furnaces, can burn hazardous waste. Hazardous waste, which is toxic, ignitable, corrosive, or reactive, can be produced by businesses or manufacturing operations. Combustion has some key advantages as a means of managing hazardous waste. First, burning hazardous waste reduces the volume of waste by converting solids and liquids to ash. Second, the burning process destroys toxic organic compounds in waste. Third, disposal of the ash in a landfill is safer and more efficient than disposal of untreated hazardous waste. The ash generated from hazardous waste combustion must be tested and, if found to be hazardous, must be treated and, if found to be hazardous, must be treated for remaining toxicity before it is disposed of in a landfill.

Additional Information Resources:

Visit the following Web sites for more information on municipal and hazardous waste combustion and solid waste:

- U.S. Environmental Protection Agency (EPA): < www.epa.gov >
- U.S. EPA, Office of Solid Waste site on combustion: < www.epa.gov/epaoswer/non-hw/muncpl/disposal.htm >
- U.S. EPA, Office of Solid Waste site on hazardous combustion: < www.epa.gov/epaoswer/hazwaste/combust >

Integrated Waste Services Association

1401 H. Street, NW.,
Suite 220
Washington, DC 20005
Phone: 202/467-6240
Fax: 202/467-6225
Email: Iwsa@ix.netcom.com

Environmental Industry Associations

4301 Connecticut Avenue,
NW.
Suite 300
Washington, DC 20008
Phone: 202/244-4700
Fax: 202/966-4841

Solid Waste Association of North America

P.O. Box 7219
Silver Spring, MD 20907-7219
Phone: 301/585-2898
Fax: 301/589-7068
Web site: www.swana.org

Be a Solid Waste Survivor



Take the Community Challenge

A Primary Unit of Study for Kentucky Schools

Be a Solid Waste Survivor – Take The Community Challenge
Primary

**A KENTUCKY ENVIRONMENTAL EDUCATION COUNCIL
PRACTICAL LIVING, SCIENCE, AND SOCIAL STUDIES INTEGRATED UNIT**

Standards: Consumerism

Practical Living: PL-E-3.1.5, There are consumer decisions (e.g., reducing, recycling, and reusing) that have positive impacts on the environment.

Practical Living: PL-E-3.3.2, To protect all citizens, there are community guidelines (e.g., school inspectors, trash collections, water treatment, waste treatment, animal control, immunization) that promote healthy living environments in the community.

Standards: Life Science

Science: SC-E- 2.1.2,Earth materials provide many of the resources humans use. The varied materials have different physical and chemical properties, which make them useful in different ways. For example, as building materials (e.g., stone, clay and marble), as sources of fuel (e.g., petroleum and natural gas), or growing the plants we use as food.

Science: SC-E- 3.3.3, All organisms, including humans, cause changes in the environment where they live. Some of these changes are detrimental to the organism or to other organisms, other changes beneficial (e.g., dams built by beavers benefit some aquatic organisms but are detrimental to others).

Standard: Government

Social Studies: SS-E-1.3.3, In order for a democratic form of government to function, citizens must plan an active and responsible role (e.g., participating in the election process, obeying the law).

Standard: Economics

Social Studies: SS-E-3.1.1, Scarcity requires people to make choices about using goods, services and limited resources.

UNIT OVERVIEW

Lesson	Title and Description of Activities, Essential and Guiding Questions and Standards
#1	<p>“THE NATURAL SORT” -- Students will sort common school objects appropriately as natural objects or man-made products, then begin to identify the natural resources used to make the different products.</p> <p>Standard: Science: SC-E-2.1.2</p> <p>Essential Question #1: How do my family and I depend on the resources in our community and our world?</p> <p>Guiding Questions:</p> <ul style="list-style-type: none"> ◆ What is a natural resource? ◆ What is a product?
#2	<p>“IT FEELS SO NATURAL!” -- Students will identify natural objects or man-made products by using only their sense of touch.</p> <p>Standard: Science: SC-E-2.1.2</p> <p>Essential Question #1: How do my family and I depend on the resources in our community and our world?</p> <p>Guiding Questions:</p> <ul style="list-style-type: none"> ◆ What is a natural object? ◆ What is a man-made product?

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Lesson	Title and Description of Activities, Essential and Guiding Questions and Standards
#3	<p>A NATURAL BEGINNING” – Students will identify natural resources used to make common products after playing “Trash Bingo”. They will also begin to learn the difference between renewable and nonrenewable resources.</p> <p>Standard: Science: SC-E-2.1.2</p> <p>Essential Question #1: How do my family and I depend on the resources in our community and our world?</p> <p>Guiding Questions:</p> <ul style="list-style-type: none"> ◆ What is a natural resource? ◆ What are renewable and nonrenewable resources?
#4	<p>“RESOURCE-FUL KENTUCKIANS” – Students will learn about Kentucky’s natural resources and several products made in Kentucky. They will also discuss ways to conserve natural resources.</p> <p>Standard: Science: SC-E-2.1.2</p> <p>Essential Question #1: How do my family and I depend on the resources in our community and our world?</p> <p>Guiding Question:</p> <ul style="list-style-type: none"> ◆ What types of resources do I consume?
#5	<p>“BATTLING ‘THWANTS’ AND ‘THNEEDS’” -- Students will listen to the book, <u>The Lorax</u>, by Dr. Seuss, then discuss the difference between wants and needs. The discussion will lead students to a better understanding of what it takes to survive and what might happen if natural resources are depleted.</p> <p>Standard: Social Studies: SS-E-3.1.1</p> <p>Essential Question #1: How do my family and I depend on the resources in our community and our world?</p> <p>Guiding Questions:</p> <ul style="list-style-type: none"> ◆ What types of resources do I consume? ◆ What happens when all of the natural resources are consumed? ◆ What is the difference between a want and a need?
#6	<p>“WHAT A WASTE!” – Students will learn the difference between solid waste and litter. They will also begin looking at the amount of waste they and their families make.</p> <p>Standard: Practical Living: PL-E-3.1.5</p> <p>Essential Question #1: My family and I use resources that create solid waste. How does that affect the environment?</p> <p>Guiding Questions:</p> <ul style="list-style-type: none"> ◆ What is the difference between litter and solid waste? ◆ How much solid waste do my family and I make?
#7	<p>“ LEARNING ABOUT THE 4 R’S” – Students will begin to learn how to <u>REDUCE, REUSE, RECYCLE</u> and <u>RESPOND</u> in a positive way to how they handle solid waste.</p> <p>Standard: Social Studies: SS-E-3.1.5</p> <p>Essential Question #2: My family and I use resources that create solid waste. How does that affect the environment?</p> <p>Guiding Questions:</p> <ul style="list-style-type: none"> ◆ What choices do my family and I have about how we <u>reduce, reuse, recycle and respond</u> to solid waste? ◆ What are the best ways to dispose of our solid waste? (e.g., most cost effective, safest, and healthiest)

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Lesson	Title and Description of Activities, Essential and Guiding Questions and Standards
#8	<p>“HOMEMADE RECYCLED SEED CARDS” -- Students will learn to reuse newspapers by making recycled paper greeting cards containing wildflower seeds.</p> <p>Standard: Practical Living: PL-E-3.1.5</p> <p>Essential Question #2: My family and I use resources that create solid waste. How does that affect the environment?</p> <p>Guiding Question:</p> <ul style="list-style-type: none"> ◆ What choices do my family and I have about how we reduce, reuse, recycle and respond to solid waste?
#9	<p>“LUSCIOUS LAYERED LANDFILLS” -- Students will learn about the different layers of landfills and their functions by constructing an edible model.</p> <p>Standard: Practical Living: PL-E-3.3.2</p> <p>Essential Question #2: My family and I use resources that create solid waste. How does that affect the environment?</p> <p>Guiding Questions:</p> <ul style="list-style-type: none"> ◆ What are the best ways to dispose of our solid waste? (e.g., most cost effective, safest, healthiest) ◆ What is a sanitary landfill?
#10	<p>“ONCE UPON A LANDFILL” -- Students will investigate how landfills looked long ago by interviewing older people about how they handled solid waste.</p> <p>Standard: Practical Living: PL-E-3.3.2</p> <p>Essential Question #2: My family and I use resources that create solid waste. How does that affect the environment?</p> <p>Guiding Questions:</p> <ul style="list-style-type: none"> ◆ What are the best ways to dispose of our solid waste? (e.g., most cost effective, safest, healthiest)
#11	<p>“GARBAGE / TRASH / WASTE” -- Students will make a list of synonyms for solid waste, make a Venn diagram to compare the synonyms and discuss organic and inorganic kinds of waste.</p> <p>Standard: Science: SC-E-2.1.2</p> <p>Essential Question #3: How can I affect the way my family, school, and community use resources and properly dispose of solid waste?</p> <p>Guiding Questions:</p> <ul style="list-style-type: none"> ◆ What is organic waste? ◆ What is inorganic waste?
#12	<p>“POTATO TRAPS” – Students will make “potato traps” and learn how insects aid in the decomposition process. They will also learn the importance of composting, both naturally in nature and at home.</p> <p>Standard: Science: SC-E-3.3.3</p> <p>Essential Question #3: How can I affect the way my family, school, and community use resources and properly dispose of solid waste?</p> <p>Guiding Questions:</p> <ul style="list-style-type: none"> ◆ How do insects help speed up the decomposition process? ◆ Why should my family and I compost?

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Lesson	Title and Description of Activities, Essential and Guiding Questions and Standards
#13	<p>“BUTTON BRIGADE” – Students will create a plan to organize the classes at school to do a school-based service learning project that will help promote proper waste disposal.</p> <p>Standard: Social Studies: SS-E-1.3.3</p> <p>Essential Question #3: How can I affect the way my family, school, and community use resources and properly dispose of solid waste?</p> <p>Guiding Questions:</p> <ul style="list-style-type: none"> ◆ Can one person, or a small group of people, really make a difference in changing recycling attitudes in our community?
#14	<p>“PLANNING FOR OUR FUTURE” – Students will develop a family solid waste action plan to take home and present to their parents and other family members.</p> <p>Standard: Social Studies: SS-E-1.3.3</p> <p>Essential Question #3: How can I affect the way my family, school, and community use resources and properly dispose of solid waste?</p> <p>Guiding Questions:</p> <ul style="list-style-type: none"> ◆ What can I do to encourage family members to reduce, reuse, recycle, and respond to solid waste disposal problems?
#15	<p>“TEACHING OUR FAMILIES ABOUT SOLID WASTE – A CULMINATING PERFORMANCE TASK” – In this final activity that ties the unit together, students will make a “resource vest.” The vest will be used as an aid to teach family members about solid waste issues. Each family will then be asked to help students keep a calendar on which they will record family efforts to reduce, reuse, and recycle, thereby responding to the solid waste disposal problem.</p>

INTEGRATION

Language Arts

- ◆ Read the Lorax, Dr. Seuss. Write a letter to the Once-ler suggesting how to make “thneeds” without using all of the Truffula Trees.
- ◆ Write couplets to the environment on recycled brown grocery bags. Use twine to hang them in trees as a tribute to mother nature.
- ◆ Keep a “Writing Journal” to show what you learn about solid waste.

Technology

- ◆ Keep databases of solid waste items
- ◆ Design spreadsheets about solid waste
- ◆ Use the Internet to research solid waste information

Arts and Humanities

- ◆ Sing “This Land is Your Land”. Discuss lyrics that describe ecosystems.
- ◆ Write songs about solid waste, using familiar tunes. Create dances to go with the songs.
- ◆ Make recycled sculptures
- ◆ Make collages of recycled items

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Integration, *continued*

Math

- ◆ Weigh and graph solid waste
- ◆ After collecting solid waste from the school grounds, lay it end to end and measure the length. Have each class do this, add the total for each class.

Science

- ◆ Conduct inquiry investigations on decomposition (e.g., Does a banana peel rot more quickly in air, water, soil, etc.?).

Social Studies

- ◆ Look at atlases to identify the location of natural resources. Focus on continent identification, reading legends, map skills.
- ◆ Share **A River Ran Wild**, by Lynne Cherry. Discuss the Nashua people and/or the industrial revolution and their relationship to the environment.
- ◆ Talk to older acquaintances about how they dealt with solid waste when they were young.

Be a Solid Waste Survivor – Take the Community Challenge
Primary

The Natural Sort

Standard

Science: SC-E-2.1.2, Earth materials provide many of the resources humans use. The varied materials have different physical and chemical properties, which make them useful in different ways. For example, as building materials (e.g. stone, clay, and marble), as sources of fuel (e.g. petroleum and natural gas), or growing the plants we use as food.

Activity Description

Students will sort common school objects appropriately as natural objects or man-made products, then begin to identify the natural resources used to make the different products.

Materials

Two signs labeled “natural objects” and “man-made products”
Two empty tables
Common school objects for students to sort

Length of Lesson

Approximately thirty minutes

Vocabulary Words

Natural Resource: a raw material or energy supplied by nature (e.g., water, minerals, or plants). Petroleum is a natural resource used to make plastic and many other products, and sunlight is a natural resource used to power lights and heat homes.

Natural Object: an item not made by man or machine.

Product: an item manufactured, or made, by hand or by industry for consumers to buy and use.

Essential Question

How do my family and I depend on the resources in our community and our world?

Guiding Questions

What is a natural resource?
What is a product?

Skills Used

Communication
Problem Solving
Observation and Classification

Activity

Step 1: This activity begins the “Solid Waste Survivor” unit with students discovering that natural resources are the raw materials used to make the products that they use each day. Before beginning this activity, make two signs: one with the words “NATURAL OBJECTS” written on it, and the other with the word “PRODUCTS” written on it.

This activity can take place at two tables in the classroom, or on the floor. Place the “NATURAL OBJECTS” sign in one area, and the “PRODUCTS” sign close to it. Also, have a collection of objects found in the classroom in a container for the students to sort.

Product	Natural Object
Chalk	Rock
Paper	Tree
Glass	Soil
Tape	Class pet
Pencil	Petroleum
Scissors	Water
Book	Leaves

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Primary

The Natural Sort, *continued*

Step 2: Explain to students that they will be sorting objects into two categories, natural objects and products. Ask students if, by looking at the types of objects in the collection, they can explain the difference between natural objects and man-made products (Refer to the **Teacher Fact Sheets** found at the beginning of this publication for more background information about “Products” and “Natural Resources”).

Step 3: Call on students to take turns selecting objects from the container to place by the appropriate signs. As students take turns sorting the objects, ask them to explain if people and/or machines made the objects, or if the objects are just a natural part of the environment. Explain the term “natural resources” to students by saying that they are materials people can “harvest” or take from the Earth. Introduce students to the idea of natural resources being used by people to make the products we use by asking if anybody knows the natural resources used to make specific products from the collection.

Step 4: Ask students to search the classroom for products not made from natural resources. Help students understand that everything we use has its start as a natural resource.

Science Extension

Divide students into teams and take them on a scavenger hunt outside the building to look for natural objects and man-made products. Each team should take along pencils and a science journal or a clipboard and paper to record findings. Explain that the recorder for each team is responsible, with the help of teammates, for making two columns on the paper, and labeling one column with the words “natural objects” and the other column as “man-made products”. Give the students a specified amount of time to search for different items. At the end of that time, gather the students in a group to discuss the findings. Graph the results of the scavenger hunt.

Assessment

Ask students to tear or cut pictures from magazines and catalogues showing a variety of products and natural objects. Give students choices of making a poster, creating a booklet, or making a brochure explaining the differences between man-made products and natural objects. Explain that they will be using the collected pictures to illustrate their work.

Literature Connections

The following books contain information about products made from natural resources.

1. The Reason for a Flower, by Ruth Heller
2. What is a Plant, by Bobbie Kalman (The Science of Living Things Series)
3. A New Coat for Anna, by Harriet Ziefert

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It Feels So Natural!

Standard

Science: SC-E-2.1.2, Earth materials provide many of the resources humans use. The varied materials have different physical and chemical properties, which make them useful in different ways. For example, as building materials (e.g. stone, clay, and marble), as sources of fuel (e.g. petroleum and natural gas), or growing the plants we use as food.

Activity Description

Students will identify natural objects and man-made products by using only their sense of touch.

Materials

A class collection of natural objects and man-made products
Small plastic containers (large enough to hold each object)
Clean laundered tube socks (enough to hold containers)
Permanent marker
Pencil and paper for each student to use to record guesses

Length of Lesson

30 – 60 minutes (depending on the depth of the lesson)

Vocabulary Words

Natural Object: an item not made by man or machine.
Product: an item manufactured, or made, by hand or by industry for consumers to buy and use.

Essential Question

How do my family and I depend on the resources in our community and our world?

Guiding Questions

What is a natural object?
What is a man-made product?

Skills Used

Communication
Problem Solving
Classification
Writing

Activity

Step 1: Before class time, gather a collection of natural and man-made objects. Each object needs to be small enough to fit inside the “feely sock”. Step 2 gives directions on how to make “feely socks”.

Step 2: Reuse clean plastic icing, margarine, cheese or small ice cream containers to put down into the toes of old laundered tube socks. Use a dark-colored permanent marker to number each “feely sock”. As each item is placed inside a sock, record the number of the sock and the item placed inside that sock. Also, record whether the item is natural or man-made. This will become the answer key to use during the activity.

Natural	Man-made
Rock	Dishes
Stick	Clothing
Tree	Jewelry
Water	Soap
Grass	Eraser
Clouds	Glue bottle
Shell	Pencil
Leaf	Jewelry
Egg	Scissors
Soil	Crayon

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Primary

It Feels So Natural! *continued*

Step 3: Remind students about sorting the different items in the activity “The Natural Sort”. Ask students if they remember the difference between a natural object and a man-made product. Ask students if they were able to find any products in the classroom that were not made from natural resources. Remind students that man-made products begin as natural resources that have been harvested, or taken, from the Earth.

Step 4: Challenge the students to use only their sense of touch to try to guess what the common object is inside each sock. The students will also need to decide whether the object hidden inside each sock is a natural or manmade object. Students will need to record the number of the sock, along with the name of the object and the word “natural” or “man-made” beside each number. Depending on the grade level of the students, this activity can be completed in a large group setting, in small groups, or individually in a learning center.

This is an example of what a student answer sheet might look like as guesses are being recorded. (Younger students could draw pictures of their guesses and write N.O. for natural object and M.P. for man-made products, if working individually.)

Rachel W.

1. Rock Natural Object
2. Eraser Manmade Product
- 3.
- 4.
- 5.
6. Leaf Natural Object
- 7.
- 8.
9. Marker Manmade Product
- 10.
- 11.

Assessment

Each student’s recording sheet can be used as an assessment tool to check for understanding of natural objects versus man-made products. For assessment purposes, do not use the recording sheet to check for correct responses as to what is inside the “feely socks”. Instead, check to see if the student wrote the terms “natural” or “man-made” beside appropriate corresponding objects.

Extensions

1. Give students a copy of the list of objects found in the “feely socks” if they are having trouble guessing the objects by simply using their sense of touch. For younger students, pictures of the objects could be used as an aid to help in the identification process.
2. After checking students’ answers for accuracy, call on one person at a time to orally describe, for the rest of the class, the object inside the “feely sock”. Model for the students by giving examples of products that are made from the object if it is a natural object. If the object is a man-made product, encourage students to tell the natural resources used to make the product, along with other clues about the product.

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Primary

A Natural Beginning

Adapted from “Tracing Trash Back to Its Roots”, from Quest for Less, an EPA Publication

Standard

Science: SC-E-2.1.2, Earth materials provide many of the resources humans use. The varied materials have different physical and chemical properties, which make them useful in different ways. For example, as building materials (e.g. stone, clay, and marble), as sources of fuel (e.g. petroleum and natural gas), or growing the plants we use as food.

Activity Description

Students will identify natural resources used to make common products after playing “Trash Bingo.” They will also begin to learn the difference between renewable and nonrenewable resources.

Materials

Copies of bingo cards for each student
Pencil for each upper primary student
Small circles or beans for each early primary student
Chart paper and markers for teacher

Length of Lesson

Approximately one hour

Vocabulary Words

Natural Resources: raw materials or energy supplied by nature (e.g., water, minerals, or plants) Trees are a natural resource used to make paper and water is a natural resource used to generate electricity to power homes and businesses.

Renewable Resource: naturally occurring raw material that, when properly used and managed, can be restored or replenished.

Nonrenewable Resource: a raw material that can be depleted faster than it naturally regenerates (e.g., petroleum, metals, etc.)

Essential Question

How do my family and I depend on the resources in our community and our world?

Guiding Questions

What is a natural resource?
What are renewable and nonrenewable resources?

Skills Used

Communication
Problem Solving

Activity

Step 1: Remind students that people need natural resources in order to manufacture man-made products. (Refer to “The Natural Sort” and “It Feels So Natural” activities.) Explain that during this lesson, students will get to play “Trash Bingo” as they learn more about the natural resources used to make products they use. Also, explain to students that they will learn about renewable and nonrenewable resources. (Refer to **Teacher Fact Sheets** about “Natural Resources” for background information.)

Step 2: List the five following categories of natural resources on a piece of chart paper: **animals, fossil fuels, metals, plants/trees and sand**. Discuss with the students some examples of products that are made from these natural resources. List each product example under the appropriate heading. Brainstorm with the students to develop a more complete list of things that are made from these natural resources. Remind students that all man-made products begin as natural resources!

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A Natural Beginning, *continued*

Step 3: Explain the rules for bingo, and hand out the bingo cards designed for older primary students found on the next page.

For early primary students, custom-make class sets of bingo cards for this lesson by visiting the following website and downloading a free shareware copy of “BingoMaker”: <http://www.5starshareware.com/Homehob/Greeting-Cards/bingo-cards.html>. (Please refer to the example given on the next page of how to enter information onto the table when using “BingoMaker” shareware.)

Step 4: For upper primary students, select words from the product list created on the chart paper (or the suggested list in the sidebar on this page) and call out one word at a time. Instruct students to find the category, or categories, that each item belongs in on their bingo card and write the name of the product inside the appropriate box or boxes. There may be more than one natural resource for each product (for example, a pair of tennis shoes might fill three categories: plant, fossil fuel and metal).

For early primary students, call out the category, along with a corresponding product. (A “call card” will be printed along with the class set of bingo cards when using “BingoMaker” shareware.) Instruct students to cover the appropriate space if the product appears on their bingo cards.

Step 5: The first student to fill the card wins. Use the **T-R-A-S-H** letters as free spaces. Be sure to check each student’s bingo card to see if all answers are correct!

Step 6: After the bingo game, or in a separate block of time, instruct each upper primary student to circle the items that are made from renewable resources. Lead students into a discussion of which resources are renewable and which are nonrenewable. Explain to students that both renewable and nonrenewable resources need to be managed appropriately or they could be depleted. Explain to students that during the “Solid Waste Survivor” unit, they will be learning ways to conserve natural resources.

Common Products

Aluminum can	Grocery bag
Aluminum lawn chair	Hamburger
Apple core	Leather jacket
Bicycle tire	Jeans
Bologna sandwich	Milk jug
Book	Mirror
Nylon shoelace	Bread
Cereal box	Sandwich bag
Cotton shirt	Soda bottle
Egg shells	Window
Glass bottle of juice	Wool hat
Water bottle	Wire
Cheese	Glass vase
Lunch box	Backpack

Assessment

Journal Activity

Give students the following information:

We have been learning about products and some of the natural resources used to make those products by playing bingo.

Think about a favorite toy or game you have at home. Write a history of that toy or game, tracing it back to the natural resource or resources used to make that toy or game. Were the resources used to make the toy or game renewable or nonrenewable? Why?

Be a Solid Waste Survivor – Take the Community Challenge Primary

A Natural Beginning, *continued*

Extensions

3. Ask students what happens if we keep using more and more natural resources. How can we stop using so many natural resources? How can we use more renewable resources than nonrenewable resources?
4. Ask students to bring one of their favorite “things” from home to share with the class. Have each student be prepared to tell where the item came from, including the resources used in producing it, and how it came to be in their house. What will happen to the item when it is old, broken, or no longer needed?

*This is an example of how to enter information to make early primary bingo cards using “BingoMaker” shareware.

	Column 1	Column 2	Column 3	Column 4	Column 5
Heading	METALS	FOSSIL FUELS	ANIMALS	SAND	PLANTS/TREES
1	Aluminum Can	Milk Jug	Hamburger	S	Cotton Shirt
2	Bicycle	R	Egg Shells	Window	Book
3	Fork	Sandwich Bag	Chicken	Glass Juice Bottle	H
4	T	Plastic Chair	Wool Hat	Mirror	Cereal Box
5	Wire	Bicycle Tire	A	Glass Pickle Jar	Apple Core

Student Handout

Name: _____

Trash Bingo



Animals	Fossil Fuels	Metals	S	Sand
Plants/Trees	Metals	Metals	Sand	Fossil Fuels
Fossil Fuels	R	A	Plants/Trees	Sand
T	Animals	Sand	Plants/Trees	H
Plants/Trees	Fossil Fuels	Fossil Fuels	Metals	Metals

T	Animals	Metals	Fossil Fuels	Fossil Fuels
Sand	Plants/Trees	A	Metals	Sand
Animals	Metals	Metals	Fossil Fuels	Plants/Trees
Plants/Trees	Sand	Sand	S	Plants/Trees
Fossil Fuels	R	Plants/Trees	Fossil Fuels	H

Trash Bingo



Name: _____

Be a Solid Waste Survivor – Take the Community Challenge
Primary

Resource-ful Kentuckians

Standard

Science: SC-E-2.1.2, Earth materials provide many of the resources humans use. The varied materials have different physical and chemical properties, which make them useful in different ways. For example, as building materials (e.g., stone, clay and marble), as sources of fuel (e.g., petroleum and natural gas), or growing the plants we use as food.

Activity Description

Students will learn about Kentucky’s natural resources and several products made in Kentucky. They will also discuss ways to conserve natural resources.

Materials

Ale 8 soda	Plastic milk jug
Paper	Cotton T-shirt
Packaged muffin or bread	Can of corn
Bag of apples	Cheese
Leather (belt, shoe, etc.)	Glass bottle of syrup
Wooden baseball bat	Plastic bottle of ketchup

Length of Lesson

Approximately one hour

Vocabulary Words

Renewable Resource; naturally occurring raw material that, when properly used and managed, can be restored or replenished (e.g., wood, leather).
Nonrenewable Resource; a raw material that can be depleted faster than it naturally regenerates (e.g., petroleum, metals, etc.)
Raw materials; still in their natural or original state.
Consumption; the amount of any product or resource (material or energy) used in a given time by a given number of people.
Scarcity; limited supply of a resource or product.

Essential Question

How do my family and I depend on the resources in our community and our world?

Guiding Question

What types of resources do I consume?

Skills Used

Communication and Problem Solving
 Research and Writing
 Observation and Classification

Activity

Step 1: Introduce, or review, the concept of natural resources with students by asking the following questions: Can people make natural resources? Are natural resources things we can use? Where do we have to go to find natural resources? Are they necessary for human life?

Step 2: Remind students that natural resources are the raw materials used to make products that we can buy at local stores – even at school.

Kentucky Natural Resources	
Cattle	Barite
Natural Gas	Coal
Apples	Petroleum
Titanium	Iron Ore
Corn	Soybeans
Limestone	Tomatoes
Fish	Wheat

Be a Solid Waste Survivor – Take the Community Challenge Primary

Resource-ful Kentuckians, *continued*

Step 3: Display all of the products from the “Materials Needed” list. Explain to students that the products on display were made in Kentucky. Ask students to identify what natural resources they think were used to make each of the products. List those natural resources on the chalkboard or on a chart. Help students with this step if they are not sure, or have research materials on hand for students to use to find background information on raw materials. The following web sites offer extensive information on Kentucky natural resources and products:

- ◆ http://www.atasteofkentucky.com/prideofky_products.asp?ID=6343
- ◆ <http://www.louisville.edu/~easchn01/kentucky/1envi.html>
- ◆ <http://www.kyagr.com/buyky/index.htm>

Step 3: Ask students to look back over the list of natural resources used to make the products and list the resources as renewable or nonrenewable. Review the meaning of these two terms, if necessary.

Step 4: Focus students’ attention to the nonrenewable resource list. Ask students what they think might happen to these resources if producers and consumers continue to consume them so quickly. Encourage students to discuss ways to conserve different natural resources.

Step 5: Share the picture book, The Garbage Monster, by Joni Sensal, with students. Encourage students to discuss what they think is happening in the pictures. (The book describes how a girl deals with a garbage monster by recycling him.)

Step 6: Instruct students to draw or paint pictures to show how they can conserve natural resources. Use the pictures to create a bulletin board display.

Homework Assignment

Have students take the list of natural resources generated during the brainstorming session home and discuss with their families the resources they consider most important. Rank the resources from most important to least important. Ask students to bring back the lists made by their families and share the top five with their classmates. Analyze the results with students. NOTE: Explain that each family has different priorities if the top five list of resources vary among students.

Assessment

Ask students to select a favorite natural resource. Write about why it is a favorite. Explain whether it is renewable or nonrenewable. If it is nonrenewable, explain what might be done to conserve it.

Extensions

1. Give students opportunities to explore the web sites listed in this lesson to learn more about Kentucky’s natural resources and products.
2. Invite speakers from local industries to visit and talk about the processes used to manufacture goods from start to finish.
3. Visit a local industry to watch a product as it is made.

Be a Solid Waste Survivor – Take the Community Challenge
Primary

Battling “Thwants” and “Thneeds”

Adapted from “Dr. Seuss and Resource Use”, from Quest for Less, an EPA Publication

Standard

Social Studies: SS-E-3.1.1, Scarcity requires people to make choices about using goods, services, and limited resources.

Activity Description

Students will listen to the book, The Lorax, by Dr. Seuss, then discuss the difference between wants and needs. The discussion will lead students to a better understanding of what it takes to survive and what might happen if natural resources are depleted.

Materials

One copy of the book, The Lorax, by Dr. Seuss

Length of Lesson

Approximately one hour on two different days

Vocabulary Words

Consumption: the amount of any product or resource (e.g., material or energy) used in a given time by a given number of consumers.
Scarcity: limited supply of a resource or product.
Natural Resource: raw material or energy supplied by nature.
Ecosystem: a system made up of a community of living plants and animals. When one part of an ecosystem is disturbed, it affects the entire ecosystem.
Pollution: the contamination of soil, water, or air by discharging or discarding potentially harmful objects or substances.

Essential Question

How do my family and I depend on the resources in our community and our world?

Guiding Questions

What types of resources do I consume?
 What happens when all of the natural resources are consumed?
 What is the difference between a want and a need?

Skills Used

Communication
 Problem Solving
 Listening

Activity

1: If necessary, introduce and discuss the pts of natural resources and product mption with students (refer to the **Teacher Fact s** found at the beginning of this publication). w the vocabulary words for this lesson. Point that as population increases, so does the mption of more and more products and natural rces. All of this is hard on the environment. would be a good time to review the difference en renewable and nonrenewable resources.)

Essential	Necessary	Luxury
Food	Phone	Bike
Clothing	Stove	Pool
Shelter	Car	Toys
Water	Books	Boat
Medicine	Paper	CD’s

Be a Solid Waste Survivor – Take the Community Challenge

Primary

Battling “Thwants” and “Thneeds”, continued

Step 2: This activity can take place either inside the building, or in a quiet spot outside. It is important to create an atmosphere free from distractions before attempting to read this story. Once the students are settled and ready to listen, read the book, The Lorax, by Dr. Seuss. Explain before starting the story that this book, like many of the other Dr. Seuss books, has “pretend” words, but some of the pretend words in this book contain real words.

Step 3: After reading the story, discuss what the Once-ler did to cause problems for the Truffula tree forest and its residents. (Factories were built, the air and water were polluted, animals moved away, all of the Truffula trees were cut down, and the ecosystem was destroyed.) Ask the students why they think the Once-ler’s face is never shown (maybe because the Once-ler is ashamed of what his actions caused in this ecosystem). Discuss why the students think the Once-ler felt the need to use all of the Truffula trees, instead of listening to the Lorax (greed for money, desire to create jobs for his relatives). Ask for suggestions of things the Once-ler could have done instead of destroying all of the Truffula trees (replanted, looked for ways to recycle thneeds, or looked for other products to produce using different resources). This lesson can be controversial so make sure students understand that most people in business and industry are responsible and this is a story to help them understand what can happen when people are not responsible.

Step 5: Ask students to go home and retell The Lorax to their parents. As a family, talk about things they need in order to live a comfortable life.

Day Two

Step 1: Ask students to name the different products they use during the course of a day (e.g., toothbrush, shoes, CDs, bike, clothing, . . .). Make a list of these items on chart paper or the chalkboard.

Step 2: Instruct students to categorize the listed words as “essential for survival”, “necessary for living in today’s society” or a “luxury”.

Step 3: After the new categories have been completed, ask students if they are surprised at the number of products we really need as compared to the number of products that are luxuries (or wants). Remind students that all manmade products require raw materials for production and create “waste” when they are no longer useful.

Assessment

Journal Activity

Say to students:

1. Think of a few of your most important needs.
2. Make a list of at least three of those needs. How can you and your family consume fewer natural resources while still using those needed products?
3. What could happen if people continue to consume more and more resources?

Extensions

1. Have students rewrite a new ending for The Lorax so the Truffula tree forest and all of the animals inhabiting the forest are saved. This writing project can be done individually, or in small groups. (Groups of students may wish to act out their new endings for the rest of the class.)
2. Ask students to think about and explain what the Lorax’s message “UNLESS someone like you cares a whole awful lot, nothing is going to get better. It’s not,” means (answers should include the need for future generations to protect and care for the Earth).
3. Students can draw pictures to illustrate their favorite part of the story, The Lorax.

Be a Solid Waste Survivor – Take the Community Challenge
Primary

What a Waste!

Standard	Practical Living: PL-E-3.1.5 , There are consumer decisions (e.g., reducing, recycling, reusing) that have positive impacts on the environment.
Activity Description	Students will learn the difference between solid waste and litter. They will also begin looking at the amount of waste they and their families make.
Materials	A variety of individually wrapped snacks and packaged foods
Length of Lesson	Approximately one hour
Vocabulary Words	Solid waste: material that has been discarded because it has worn out, is used up, or is no longer needed, such as packaging, newspapers and broken appliances. Litter: waste materials carelessly discarded in an inappropriate place.
Essential Question	My family and I use resources that create solid waste. How does that affect the environment?
Guiding Questions	What is the difference between litter and solid waste? How much solid waste do my family and I make?
Skills Used	Writing Problem Solving Organizing Data Graphing Computation

Activity

Step 1: Show the students a variety of individually wrapped snacks. Ask students if the packaging of the snacks is useful. (They should respond that it keeps the snacks from getting old and dirty.) Explain that cereal boxes, plastic jugs and other materials that things are boxed, or stored, in are used to protect the food. Ask students what happens to the wraps or containers once the food is eaten or becomes old? Explain that once something no longer has any use, it is thrown away and becomes **SOLID WASTE**. Also, explain that improperly discarded solid waste is called **LITTER**.

Dinner Containers

Soup – metal can with label
Hamburger – plastic tray and clear plastic wrap
Ketchup – plastic bottle, lid, paper label
Apple sauce – glass jar, metal top, paper label
Carrots – plastic bag
Ice cream – plastic or cardboard container
Milk – plastic jug with lid or waxed cardboard carton

Be a Solid Waste Survivor – Take the Community Challenge Primary

What a Waste! *continued*

Step 2: Ask students to list everything they ate at home for dinner on the previous night, or the last night they ate at home. Stress that they need to be as accurate as possible, including “extras” like ketchup, butter, or salt.

Step 3: While students are listing their food items, the teacher should make a list of food items on the chalkboard, or overhead projector similar to the information shared in the box labeled “Dinner Containers” on the previous page. Share this list with the students and explain that each student will write beside the food items they ate at home the materials used to make the containers each food item was in when purchased at the store. Some students may need to see visual examples of some food containers. Others may need to hear several examples, similar to those listed by the teacher.

Step 4: Once the students finish listing the materials used to make the food containers, ask each student to count the total number of containers used in his or her household on the previous evening. Add the total number of containers used by the entire class. Multiply this number by 365 to obtain a rough estimate of the total number of containers used in one year. Ask students to estimate how much of the classroom would be filled with that many containers.

Step 5: Remind students that toys, shoes, furniture, and many other things we purchase also come in packaging of some sort. Ask students to think about the amount of solid waste created by those types of items.

Step 6: Share with students that on the average, each person in the United States throws away over four pounds of solid waste each day. Help students multiply four pounds by the number of people in their family to obtain an estimate of the amount of waste produced by each family each day. Then multiply that number by 365 days to obtain the amount of waste thrown away each year. Add the yearly total for each student to obtain the approximate poundage of waste produced each year by families represented by the entire class. **WHAT A WASTE!**

Assessment

1. Ask students to make posters to show others the difference between littering and disposing of solid waste in an appropriate manner.
2. Hang finished posters around the building and community after they are completed.

Extensions

1. Take students on a “litter” walk around the school property to pick up litter. Stress with the students to use precaution and ask an adult to help if they find broken glass or sharp objects.
2. Ask students to begin thinking of ways to reduce the amount of solid waste thrown away both at home and at school.
3. Ask students to calculate how many days it would take them to accumulate solid waste equal to their weight if they used a rate of four pounds per day.

Be a Solid Waste Survivor – Take the Community Challenge
Primary

Learning About the 4 R's

Standard	Practical Living: PL-E-3.1.5 , There are consumer decisions (e.g., reducing, recycling, reusing) that have positive impacts on the environment.
Activity Description	Students will begin to learn how to REDUCE, REUSE, RECYCLE and RESPOND in a positive way to how they handle solid waste.
Materials	A large box labeled “Classroom Trash Collection Box” A large tarp or old sheet to lay week-old trash on for sorting Four smaller boxes labeled “Paper”, “Glass”, “Plastic”, “Metal”
Length of Lesson	Approximately one hour on the fifth day of the activity
Vocabulary Words	Reduce: to decrease the amount of waste, either by using wiser purchasing habits or by reusing or recycling more items. Reuse: a type of SOURCE REDUCTION activity involving the use of a product or container for the same purpose or a different purpose. Recycle: to collect, sort, process, and convert materials that would have been thrown away into raw materials used to make the same or new products. Respond: in this context, the act of reconsidering waste-producing activities and expressing preferences for less waste. Municipal Solid Waste (MSW): waste collected from homes, institutions (e.g., schools or hospitals), commercial establishments (e.g., businesses and restaurants), and some industries, and taken to sanitary landfills. Also known as garbage, trash, refuse or debris.
Essential Question	My family and I use resources that create solid waste. How does that affect the environment?
Guiding Questions	What choices do my family and I have about how we reduce, reuse, recycle and respond to solid waste? What are the best ways to dispose of our solid waste? (e.g. most cost effective, safest, and healthiest)
Skills Used	Categorizing Problem Solving

Activity

Step 1: Introduce this lesson by telling students that, as a class, everybody will be throwing all **DRY** trash into the large box marked “Classroom Trash Collection Box” for an entire school week. Emphasize that all **WET** trash, or uneaten food, should be thrown into the regular trashcan. Explain that students need to rinse all bottles and cans.

Recyclable Materials

- ◆ Aluminum and steel cans
- ◆ Cardboard
- ◆ Newspapers and magazines
- ◆ Glass jars or bottles
- ◆ Plastic containers
- ◆ Other materials recycled in your community

Be a Solid Waste Survivor – Take the Community Challenge Primary

Learning About the 4 R's, *continued*

Day 7

Step 1: In one week, spread a tarp or sheet on the floor. Dump the box of trash collected in the “Classroom Trash Collection Box” onto the large tarp or sheet.

Step 2: Ask students to gather around the trash so they can help count the pieces of trash that were thrown away during the previous week.

Step 3: After the pieces of trash have been counted, and the number has been recorded, explain that there is an easy way to **reduce** (decrease) the amount of trash that was placed in the collection box. Show students the four boxes marked “Paper”, “Glass”, “Plastic”, and “Metals”. Tell students to take a good look, once again, at the trash. As each piece of trash is held up, ask students if the trash might be placed in one of the four smaller boxes, or if it can be **reused** in the classroom or at home. Any trash not fitting into one of these categories should be put back in the collection box.

Step 4: After all of the trash has been resorted, count the pieces remaining in the “Classroom Trash Collection Box”. Compare the previous number of pieces of trash with the number after the items are sorted. Ask students if the number has decreased significantly. Explain.

Step 5: Divide the students into cooperative working groups and have each group come up with at least five ways to reduce the amount of waste that goes into the “Classroom Trash Collection Box”. Discuss the different ideas with the entire class. (Emphasize **reducing and reusing** by suggesting such things as using plastic containers rather than plastic wrap in lunch boxes, using lunch boxes instead of lunch bags, bringing juice in a thermos instead of purchasing juice boxes, etc.)

Reading and Writing Connection

Read the book, **Recycle!** by Gail Gibbons to students. Then give students the following directions for a writing assignment:

Write about what you might be able to do differently at home that will help reduce the amount of trash you and your family collect each week for the garbage truck to take to the landfill.

Step 6: Ask students for suggestions of what to do with the sorted trash items. If the school has a recycling program in place, explain to students that this sorted classroom trash can be recycled along with other items in the building. Show students where the recycling containers are located in the building so they will begin using the containers for personal trash, when needed. If there is not an active recycling program within the school, but there is one in the community, tell students that the sorted trash items will be taken to the community's recycling center.

Step 7: Explain to students that the items being taken to the recycling center need to be sorted because the different categories of recyclable waste will be compacted at the local recycling center. Then the compacted waste will be sent to industries where the materials can be reprocessed and turned back into raw materials that can be used to make new products. Explain that by reusing and recycling waste, students and industry are saving natural resources, reducing the amount of waste being buried at sanitary landfills, and saving on energy and material costs to produce the recycled goods, or products.

Be a Solid Waste Survivor – Take the Community Challenge Primary

Learning About the 4 R's, *continued*

Step 8: Leave the four small boxes labeled “Paper”, “Glass”, “Plastic”, and “Metals” sitting in the room, but do not make it a point to encourage students to use the box to recycle any of their solid waste. Model for the students by throwing recyclable items in the appropriate boxes throughout the week.

Day 14

Step 1: Wait one more week and gather students to count the pieces of trash in the “Classroom Trash Collection Box” a second time. Compare the number of pieces of trash with the amount counted previous week. Hopefully, there will be a drastic reduction in the amount of trash thrown in the collection box. Discuss the progress made with class members. Ask students what caused the reduction of solid waste generated by classmates. Call on individual students to explain what they personally did to help reduce the amount of waste entering the municipal solid waste system. List the different strategies used to reduce waste on the chalkboard or a classroom chart.

Step 2: Continue classroom recycling throughout the school year. Also, encourage students to reuse as much of the recycled trash as possible by doing such things as using both sides of paper or keeping colored paper scraps and any other appropriate items for classroom art projects.

Assessment

1. Ask students to name some examples of recyclable items.
2. Have students explain why it is important to sort recyclable items.
3. Ask students to explain another way to reduce the amount of solid waste entering the municipal solid waste stream.

Extensions

1. Invite the local solid waste coordinator to visit the classroom and talk about how recycling is handled in the community.
2. Ask students to graph or chart the results of the trash disposal project.
3. Encourage students to share information learned at school about **reducing, reusing, recycling and responding** with family members.
4. With the help of students, write a classroom recycling pledge, possibly something like this:
“**I will respond to the solid waste problem by reducing, reusing and recycling my trash every day.**”
Post the pledge in the classroom and recite it with students every morning.

Be a Solid Waste Survivor – Take the Community Challenge
Primary

Handmade Recycled Seed Cards

Adapted from “Handmade Recycled Paper Planters”, from Quest for Less, an EPA Publication

Standard

Practical Living: PL-E-3.1.5, There are consumer decisions (e.g., reducing, recycling, and reusing) that have positive impacts on the environment.

Activity Description

Students will learn to reuse newspapers by making recycled paper greeting cards containing wildflower seeds.

Materials

Large stack of newspapers	Egg Beaters
Scissors	Wildflower seeds
Three to five 2-gallon buckets	Old, but clean, pantyhose
Water	Old wire hangers
Hand lenses	Food coloring (optional)

Length of Lesson

Approximately two to three hours spread out over three days

Vocabulary Words

Recycle: to collect, sort, process, and convert materials that would have been thrown away into raw materials used to make the same or new products.

Fibers: long, thick-walled cells that give strength and support to plant tissue. Wood and cloth fibers are used to make paper.

Pulp: a mixture of fibrous material such as wood, rags, and paper, ground up and moistened to be used in making paper products.

Virgin Materials: raw materials that have not yet been used

Essential Question

My family and I use resources that create solid waste. How does that affect the environment?

Guiding Question

What choices do my family and I have about how we **reduce, reuse, recycle** and **respond** to changing our habits on how to deal with solid waste?

Skills Used

Motor Skills
Listening and Following Directions

Activity

Step 1: Introduce the concepts of recycling and decomposition to students. Explain that making items from recyclable materials, rather than virgin materials benefits the environment by saving natural resources. (Refer to the **Teacher Fact Sheets** found at the beginning of this publication.)

Step 2: Discuss with students how paper is made. Explain that most paper is made from only trees, while other paper is made from a combination of trees and

old newspaper or used office paper. A small amount of paper is even made from cotton, papyrus or rags. Discuss how using recycled paper helps conserve our forests. Help students explore the environmental implications of this.

Step 3: Set out newspapers and have each student cut up two full pages of newspaper into _ to 1-inch square pieces. Demonstrate for students.

Be a Solid Waste Survivor – Take the Community Challenge Primary

Handmade Recycled Seed Cards- *continued*

Step 4: Ask a few student volunteers to fill the buckets 1/3 full with paper and the remaining 2/3 with water (1 part paper to two parts water). Let this mixture sit overnight. By the next day, the newspaper fibers will be soft and ready to pulp (break down fibers).

Step 5: Give each student a wire hanger and one leg of an old pantyhose. Ask the students to reshape the hanger into the shape of a circle. Once this is done, ask them to stretch the pantyhose over the circular part of the hanger. Secure the pantyhose by tying with string. This “pantyhose screen” will be used on the next day to hold the paper pulp as it dries.

Day 2

Step 1: On the second day, have students take turns pulping the fibers with the hand beater until the paper and water look like mush. Explain that the pulping process breaks down the fibers into a form that can be bonded together again to make recycled paper. Have students look at the pulp with a hand lens to see the loose wood fibers. (A small amount of food coloring added to the pulp will give it color, if desired. This is also the time to add wildflower seeds.)

Step 6: Give each student a “pantyhose screen” made on the previous day. Instruct each student to scoop out about one cup of the pulp and spread it out onto the screen, in a rectangular shape, as thin as possible without leaving holes. Using a rolling pin on top of a stack of newspapers helps flatten the paper.

Step 7: Let the pulp dry completely over the next two days. While the drying is taking place, students can be composing the verse for the cards they will be making.

Day 3

Step 1: Pull the dried, recycled paper from the screens. Use scissors to cut the paper into the desired shape for the greeting card. Give students time to finish writing the composed verse on the greeting card. Include directions for planting the cards before sending them home with students.

Step 2: Before sending the completed cards home with the students, discuss how the card will decompose in the soil and the seeds will germinate and grow.

Assessment

Ask students to explain, in writing, how making new paper from old newspapers benefits the environment. Encourage students to include different things in the environment that are affected in a positive way when recycling takes place.

Extensions

1. Read the book, *From Tree to Paper*, by Wendy Davis.
2. Help students diagram and label all of the steps that occur in making paper from recycled materials, versus making paper from only virgin materials.
3. Encourage students to discuss what else they can do to reduce the number of trees being cut down to make paper.
4. Visit the following web site (<http://www/kinderart.com/seasons>) for art project ideas that encourage the reuse of plastic milk jugs.

Writing Connection

Ask students to write a story about the journey of the wildflower seeds from their first days on the card to when they take roots in the ground outside. Remind students that they can write the story as a nonfiction feature article, or as a fictitious literary story.

Be a Solid Waste Survivor – Take the Community Challenge
Primary

Luscious Layered Landfills

Adapted from Quest for Less, an EPA Publication

Standard

Practical Living: PL-E-3.3.2, To protect all citizens, there are community guidelines (e.g. school inspections, trash collection, water treatment, waste treatment, animal control, immunization) that promote healthy living environments in the community.

Activity Description

Students will learn about the different layers of landfills and their functions by constructing an edible model.

Materials

One 8-ounce pliable clear plastic cup per student
Five chocolate sandwich cookies per student
One 8-ounce box of raisins per student
One fruit rollup per student
Two graham crackers per student
Two red licorice sticks per student
One package of birthday candles
One pack of matches
One scoop of chocolate ice cream (or pudding) per student
Two tablespoons of whipped cream per student
One plastic knife per student
One plastic fork per student
One handful (per student) of a variety of small chewable candies
One copy of “Anatomy of a Landfill” handout per student

Length of Lesson

Approximately one hour

Vocabulary Words

Sanitary landfill: a specially engineered site for disposing of solid waste on land, constructed so that it will reduce hazard to public health and safety.
Clay Liner: absorbs any leachate (or liquid) that escapes the plastic liner of a landfill.
Plastic liner: prevents leachate from escaping into the ground.
Leachate: natural byproduct of decomposing garbage.
Leachate collection pipes: used in landfills to collect leachate.
Methane: a colorless, odorless, flammable, gaseous hydrocarbon that is a product of the anaerobic decomposition of organic matter; can be burned as a fuel.
Decompose: the process by which a substance is broken down into its basic elements.

Essential Question

My family and I use resources that create solid waste. How does that affect the environment?

Guiding Questions

What are the best ways to dispose of our solid waste?
What is a sanitary landfill?

Skills Used

Observation and Classification
Motor Skills
Listening and Communication

Be a Solid Waste Survivor – Take the Community Challenge
Primary

Luscious Layered Landfills, *continued*

Activity

Check for food allergies before teaching this lesson!

Step 1: Refer to the **Teacher Fact Sheets** found at the beginning of this publication for background information on landfills. Explain the purpose of a landfill to students and explain that they will construct their own model landfills in class. Copy and distribute the “Anatomy of a Landfill” handout for each student. Using the handout, go over each layer’s name and function with students.

Step 2: Distribute a cup and five chocolate sandwich cookies to each student. Explain that the cup represents an excavated hole in the ground.

Step 3: Have students carefully “unscrew” two of their cookies so that one half has white cream and the other is bare. Students should have two cookie halves with white cream and two cookie halves without cream. Crush the bare cookie halves into small pieces and put them into the cup. Explain that the crushed cookies represent a layer of soil that is placed in the bottom of real landfills.

Step 4: Next, have students take the cookie halves with white cream and break them up into two or three pieces. Direct students to place the pieces in the cup with the white cream face up. These pieces represent a layer of clay that is put on top of the soil in real landfills.

Step 5: Have students use the plastic knife to cut their fruit rollups to roughly fit the size of the top of the cup. Slide the rollup into place (will push up on sides) on top of the cookies to represent a plastic liner. Plastic liners prevent leachate from escaping from a landfill into the ground. Leachate is liquid created when trash decomposes (decays).

Step 6: Have students crush and add their graham crackers to represent a sand layer. This layer is used to prevent liquids in landfills from seeping out into the water table.

Journal Activity

Ask students to list some common items they throw away. What types of items do they think pioneers threw away 200 years ago? Ask students to predict what types of items will be thrown away in the future.

Step 7: Next, have students place raisins on top to represent a layer of pebbles. Like the sand layer, pebbles provide further protection against leachate leaks.

Step 8: Have students rip the licorice sticks in half and bite, or cut, off both ends to represent leachate pipes. Stick “pipes” into the pebble layer. These pipes collect any leachate that collects on top of the liners.

Step 9: Ask students to sprinkle the candies on top of the raisins. The candies represent pieces of garbage. Ask students to think about what happens when a landfill or “cup” is filled up with trash or “candies”. How can they reduce the amount of trash that is sent to the landfill? (Refer to **Teacher Fact Sheet** located at the beginning of this publication for more information on recycling, if needed.)

Step 10: Give each student a scoop of ice cream on top of the candies. Then, have students add one more layer of candies on top of the ice cream. The ice cream layer represents the seepage created from rain seeping through the garbage. Explain that in a real landfill, more layers of garbage or “candies” are placed on the landfill each day, so that liquid from the decomposition of the trash is continually created.

Be a Solid Waste Survivor – Take the Community Challenge Primary

Luscious Layered Landfills, *continued*

Step 11: Direct students to “unscrew” their two remaining cookies and crush another layer of the bare cookie halves, without the cream, on top of the candies and ice cream to represent soil again. (Students can eat the other cream-covered cookie halves.) This layer reduces the amount of rainwater that reaches the garbage.

Step 12: Each student should use a layer of whipped cream to “cap” the landfill or cover it. Explain that a plastic cap is used on real landfills to prevent odor, insect and rodent problems.

Step 13: In front of the class, stick a candle deep into your own edible “landfill” and light it. Explain that the candle represents the methane gas recovery system, which draws methane gas from the decomposing garbage. The flame represents energy that can be generated by burning the captured methane gas.

Step 14: Have students eat their landfills as a snack. When they get to the bottom of the cup, ask students to notice whether their cookie or “soil” layer is dry, or whether the ice cream or “leachate” leaked past the many layers and the fruit roll-up liner to soak the cookies. Remind students that if they built their landfill correctly, the cookies will be dry. In a real landfill, the soil remains protected from leachate.

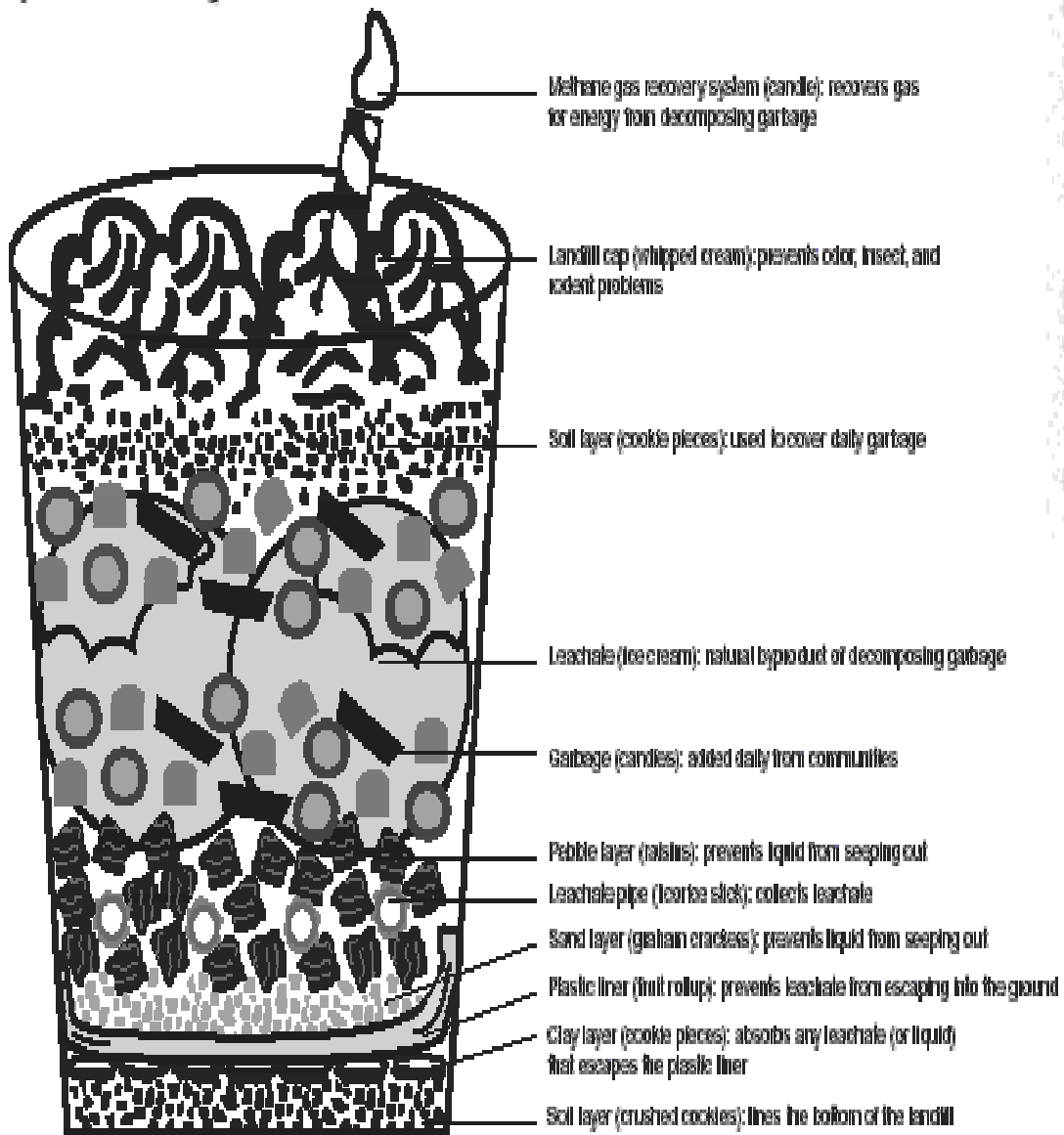
Assessment

1. Ask students to explain, either verbally or in writing, why landfills are important to our environment.
2. As a review, ask students to include ways people can reduce the amount of trash sent to landfills.

Extensions

1. Before enjoying the luscious layered landfill as a snack, team students up in pairs to review the purpose of all of the different layers in landfills. (Remind them that they may use the handout for reference, if needed.)
2. Have students conduct a survey of friends and family asking them where their garbage goes. Have them record peoples’ responses and determine whether they are well informed. In class, discuss the survey results.
3. Contact the local Solid Waste Coordinator for videos or materials to share with students about local solid waste management.
4. Visit the following web site to see pictures of a California landfill from the 1920’s up to the present:
[“http://www.lalc.k12.ca.us/uclasp/ISSUES/landfills/landfills.html”](http://www.lalc.k12.ca.us/uclasp/ISSUES/landfills/landfills.html)

Anatomy of a Landfill



Be a Solid Waste Survivor – Take the Community Challenge
Primary

Once Upon a Landfill

Standard

Practical Living: PL-E-3.3.2, To protect all citizens, there are community guidelines (e.g. school inspections, trash collection, water treatment, waste treatment, animal control, immunization) that promote healthy living environments in the community.

Activity Description

Students will investigate how landfills looked long ago by interviewing older people about how they handled solid waste.

Materials

A list of interview questions (to be developed in class)
Note to Parents

Length of Lesson

Approximately 30 minutes on first day and one hour another day

Vocabulary Words

Sanitary Landfill: a specially engineered site for disposing of solid waste on land, constructed so that it will reduce hazard to public health and safety.
Dump: a site where waste is disposed of in an unmanaged, uncovered area.
Municipal Solid Waste Stream: waste collected in a community from homes, small institutions, businesses and industry for disposal in a local sanitary landfill.

Essential Question

My family and I use resources that create solid waste. How does that affect the environment?

Guiding Question

What are the best ways to dispose of our solid waste? (E.g. most cost effective, safest, healthiest)

Skills Used

Communication
Writing

Activity

Step 1: Before starting this lesson, find the following web site and bookmark it to share the photos with students:

<http://www.lalc.k12.ca.us/uclasp/ISSUES/landfills/landfills.html> (Click onto “Lopez Canyon Landfill Virtual Field Trip” to view sanitary landfill photos.) This site also contains some pictures of older landfills to share later in this lesson, after the interviews have taken place.

Step 2: Ask students what happens to solid waste once they put it in garbage cans. Help students understand that once trash is thrown into a garbage can, and picked up by a garbage truck, it enters the municipal solid waste stream (MSW) and has to be taken to a sanitary landfill. Also explain that there are federal and state laws so the solid waste coordinator of the landfill knows exactly how the landfill has to be managed to keep it from becoming a health hazard.

Interview Questions

1. When were you born?
2. When you were little, what types of trash did you and your family have?
3. Did garbage trucks come to your house to pick up your trash when you were little?
4. Where did you put your trash?
5. Were there any sanitary landfills like we have today when you were little?
6. Has the type and amount of waste, or trash, changed since you were little? How?

Be a Solid Waste Survivor – Take the Community Challenge

Primary

Once Upon a Landfill, *continued*

Step 3: Explain to students that in order to learn more about how landfills looked many years ago, each student will be interviewing an older person (either a family member or another elderly person in the community). So each student collects the same type of information, explain that everybody will be using the same set of interview questions.

Step 4: Ask students to think about what information they would like to learn about landfills from long ago. Brainstorm to develop a list of questions, similar to those on the previous page.

Step 5: Explain that students need to ask their parents for advice on whom to interview. (Suggest grandparents, neighbors, or friends of the family.) Tell students that the older the person they interview, the more interesting the answers from the interview will probably be.

Step 6: Type the interview questions, leaving room for students to write the answers directly under each question. Make enough copies so each student has one to take home.

Step 7: Set a reasonable deadline for students to return the completed assignment. Send the interview questions and a note explaining the assignment to parents home with each student.

Step 8: After all students have completed and returned the homework assignment, gather all students to discuss the results. Explain the difference between the terms “sanitary landfill” and “dump”. Show pictures of the two, if available.

Step 9: Create a “landfill timeline” so students can see how trash accumulation and disposal has changed over the years. Leave room on the timeline for students to add their own illustrations and information about how they think landfills might look in the future. Ask students what they think might happen to the landfills we have right now.

Assessment

1. Ask students to write a comparison of how trash disposal has changed in the past 50 – 100 years in the United States.
2. Encourage students to include in their comparison paper which type of trash disposal they think is best for the environment. Why?

Note to Parents

We have been studying about how important it is to dispose of our solid waste appropriately in sanitary landfills. We are also interested in learning about how people who were born at least fifty years ago, or longer, disposed of their trash.

As a class, we came up with a list of questions to ask an elderly relative or friend. We would appreciate your help in assisting your child in contacting an acquaintance to interview. We hope this assignment will help our students better understand some of the changes that have taken place in our country during the last century.

If possible, we would like your child to complete the interview and return the answers to the questions by _____.

Thank you so much for helping your child complete this homework assignment!

Extensions

1. Share analyzed data that has been collected with other students in school in an effort to educate others about changes in our society and proper trash disposal.
2. Publish results of survey and share with parents through the classroom or PTA newsletter.
3. Debate the question: “Is change good or bad?”

Be a Solid Waste Survivor – Take the Community Challenge
Primary

Garbage / Trash / Waste

Standard

Science:SC-E-2.1.2, Earth materials provide many of the resources humans use. The varied materials have different physical and chemical properties, which make them useful in different ways. For example, as building materials (e.g. stone, clay, and marble), as sources of fuel (e.g. petroleum and natural gas), or growing the plants we use as food.

Activity Description

Students will make a list of synonyms for solid waste, make a Venn diagram to compare the synonyms and discuss organic and inorganic kinds of waste.

Materials

- Chart paper
- Markers
- Dictionary
- Thesaurus

Length of Lesson

Approximately one hour

Vocabulary Words

Organic Waste: waste composed of living or once-living matter; (e.g. leaves) more broadly, composed of chemical compounds principally based on the element carbon.
Inorganic Waste: waste not composed of once-living material (e.g. minerals); generally, composed of chemical compounds not principally based on the element carbon.
Synonyms: words with similar, or the same, meanings.

Essential Question

How can I affect the way my family, school, and community use resources and properly dispose of solid waste?

Guiding Questions

- What is organic waste?
- What is inorganic waste?

Skills Used

- Communication
- Writing

Activity

Step 1: Explain to students that there are many words in the English language that mean the same thing, or almost the same thing. We call these words synonyms. Tell the students that they will be brainstorming to think of synonyms for the word “waste”, but that they need to understand there are two different types of waste: organic and inorganic. Explain the difference, giving examples, if necessary. Then ask for synonyms. (Use the thesaurus if students have trouble.)

Trash Synonyms

Garbage	Refuse
Debris	Junk
Clippings	Rubbish
Droppings	Waste
Sweepings	Litter

Be a Solid Waste Survivor – Take the Community Challenge

Primary

Garbage / Trash / Waste, continued

Step 2: Write the synonyms on a piece of chart paper, or on the chalkboard. Ask students to use the synonyms in sentences, in order to check for comprehension.

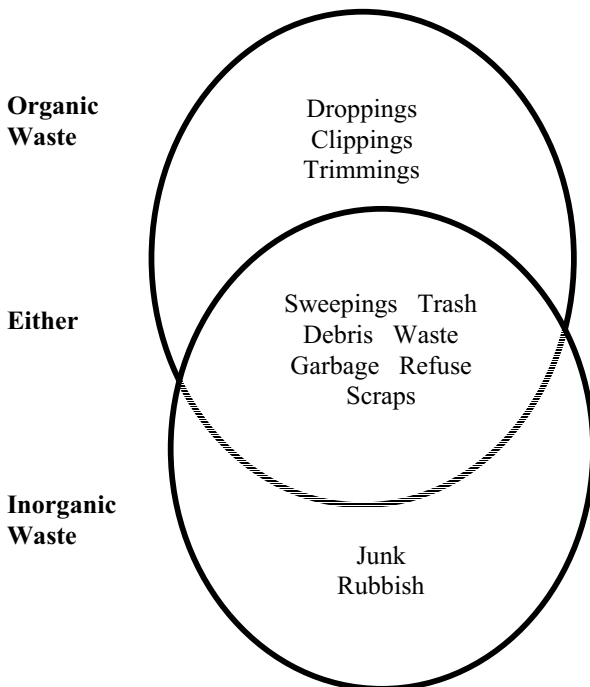
Step 3: Explain to students that a Venn diagram is a type of graph that shows a comparison between two or more things. Explain that, as a class, they will construct a Venn diagram that will show which synonyms for waste usually refer to “organic waste”, and which synonyms usually refer to “inorganic waste”. Explain the difference between the two terms. Draw the Venn diagram on chart paper or the chalkboard.

Step 4: Call on students, again, to use each synonym in a sentence. After each sentence, ask students to decide whether the word is talking about organic or inorganic waste. Place the synonym appropriately inside the diagram. Have a dictionary for reference if there is a disagreement about where to place the word.

Assessment

1. Prepare a list of ten different types of waste (e.g. grass clippings, old refrigerator, paper, food scraps, plastic wrap).
2. Ask students to number a paper one through ten.
3. Explain to students that as a word from the list is read, each student should write “I” for inorganic waste or “O” for organic waste next to the corresponding number on their paper.
4. Check the work together in class so students who do not yet understand the concepts will get another chance for review.

Waste Venn Diagram



1. Ask students to write down everything they threw away in the lunchroom. Label each waste item as organic or inorganic.
2. Sit in a circle and point to a student. The student should be ready to call out the name of an item. Explain that the remaining students will stick their thumb up in front of them if the item is “organic”. Instruct students to put their thumb down in front of them if the item is “inorganic”.

Be a Solid Waste Survivor – Take the Community Challenge
Primary

Potato Traps

Standard

Science: SC-E-3.3.3, All organisms, including humans, cause changes in the environment where they live. Some of these changes are detrimental to the organism or to other organisms, other changes are beneficial (e.g. dams built by beavers benefit some aquatic organisms but are detrimental to others).

Activity Description

Students will make “potato traps” and learn how insects aid in the decomposition process. They will also learn the importance of composting, both naturally in nature and at home.

Materials

Large uncooked potato
Two rubber bands and hand trowels for each student
Metal knife for teacher and plastic knives for students
Spoon for each student
Straw, tape and paper to make a “flag”
Science journals, pencils and **Compost Critters**, by Bianca Lavies
Clear plastic container and hand lens for each student

Length of Lesson

Thirty minutes to one hour on at least three different days

Vocabulary Words

Organic: from a living or once-living organism (e.g. plant, animal, person or bacteria).
Inorganic: not composed of once-living material (e.g. rocks or minerals).
Decompose: to decay or rot.
Millipede: Insect that helps decompose organic materials.
Fungi: a major group of organisms that absorb their nutrients from dead or living organisms. Mushrooms, yeast, toadstools, rusts, molds, and mildews are all fungi.

Essential Question

How can I affect the way my family, school, and community use resources and properly dispose of solid waste?

Guiding Questions

How do insects help speed up the decomposition process?
Why should my family and I compost?

Skills Used

Communication/Observation
Motor Skills
Data Collection and Analysis

Activity

Step 1: Explain to students that in this activity they will be building a potato trap that will be placed outside. The purpose of the trap is to capture insects that help organic materials decompose naturally in the outdoor environment. This type of decomposition is nature’s way of recycling, because the rich soil-like product contains organisms that are good for the soil.

Discuss with students the plants and animals, such as snails, slugs, beetles, millipedes, earthworms, fungi, pill bugs, mushrooms and lichen that perform nature’s recycling work. (Read the book, **Compost Critters**, by Bianca Lavies, and refer to **Teacher Fact Sheets** for information on composting.)

Be a Solid Waste Survivor – Take the Community Challenge Primary

Potato Traps, *continued*

Step 2: Give each student a potato that has been cut in half lengthwise, by an adult. Also, give each student a spoon. Instruct students to use the spoon to scoop out most of the inner portion of the potato. Show an example.

Step 3: Next, instruct students to rubber band the two halves of the potato back together, then use a plastic knife to cut a hole about the size of a dime in each end of the potato. This gives insects an entrance into the potato.

Step 4: Instruct students to take a straw, small piece of paper and tape. Tell students to write their name on the piece of paper. Tape the piece of paper to the top of the straw. Students will use the flag to mark the location of their potato trap.

Step 5: Take the students outside with their potato traps, flags and hand trowels. Show students areas of the school property where their potato traps should remain undisturbed.

Step 6: Have each student use a trowel to scoop up a small amount of soil. (This area should be deep enough so the potato trap door is level with the surface of the ground.)

Step 7: Tell students to place the potato trap into the shallow hole. Poke the straw through the potato and into the soil to hold the potato in place, and to mark each student's potato trap.

Step 8: Check the potato traps every two days to record the kinds and numbers of critters in the traps. Have students record the changes taking place both inside and outside the potato traps. When checking the potato traps, have each student take along a hand lens, science journal, pencil and a clear plastic container. The containers make it easier for students to observe and count the critters before releasing them to their natural environment. It would be a great resource tool to have an animal encyclopedia on hand, or a copy of the book, **Compost Critters**, so students can locate their critters and record the names accurately in their journals. (Students may need rubber gloves to wear as they check on the decomposing potato traps.)

Step 9: Once back in the classroom, ask students to share what they found in the potato traps. Give students ideas of how they might organize their data so it will be easier to manage each day. Check to see if students understand that as decomposition takes place, the resulting compost material will be reused in the soil.

Step 10: Discuss why it is so important that nature recycle its dead plants and animals. Relate this back to why it is so important for people to recycle, also. Explain that we can compost yard clippings and some food scraps in compost bins rather than putting these items in garbage bags to be sent to landfills. This is one type of "source reduction", or decrease of solid waste being sent into the municipal solid waste stream. The resulting material is also very good to use in landscaping at home.

Assessment

Pose the following question to your students:

We have been learning about animals and other organisms in nature that help decompose organic materials. What do you think will be left of your potato trap once the decomposition process has been completed? Why? (Answer: rubber bands, straw and tape because it takes them much, much longer to decompose, if they ever do.)

Extensions

1. Start a school-composting project.
2. Take a nature walk and look for signs of natural composting.
3. Study nature's recyclers in the winter by collecting some leaf litter, bringing it inside, and warming it with a lamp. Dormant recyclers, such as millipedes, ants, spiders and worms will come to life under the heat.

Be a Solid Waste Survivor – Take the Community Challenge
Primary

Button Brigade

Standard

Social Studies: SS-E-1.3.3, In order for a democratic form of government to function, citizens must plan an active and responsible role (e.g. participating in the election process, obeying the law).

Activity Description

Students will create a plan to organize the classes at school to do a school-based service-learning project that will help promote proper waste disposal.

Materials

A badge making tool (if one is available) and appropriate supplies
Student designed “Button Brigade” laminated badges, if badge making tool is not available or is too expensive to use
Chart paper and markers (or chalkboard)

Length of Lesson

Approximately one hour on two to three different days

Essential Question

How can I affect the way my family, school, and community use resources and properly dispose of solid waste?

Guiding Question

Can one person, or a small group of people, really make a difference in changing recycling attitudes in our community?

Skills Used

Communication
Organization
Problem Solving

Activity

Step 1: Ask students to share some of the things they have learned during the “Solid Waste Survivor” unit. Chart the volunteered information. (If necessary, drop hints to help students remember some of the lessons and concepts taught.)

Step 2: Ask students the guiding question: “Can one person, or a small group of people, really make a difference in changing recycling attitudes in our community?” Debate this within the class.

Step 3: Ask students to brainstorm about things they can do to help promote proper waste disposal at school. List the different ideas on chart paper or a chalkboard. Visit the following Environmental Protection Agency Internet site for other service-learning project ideas:

<http://www.epa.gov/epaoswer/general/educate/svclearn.htm>

Possible Ideas for Our School-Based Service-Learning Project

1. Biweekly or monthly trash pick-up on school property
2. School recycling program
3. Write and perform infomercials to present regularly at assemblies or on news programs at school.
4. Talk to friends in different classes about the importance of reducing, reusing, recycling and responding to the solid waste problem by creating less waste.
5. Develop a school compost pile and either sell or give away the compost to local farmers or gardeners, or use at school.

Be a Solid Waste Survivor – Take the Community Challenge Primary

Button Brigade, *continued*

Step 4: After listing the ideas for service-learning projects, look back over each project, one at a time. Discuss pros and cons of each idea with students. Make sure the project you and your students decide to undertake is one that is feasible, will meet with success, and will make a difference at your school. Try to choose a project that can eventually involve all students attending your school in a meaningful way.

Step 5: With students' help, write a specific action plan on how the service-learning project will be implemented, and who will be involved in overseeing the project. Check with the school principal to make sure the selected service project meets with his or her approval. The plan may need to be taken before the Site Based Council of the school to receive consensus from this group before proceeding any further.

Step 6: Once the project has been approved, explain to students that they will need to design a nametag for students who are actively involved in the service project, to wear when working on the project. These nametags should be durable so they can be passed from class to class. The nametags should be simple, but should identify the group wearing them as "Planet Survivors", "Recycling Rangers", or some similar "Environmental Hero". Give students a few days to come up with a nametag design, so they are not rushed and will have time to think about a catchy phrase or school logo.

Step 7: Once the badge designs have been submitted, select judges to decide on the winning design.

Step 8: If the school owns a badge making kit, durable badges can be easily made, sporting the winning design. If not, the design can be copied onto tag board or colored construction paper, then cut out and laminated. Punch two holes at the top of the nametag. Then string yarn through the holes so the nametag can be worn around the neck, or pin with a large safety pin. A minimum of 30 badges should be made, so there will be an adequate supply to pass from class to class.

Step 9: Present, in detail, the service-learning plan at a faculty meeting. Explain that in order for the project to be totally successful, it should involve every teacher and student. Explain the commitment level needed from teachers. (Since the service project has already been planned and organized by the students in your class, it should not be too time consuming for other teachers.) Ask for a show of hands from teachers who are willing to volunteer themselves and their students to help implement the project. Write down names so you and your students can schedule the other classes into the school year, as needed.

Assessment

The assessment for this lesson should include an evaluation by students and teachers as to the effectiveness of the implemented service-learning plan. This should take place periodically and should be ongoing so that the project remains a primary focus for everyone involved.

Extensions

1. Involve parents in the service-learning project as volunteers to help get the project started and to help maintain it (along with students), so it becomes a total school and community project.
2. If the service-learning project is a success, contact The Environmental Protection Agency on the Internet at "<http://www.epa.gov/osw/>" to let them know about your project.
3. Contact local newspapers and television stations and invite them to visit the school and interview students involved in the service-learning project.

Be a Solid Waste Survivor – Take the Community Challenge
Primary

Planning for Our Future

Standard	Social Studies: SS-E-1.3.3 , In order for a democratic form of government to function, citizens must plan an active and responsible role (e.g. participating in the election process, obeying the law).
Activity Description	Students will develop a family solid waste action plan to take home and present to their parents and other family members.
Materials	Paper, pencil and crayons or markers Local recycling center recycling guidelines (if available) Overhead projector and overhead markers (for day 2) Transparency of community map (for day 2) Copy of community map for each student (for day 2)
Length of Lesson	Approximately one hour on first day and 30 minutes the next day
Essential Question	How can I affect the way my family, school, and community use resources and properly dispose of solid waste?
Guiding Question	What can I do to encourage family members to <u>reduce, reuse, recycle, and respond</u> to solid waste disposal problems?
Skills Used	Communication Writing and Drawing Problem Solving

Activity

Step 1: Remind students that they have been working hard throughout this unit to learn about things they can do to help keep the Earth healthy for future generations. Tell students that it is now up to each one of them to spread the word about the “**Four R’s**” (**REDUCING, REUSING, RECYCLING, and RESPONDING**). Explain that in this lesson students will think about, and write, a family solid waste action plan. The plan will include ways family members will implement the “**Four R’s**” at home.

Step 2: Remind students that each of their families are probably **reducing, reusing, and recycling** solid waste in different ways at home. Home action plans need to be tailored to meet the individual needs of each family.

Make a Difference



One Day at a Time

Be a Solid Waste Survivor – Take the Community Challenge Primary

Planning for Our Future, *continued*

Step 3: Ask students to write, or draw, what they will encourage family members to do at home. If the local recycling center has published guidelines on recycling, give each student a copy of these guidelines to use when writing the action plan, so information about how to prepare items for recycling can be accurately included. Remind students that it is up to each of them to sell their action plan to family members. Also, remind students that if some family members do not choose to participate in a family solid waste disposal plan, not to become discouraged. Remind students that, even individually, they can make a difference, as long as they each keep practicing what they have learned during this unit.

Step 4: If there are students who say that their families are already **reducing, reusing and recycling**, encourage them to write a plan showing specifically what they are already doing at home. When it is completed, ask students to suggest other activities the family might be able to do.

Step 5: Once the family action plans have reached the publishing stage of the writing process, encourage students to add colorful illustrations showing family members caring for the Earth by **reducing, reusing, recycling and responding!**

Day 2

Step 6: Locate a neighborhood or community map at <http://www.mapquest.com/>, or from the local Chamber of Commerce. Make a copy of the map for each student and a transparency of the map to use on the overhead projector.

Step 7: Have students use bright markers or yellow crayons to highlight the streets where they live. Use the transparency and overhead projector to show students the streets they need to mark. Talk about the impact they will have on their community just by having good solid waste habits in their own homes!

Step 8: The completed family action plan, community map and “Resource Vest” (the unit’s culminating activity) should be sent home at the same time.

Assessment

The assessment for this lesson will be the completed family action plan. Give each student the following criteria at the beginning of this lesson.

Your Family Action Plan should contain the following information:

1. **What will you and your family do to reduce the amount of solid waste you are currently putting in your trashcans for weekly garbage pick-up?**
2. **How will you and your family reuse some of the containers and products you are currently throwing into trashcans?**
3. **What solid waste items will you and your family recycle? (Remember that this also includes composting.)**
4. **Will you and your family positively respond to the solid waste dilemma by reconsidering waste-producing activities and by expressing preferences for less waste?**
5. **Can you think of one other relative or friend you can talk to about the benefits of appropriate solid waste disposal?**

Extensions

1. Follow this lesson up with periodic reports from students about how the home action plan is working.
2. Praise students for their efforts to teach others about proper solid waste disposal.

**Be a Solid Waste Survivor – Take the Community Challenge
Primary**

**Teaching Our Families About Solid Waste
A Culminating Performance Task**

Standards

- ◆ **Practical Living: PL-E-3.1.5**
- ◆ **Practical Living: PL-E-3.3.2**
- ◆ **Science: SC-E-2.1.2**
- ◆ **Science: SC-E-3.3.3**
- ◆ **Social Studies: SS-E-1.3.3**
- ◆ **Social Studies: SS-E-3.1.1**

Activity Description

In this final activity that ties the unit together, students will make a “resource vest.” The vest will be used as an aid to teach family members about solid waste issues. Each family will then be asked to help students keep a calendar on which they will record family efforts to **reduce, reuse, and recycle**, thereby **responding** to the solid waste disposal problem.

Materials

Brown paper grocery bag
Scissors and tape
Crayons, markers or pencils
Copies of calendar for each student (at the end of this lesson)

Length of Lesson

Approximately one to two hours

Essential Questions

- ◆ **How do my family and I depend on the resources in our community and our world?**
- ◆ **My family and I use resources that create solid waste. How does that affect the environment?**
- ◆ **How can I affect the way my family, school, and community use resources and properly dispose of solid waste?**

Guiding Question

What can I do to encourage family members to **reduce, reuse, recycle, and respond** to solid waste disposal problems?

Skills Used

Organization and Communication
Writing and Drawing
Problem Solving
Motor Skills

Activity

Step 1: Contact a local grocery store and ask for a donation of a class set of brown grocery bags for this final activity.

Step 2: Remind students that they have been learning many things about natural resources, natural objects and products, organic and inorganic materials, composting, and the proper disposal of

solid waste in sanitary landfills during this “Solid Waste Survivor” unit. (If you have completed the “Button Brigade” lesson, refer to the charted concepts students shared at that time. If this lesson was skipped, spend a few minutes reviewing concepts that were covered during this “Solid Waste Survivor” unit.)

Be a Solid Waste Survivor – Take the Community Challenge Primary

“Teaching Our Families about Solid Waste” – A Culminating Performance Task, *continued*

Step 3: Assist students as they cut holes for their heads in the bottom of the bag, armholes in each side and a slit down the front. (Even young students can cut the holes and front slit independently if an adult traces the lines for the circles and slit onto the paper bag.) If the bags have an advertisement on the outside, turn the bag inside out. The grocery bag vests might also need to be reinforced around the neckline with tape so they do not tear.

Step 4: Once the vests have been cut and turned inside out, explain to students that it is now their turn to be teachers. Explain that they will turn the paper vest into a teaching tool to help them teach family members about solid waste and its proper disposal. Instruct students to think about the many things they have learned during the “Solid Waste Survivor” unit. (A list of the vocabulary words from the different lessons would help students remember some of the topics that were covered.) Instruct students to use the back of the vest to share information about REDUCING. The front left and right sides will be used for REUSING and RECYCLING. (The idea is for students to come up with more ideas for reducing than for the other two solid waste disposal solutions.) Explain that students should use pencils, first, to write their ideas and sketch the pictures. Once the preliminary work has been completed in pencil, encourage students to use washable markers, or crayons to help make the resource vests more colorful. Tell students that they can make illustrations, write words and phrases, make lists, etc. on the vest, to represent solid waste ideas they have learned. (Move among students during this activity and offer individual encouragement.)

Step 5: As students finish their resource vests, have “feely socks” and environmental books available for students. Also, go to the following Environmental Protection Agency web site (<http://www.epa.gov/epaoswer/osw/kids.htm>) for games students can play as they wait for classmates to complete the assigned task.

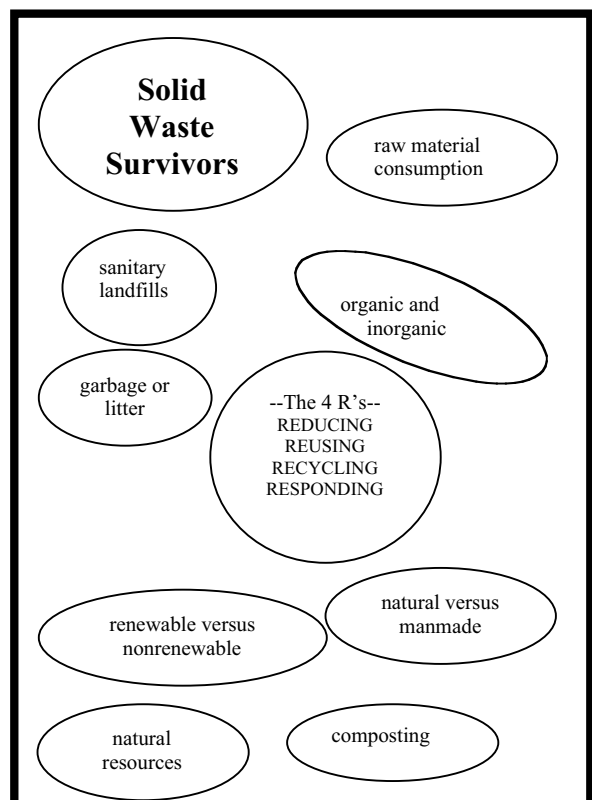
Assessment

Refer to the “Culminating Activity Scoring Guide” found at the end of this lesson.

Step 6: Once the vests have been completed, pair students up together to practice explaining the information on their vests. Once each student has practiced sharing the information on the vest with a classmate, take turns allowing each student to share the information on the vest with the entire class. (This is giving students two different opportunities to practice what they will say to family members once the vest is sent home.)

Step 7: Ask students to take the vest home and, while wearing the vest, explain what they have learned to family members. The drawings and words act as prompts that students can use to remember the concepts they have learned. If the lesson, “Planning for Our Future” has been taught, also send the family solid waste action plan home with the resource vest.

Step 8: Ask students and families to find ways to **REDUCE**, **REUSE**, **RECYCLE** and **RESPOND** to the solid waste disposal problems every day, and to write those actions on a calendar for one week. (See the calendar at the end of this lesson.) Calendars should be returned on a predetermined date and serve as part of the assessment.





Solid Waste Survivor Calendar

Dear Family,

Each day, I will try to do something to say I am a solid waste survivor and a friend of the environment. For one week, please help me keep a record of what I do. Everyday, I want to put either a picture, a sentence, a list or a conversation bubble in each box below to help me explain what I have done that day to help improve the way we deal with solid waste. Please help me remember to include all of the ways we reduce, reuse and recycle solid waste at home each day. I want to thank you very much for helping me!

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday

Name _____ Please return to school on the following date: _____

Be a Solid Waste Survivor – Take the Community Challenge
Primary

Assessment Rubric for Primary Unit Culminating Project
“Teaching Our Families about Solid Waste”

4	<p>The student has an extensive understanding of the concepts of reducing, reusing and recycling and illustrates this on the resource vest by including 4 or more concepts on recycling and reusing and 5 or more on reducing. The student shows that he or she understands the concepts illustrated on the vest by giving elaborate details and sophisticated support for each concept. Included in the description is the idea that solid waste is a problem in our society.</p> <p>The student monitors and improves his or her family’s solid waste disposal habits by recording at least 7 activities that reduce, reuse or recycle the family’s solid waste. Activities are from all 3 categories and no activity is repeated.</p>
3	<p>The student has an appropriate understanding of the concepts of reduce, reuse and recycle and illustrates this on the vest by including 3 or more concepts on recycling and reusing and 4 or more on reducing. The student orally explains the concepts on the vest by giving details and providing support for each concept. There may be occasional inaccuracies but these do not interfere with conceptual understanding.</p> <p>The student monitors and improves his or her family’s solid waste disposal habits by recording at least 7 activities that reduce, reuse and recycle the family’s solid waste. Activities are from all 3 categories.</p>
2	<p>The student has limited understanding of the concepts reduce, reuse and recycle. He or she includes 2 or more concepts on reusing and recycling on the vest and 3 or more on reducing. The student orally explains the vest by giving relevant details for all examples and provides support for at least 3.</p> <p>The student monitors and improves their family’s solid waste disposal habits by recording at least 7 activities that reduce, reuse and recycle the family’s solid waste. At least 2 activities are from different categories.</p>
1	<p>The student begins to understand the concepts of reduce, reuse and recycle and includes 2 or more examples for each concept on his or her vest. The student begins to orally explain the vest by giving relevant details about each of their examples.</p> <p>The student monitors and improves his family’s solid waste reduction habits by recording at least 4 activities that reduce, reuse or recycle the family’s solid waste.</p>
Notes	

Be a Solid Waste Survivor



Take the Consumer Challenge

An Intermediate Unit of Study for Kentucky Schools

**Be A Solid Waste Survivor – Take The Consumer Challenge
Intermediate**

**A KENTUCKY ENVIRONMENTAL EDUCATION COUNCIL
PRACTICAL LIVING, SCIENCE, AND SOCIAL STUDIES INTEGRATED UNIT**

Standards: Consumerism

Practical Living: PL-E-3.1.2, Products and services are compared and evaluated based on price, quality, and features.

Practical Living: PL-E-3.1.5, There are consumer decisions (e.g., reducing, recycling, and reusing) that have positive impacts on the environment.

Practical Living: PL-E-3.3.2, To protect all citizens, there are community guidelines (e.g., school inspections, trash collections, water treatment, waste treatment, animal control, immunization) that promote healthy living environments in the community.

Standards: Earth and Life Science

Science: SC-E-2.1.2, Earth materials provide many of the resources humans use. The varied materials have different physical and chemical properties, which make them useful in different ways. For example, as building materials (e.g., stone, clay and marble), as sources of fuel (e.g., petroleum and natural gas), or growing the plants we use as food.

Science: SC-E-3.3.3, All organisms, including humans, cause changes in the environment where they live. Some of these changes are detrimental to the organism or to other organisms; other changes are beneficial (e.g., dams built by beavers benefit some aquatic organisms but are detrimental to others).

Standards: Economics

Social Studies: SS-E-3.1.1, Scarcity requires people to make choices about using goods, services and limited resources.

Social Studies: SS-E-3.1.3, Every time a choice is made, an opportunity cost is incurred. Opportunity cost refers to what is given up when an economic choice is made.

Social Studies: SS-E-3.4.1, Producers create goods and services; consumers make economic choices about which ones to purchase.

UNIT OVERVIEW

Lesson	Title and Description of Activities, Essential and Guiding Questions and Standards
#1	<p>“THE BUCK STOPS HERE” -- Students will design “Enviro-Bucks” to be earned during this intermediate “Solid Waste Survivor” unit. Students will also learn what the saying “The buck stops here” means as it relates to taking responsibility for one’s actions.</p> <p>Standard: Social Studies: SS-E-3.1.3</p> <p>Essential Question #2: How do my choices about what I buy and use affect the environment?</p> <p>Guiding Question:</p> <ul style="list-style-type: none"> ◆ As a consumer, what can I do to help the environment?

UNIT OVERVIEW

Lesson	Title and Description of Activities, Essential and Guiding Questions and Standards
#2	<p>“RESEARCHING RESOURCES” – Students will research resources used to make a favorite item they own, investigating their sources, uses and availability. They will present conclusions to the class and identify on a world map where to find the natural resources.</p> <p>Standard: Science: SC-E-2.1.2 Essential Question #1: Where do the things I use come from and what happens to them when I am through using them? Guiding Questions:</p> <ul style="list-style-type: none"> ◆ What natural resources are needed to make the things I use, and are those resources renewable or nonrenewable?
#3	<p>“SOMETHING FISHY IS GOING ON HERE” – Students will understand that some resources become depleted when they are used faster than they can be replenished.</p> <p>Standard: Science: SC-E-3.3.3 Standard: Social Studies: ss-E-3.1.1 Essential Question #2: How do my choices about what I buy and use affect the environment? Guiding Questions:</p> <ul style="list-style-type: none"> ◆ What is an environmental cost? ◆ As a consumer, what can I do to help the environment?
#4	<p>“DESKTOP LANDFILLS” – Students will learn about the amount of waste that they produce as they build a desktop landfill in a gallon milk container.</p> <p>Standard: Practical Living: PL-E-3.1.5 Essential Question #1: Where do the things I use come from and what happens to them when I am through with them? Guiding Questions:</p> <ul style="list-style-type: none"> ◆ When I am through with the things I use, what happens to them?
#5	<p>“THE EVOLUTION OF TRASH” -- Students will learn from participating in this skit that as population and the use of synthetic materials increased, so did solid waste disposal problems.</p> <p>Standard: Practical Living: PL-E-3.1.5 Essential Question #2: How do my choices about what I buy and use affect the environment? Guiding Question:</p> <ul style="list-style-type: none"> ◆ As a consumer, what can I do to help the environment? ◆ How can I generate the least amount of solid waste?
#6	<p>“A TRASHY PIZZA BULLETIN BOARD” – Students will create a “trashy pizza” bulletin board as they learn about the amount and types of waste generated in the United States over a one-year period.</p> <p>Standard: Practical Living: PL-E-3.3.2 Essential Question #1: Where do the things I use come from and what happens to them when I am through with them? Guiding Questions:</p> <ul style="list-style-type: none"> ◆ When I am through with the things I use, what happens to them?

UNIT OVERVIEW

Lesson	Title and Description of Activities, Essential and Guiding Questions and Standards
#7	<p>“FOLLOW THE SOLID WASTE TRAIL” – Students will investigate and learn about the importance of purchasing reusable and recyclable products by building a compost and landfill model.</p> <p>Standards: Practical Living: PL-E-3.3.2 and PL-E-3.1.5</p> <p>Essential Question #1: Where do the things I use come from and what happens to them when I am through with them?</p> <p>Guiding Questions:</p> <ul style="list-style-type: none"> ◆ When I am through with the things I use, what happens to them?
#8	<p>“PREFERABLE PICNIC PLANNING” – Students will plan an ecological picnic. They will evaluate products usually taken on a picnic and plan for the least amount of solid waste disposal.</p> <p>Standard: Practical Living: PL-E-3.1.5</p> <p>Standard: Social Studies: SS-E-3.1.3</p> <p>Essential Question #3: What process should I use to evaluate the choices I make as a consumer in order to reduce the amount of solid waste I produce?</p> <p>Guiding Questions:</p> <ul style="list-style-type: none"> ◆ How can I identify and apply criteria to making my decisions on what to buy? (E.g., cost, media and peer pressure, convenience, environmental impact, health and safety)
#9	<p>“INSPECTING PRODUCTS” -- Students will compare and evaluate products as they begin to learn techniques to make them wiser environmental consumers.</p> <p>Standard: Practical Living: PL-E-3.1.2</p> <p>Standard: Social Studies: SS-E-3.4.1</p> <p>Essential Question #3: What process should I use to evaluate the choices I make as a consumer in order to reduce the amount of solid waste I produce?</p> <p>Guiding Questions:</p> <ul style="list-style-type: none"> ◆ How can I identify and apply criteria to make my decisions on what to buy? (E.g., cost, convenience, media and peer pressure, environmental impact, health and safety).
#10	<p>“MAKING WISE BUYS” — Students will research and evaluate school supplies and determine which products are the most environmentally preferable to buy.</p> <p>Standard: Practical Living: PL-E-3.1.2</p> <p>Standard: Social Studies: SS-E-3.4.1</p> <p>Essential Question #3: What process should I use to evaluate the choices I make as a consumer in order to reduce the amount of solid waste I produce?</p> <p>Guiding Questions:</p> <ul style="list-style-type: none"> ◆ How can I identify and apply criteria to making my decisions on what to buy? (E.g., cost, media and peer pressure, convenience, environmental impact, health and safety)
#11	<p>“THE ULTIMATE ENVIRO-FRIENDLY PRODUCT – A CULMINATING PERFORMANCE TASK” – Students will design and mass-produce an environmentally preferable product made from reusable solid waste. The product will be evaluated based on its durability, the use of recycled materials, its usefulness and if it is environmentally friendly. An assessment rubric is included at the end of this activity.</p> <p>Standards: Practical Living: PL-E-3.1.2, PL-E-3.1.5, PL-E-3.2.2</p> <p>Standards: Science: SC-E-2.1.2, SC-E-3.3.3</p> <p>Standards: Social Studies: SS-E-3.1.1, SS-E-3.1.3, SS-E-3.4.1</p> <ul style="list-style-type: none"> ◆ How do I make the best choices about what to buy?

UNIT OVERVIEW

Lesson	Title and Description of Activities, Essential and Guiding Questions and Standards
#12	<p>“Marketing Enviro-Products” – Students will prepare their ultimate enviro-products to sell at the Enviro-Market by creating advertisement slogans, commercials and posters.</p> <p>Standard: Practical Living: PL-E-3.1.2 Standard: Social Studies: SS-E-3.4.1</p> <p>Essential Question #3: What process should I use to evaluate the choices I makes as a consumer in order to reduce the amount of solid waste I produce?</p> <p>Guiding Questions:</p> <ul style="list-style-type: none"> ◆ How do I make the best choices about what to buy?
#13	<p>“THE ENVIRO-MARKET – A CULMINATING EVENT” – In this final activity students will sell their enviro-products made from recyclable items. The enviro-products will be priced according to how environmentally preferable they are. For example, items that are harmful to the environment will cost much more than items that are environmentally friendly.</p> <p>Standard: Practical Living: PL-E-3.1.2 Standard: Social Studies: SS-E-3.4.1</p> <p>Essential Question #3: What process should I use to evaluate the choices I make as a consumer in order to reduce the amount of solid waste I produce?</p> <p>Guiding Questions:</p> <ul style="list-style-type: none"> ◆ How do I make the best choices about what to buy?

INTEGRATION

Language Arts

- ◆ Write a paper about how your life would be different if plastic had never been invented
- ◆ Write a story about a homeless man or woman living at the dump. Could he or she survive on what the rest of us throw away?

Social Studies

- ◆ Invite a panel of people 70 and older to your classroom. Hold a panel discussion in which you ask them how their families dealt with solid waste when they were children. Ask if they remember the depression and WWII. Was dealing with solid waste different during those times?
- ◆ Go to the grocery store with a grandparent or other relative or friend over 70 years of age. Look at various items and talk about how those items were used and packaged when they were children. (For example, candy, milk, cheese, eggs, flour, and vegetables). Report to the class on how things were different when these older people were children.

INTEGRATION

Integration, *continued*

Math

- ◆ Find a way to weigh all the trash your class produces in the classroom each day. Keep records and get an average for each week. Make a set of graphs and charts to illustrate your findings.
- ◆ Do pie charts to show what percentage of glass, paper and plastic is reused or recycled in the U.S. each year.

Arts and Humanities

- ◆ Make a toy for a younger child using recycled materials. Make sure the toy is safe.
- ◆ Write and perform a skit in which a person your age feels pressured to buy something he/she does not need and cannot afford. What are some of the ways he/she might feel pressured (media/peers) and how might he/she feel.

Technology

- ◆ Interview someone from a local company or from the Kentucky Department of Waste Management about how companies use computers to track raw materials and solid waste in order to be both earth-friendly and cost effective.
- ◆ Go to www.epa.gov and explore the kids' page on solid waste.

Be a Solid Waste Survivor – Take the Consumer Challenge
Intermediate

The Buck Stops Here!

Standard	Social Studies: SS-E-3.1.3 , Every time a choice is made, an opportunity cost is incurred. Opportunity cost refers to what is given up when an economic choice is made.
Activity Description	Students will design “Enviro-Bucks” to be distributed during this intermediate “Solid Waste Survivor” unit. Students will also learn what the saying “The buck stops here” means as it relates to taking responsibility for one’s actions.
Materials	Paper, crayons, markers and pencil Computer (optional)
Length of Lesson	Approximately one hour
Vocabulary Words	Consumer: one who buys products or services. Environment: the external conditions that influence the development and survival of an organism or population; usually refers to air, water, land plants, and animals.
Essential Question	How do my choices about what I buy and use affect the environment?
Guiding Question	As a consumer, what can I do to help the environment?
Skills Used	Creativity Problem Solving

Activity

Step 1: Write the phrase “The Buck Stops Here” on the chalkboard. Ask students if they have ever heard that saying used by adults, or in stories. Ask students to think about that saying and share what they think it means. If students have difficulty understanding what it means, explain to students that this phrase means that everybody must accept responsibility for their actions, rather than trying to blame others for problems they create.

Ask students if they have ever earned money, or had money given to them as a gift. Ask students if they have ever spent money to buy a toy, game, clothing, etc. Explain to students that when people buy things (or services) they become consumers.

Explain to students that during this “Solid Waste Survivor” unit, they will be studying and learning about how, as consumers, they make choices in their



daily lives that affect the Earth and its inhabitants. Explain that some of those choices include things they want to buy, and how they deal with the solid waste, or trash, left over from the packaging of the product they purchase, or the product when it loses its usefulness.

Be a Solid Waste Survivor – Take the Consumer Challenge Intermediate

The Buck Stops Here, *continued*

Step 2: Ask students to think of the first thing that comes to mind when they hear the word environment. Encourage students to share ideas with classmates. Help students understand that the environment includes everything around them.

Step 3: Tell students that during this unit they will be learning about the many positive things they can do, as consumers, to keep the environment safe for themselves and future generations. (E.g., **reduce the amount of solid waste each person throws away, reuse as many products or product containers as possible, and recycle.**) Explain to students that as they are learning these positive things, they will be able to earn a special type of money for their efforts, called Enviro-Bucks (a nickname for environmental money). Give students some examples of how they will be able to earn Enviro-Bucks. (E.g., completing assigned work on environmental topics in a timely manner, working cooperatively on group projects dealing with environmental studies, reusing and recycling solid waste (trash) appropriately at school, doing environmental acts of kindness like picking up trash, recycling, etc.)

(SKIP STEPS 4 - 6, IF YOU PLAN TO USE THE SAMPLE SHEET OF ENVIRO-BUCKS LOCATED AT THE END OF THIS LESSON.)

Step 4: Explain that students will have an opportunity to design the Enviro-Bucks for use during this unit of study. Show students an 8_ by 11-inch sheet of white copy paper. (Paper that is clean on only one side works fine, plus it shows students, by example, how to reuse a potential solid waste product.) Explain that eight Enviro-Bucks should fit on one sheet of 8_ by 11 inch paper, and be the same size. Also explain that the Enviro-Bucks should contain pictures and words that will identify them as “environmental money”. Tell students that they can work individually, or in small groups, to design the Enviro-Bucks. Set a time limit for students to complete their design (Give as a homework assignment, if students want to work with computer graphics on a home computer.)

Journal Activity

Costs to the Environment

Tell students that the choices we make as consumers each day when we buy products and dispose of solid waste carry environmental costs. Explain that those costs add up as people around the world make unwise choices about how they treat the environment.

Ask students to think and write about some different choices that people might make that costs the environment its health and safety.

Step 5: Once the Enviro-Buck designs are completed, give each designer an opportunity to explain the graphics and logo to the entire class. Put the designs on display so students can look closely at each design.

Step 6: In order to select one design to copy and prepare for distribution, give students the opportunity to vote for one Enviro-Buck design. Number each submitted design, then ask students to complete a secret ballot by listing only one number on a piece of paper. Tally the votes, and announce the winning design.

Step 7: Add a different numerical value to the Enviro-Bucks by writing numbers on the winning sample, or copy the Enviro-Bucks onto different colors of paper, with each color worth a specific value. (See the last page of this unit.)

Be a Solid Waste Survivor – Take the Consumer Challenge Intermediate

The Buck Stops Here! *Continued*

Step 8: Remind students that they will be paid Enviro-Bucks during this unit of study. Explain that students will need to save the Enviro-Bucks until the end of the unit. At that time, they will have a special event where they will be able to spend their Enviro-Bucks. (Students will get to develop environmentally friendly products from recycled materials to sell to each other during an “Envir-O-Market” activity. Explain that each item at the “market” will cost a certain amount of Enviro-Bucks. Remind students that as they receive the Enviro-Bucks it will be their responsibility to keep their environmental money in a safe place so it is not lost.

Enviro-Bucks General Information

Earn Enviro-Bucks:

- ◆ 1 Enviro-Buck for staying on task during environmental lessons.
- ◆ 1 Enviro-Buck for cooperating during environmental group activities
- ◆ 1 Enviro Buck for performing environmental “acts of kindness”
- ◆ 1 Enviro-Buck for turning in completed environmental assignments
(BONUSES UP TO 5 ENVIRO-BUCKS FOR EXCEPTIONAL WORK ON ASSIGNMENTS)
- ◆ Smaller denominations of Enviro-Bucks may be traded in at designated times for larger bills.

(These rates and conditions may be adjusted.)

Assessment

Ask students to rephrase the saying “The buck stops here” in terms that will help them explain it to friends their own age. Instruct students to use an environmental scenario as they rephrase the saying. (E.g., “I am responsible for separating recyclable items at home, instead of throwing them in the trash can or expecting others to do it for me.” Display the new phrases on a “RESPONSIBILITY” bulletin board.

Extensions

1. Encourage students to start journal entries of suggested ideas for doing “environmental acts of kindness”
2. Take a walk outside with clipboards, paper and pencils. Find a quiet spot to sit and sketch Enviro-Buck ideas.
3. Read Heron Street (a book that shows the environmental impact made on a wetlands area when a housing development was built), by Ann Turner, and discuss the “environmental costs” depicted in that story, plus the need for new homes and places to live.

INVEST IN A BRIGHT FUTURE

1 Buck

EARN ENVIRO-BUCKS TODAY

INVEST IN A BRIGHT FUTURE

1 Buck

EARN ENVIRO-BUCKS TODAY

INVEST IN A BRIGHT FUTURE

1 Buck

EARN ENVIRO-BUCKS TODAY

INVEST IN A BRIGHT FUTURE

1 Buck

EARN ENVIRO-BUCKS TODAY

INVEST IN A BRIGHT FUTURE

5 Bucks

EARN ENVIRO-BUCKS TODAY

INVEST IN A BRIGHT FUTURE

5 Bucks

EARN ENVIRO-BUCKS TODAY

INVEST IN A BRIGHT FUTURE

10 Bucks

EARN ENVIRO-BUCKS TODAY

INVEST IN A BRIGHT FUTURE

20 Bucks

EARN ENVIRO-BUCKS TODAY

Be a Solid Waste Survivor – Take the Consumer Challenge
Intermediate

Researching Resources

Adapted from “Sources of Resources”, from Quest for Less, an EPA Publication

Standard

Science: SC-E-2.1.2, Earth materials provide many of the resources humans use. The varied materials have different physical and chemical properties, which make them useful in different ways. For example, as building materials (e.g., stone, clay and marble), as sources of fuel (e.g., petroleum and natural gas), or growing the plants we use as food.

Activity Description

Students will research resources used to make a favorite item they own, investigating their sources, uses and availability. They will present conclusions to the class and identify on a world map where to find the natural resources.

Materials

Wool sweater	Plastic milk jug	Pushpins
Paper	Cotton T-shirt	Scissors
Rubber boot or raincoat	Metal can of food	Paper labels or tags
Scissors	Dairy product	Markers
Leather product	Glass bottle	World map
Computer diskette	Wooden toy	Research tools

Length of Lesson

Approximately one hour, in two class sessions, depending on research tools

Vocabulary Words

Renewable Resource; naturally occurring raw material that, when properly used and managed, can be restored or replenished.
Nonrenewable Resource; a raw material that can be depleted faster than it naturally regenerates (e.g., petroleum, metals, etc.)
Raw materials; still in their natural or original state.
Consumption; the amount of any resource (material or energy) used in a given time by a given number of people.
Scarcity; limited supply of a resource or product.

Essential Question

Where do the things I use come from and what happens to them when I am through using them?

Guiding Questions

What natural resources are needed to make the things I use, and are those resources renewable or nonrenewable?

Skills Used

Research and Writing
 Observation and Classification
 Communication and Problem Solving

Activity

Step 1: Display all of the materials from the “Materials Needed” list above except for the last six items. Discuss the concept of natural resources with the students and ask them to identify what raw materials were used to make each of the objects on display. List student answers on the board, or on a

chart. Use the list to define and explain the key vocabulary words. (Refer to the **Teacher Fact Sheets** at the beginning of this publication for background information on “Products” and “Natural Resources”.)

Be a Solid Waste Survivor – Take the Consumer Challenge Intermediate

Researching Resources, *continued*

Step 2: Discuss, as a class, the following questions and concepts to help students better understand the concept of natural resources.

- ◆ Can people make natural resources?
- ◆ Are natural resources things we can use?
- ◆ Are natural resources necessary for life?
- ◆ As population increases, the natural resources in that area may become scarce. People will have to change their daily living habits in order to conserve their resources.
- ◆ Natural resources are living parts of the physical environment (including air, sun, wind, rain, plants, animals, etc.).

Step 3: Brainstorm with students to identify other well-known resources such as those listed under “Valuable Natural Resources”. Try to come up with at least as many resources as there are students in the class. Add these resources to the other list.

Step 4: Explain that students will have the opportunity to find out more about different natural resources in this activity, by using research tools. Display the books and encyclopedias, or schedule to take students to the media center for research time.

Valuable Natural Resources

Aluminum	Nickel
Natural Gas	Chromium
Coal	Petroleum
Cobalt	Platinum
Corn	Silver
Diamonds	Tin
Fish	Wheat
Water	Wool
Gold	Zinc

Step 5: Ask students to think of one or two items they have purchased recently that they really like; such as, a toy, a music CD, food at a restaurant, or a video game. Explain to students that they will research their favorite product to try and find out what natural resources were needed to make that item and in what part of the world those resources are found.

Step 6: Call on students, one at a time, so each might name his or her favorite item chosen to research. On a chart, or on the chalkboard, write each student’s name and the item selected to research, so there will be a variety of different products.

Step 7: Encourage students to create a timeline showing their product’s beginning, and the processes it had to go through in order to make it to their home. (See the bottom of the next page for an example.)

Step 8: Give each student a copy of a world map. On that map, each student should identify where the natural resources that were used in their special item originated and where the item was manufactured or distributed.

Homework Assignment

Instruct students to check different products at home. Make a list of companies that manufactured the products and countries where the products were manufactured.

Upon returning the work to school, compile a master list of the different products checked and countries where the products were manufactured.

Compare data to see which country was represented the most in this informal survey.

Discuss findings.

Be a Solid Waste Survivor – Take the Consumer Challenge Intermediate

Researching Resources, *continued*

Step 9: Display a large map of the world in the front of the classroom. Have students write the name of the resource(s) used to make their favorite item on several small pieces of paper or labels.

Step 10: Have students take turns presenting information about their favorite product to the class, discussing their research conclusions. Students should begin their presentation by telling the class which favorite item they researched, what raw materials, or resources are used to make that item. Also, ask where the resources are most typically found.

Step 11: Students should pin the paper that labels their resource on the map in the appropriate regions. Also, students should discuss whether the resource is renewable or nonrenewable. Discuss the availability of the natural resource at this time, also, if the information was located.

Step 12: Before concluding this activity, lead students toward a better understanding of the reality that many of our resources are non renewable, and are becoming scarce. The consumption rate is too high, because of the demands consumers place on companies to produce more products for them to buy. This is harming the environment.

Assessment

Ask students to list some of the natural resources they use frequently. Are the resources renewable or nonrenewable? Ask students to write about what they would do if the world supply of those resources became depleted.

Pose the question: “Who is responsible for the depletion of natural resources?”

Extensions

1. Research natural resources from selected countries around the world, or from different states in the United States. Make a comparison chart of the different resources to compare the availability.
2. Visit the following web sites to research resources in the state of Kentucky on the Internet:

<http://www.louisville.edu/~easchn01/kentucky/1envi.html>

The Life of a French Fry (Sample Product Time-Line)

It starts as a potato growing in ground. → The potato is harvested and sent to a potato processing plant. → At the potato processing plant, potatoes are washed, peeled, sliced and pre-cooked by machines. → French Fries are quickly frozen, then packaged in a plastic bag. → Frozen French Fries are sent to food distribution centers where they are bought by different companies, like McDonald’s or Kroger. → The product is bought for immediate consumption (like at the drive-up window at Burger King) or to be taken home and cooked.

Yum! Yum!

Be a Solid Waste Survivor – Take the Consumer Challenge
Intermediate

Something Fishy is Going on Here

Standards

Science: SC-E-3.3.3, All organisms, including humans, cause changes in the environment where they live. Some of these changes are detrimental to the organism or to other organisms; other changes are beneficial (e.g., dams built by beavers benefit some aquatic organisms but are detrimental to others).

Social Studies: SS-E-3.1.1, Scarcity requires people to make choices about using goods, services and limited resources.

Activity Description

Students will understand that some resources become depleted when they are used faster than they can be replenished.

Materials

Paper and pencil
Internet accesses
Copy of story “Got Fish?” from Teachers’ PET Term Paper, Summer 2001 Issue

Length of Lesson

Approximately one hour

Vocabulary Words

Natural Resource: a raw material or energy supplied by nature (e.g., water, minerals, or plants). Petroleum is a natural resource used to make plastic and many other products, and sunlight is a natural resource used to power lights and heat homes.

Consumption: the amount of any resource (material or energy) used in a given time by a given number of people.

Scarcity: limited supply of a resource or product.

Environmental Cost: harm done to the environment when consumers and producers make unwise choices about how they use natural resources and dispose of waste.

Essential Question

How do my choices about what I buy and use affect the environment?

Guiding Questions

What is an environmental cost?
As a consumer, what can I do to help the environment?

Skills Used

Reading
Communication and Problem Solving

Activity

Step 1: Introduce this activity by telling students that they will be discussing a global problem and trying to come up with some solutions to the problem. Remind students that products begin as natural resources and that people cannot “make” natural resources.

Teacher Information

Copies of “Popular Planet Press”, a newsletter for students in grades 3-6, published by ZPG Population Education Program, can be ordered by calling 1-800-767-1956. The newsletter is published three times each year. An annual classroom subscription of 30 copies costs \$7. Single copies of the newsletter are free.

Be a Solid Waste Survivor – Take the Consumer Challenge Intermediate

Something Fishy is Going on Here, *continued*

Step 2: Explain to students that they will be reading an article called “Got Fish?” together in class. Pass out copies of “Got Fish?” to each student. Before reading the article, go over the “Fish Phrases” (vocabulary words) with students. This should help make the article easier to understand.

Step 3: The article can be read through silently at first, then out loud in a large group, or in smaller groups, depending on teacher choice.

Step 4: Once the article has been read, call on different students to retell the problem facing the fishing industry. Discuss the implications of a depleted fish supply. What will happen to the cost of fish as the supply continues to dwindle? (Discuss supply and demand.) What is the environmental cost in this scenario? (The balance of the ocean ecosystem would be thrown off with the depletion of whole species of fish.)

Step 5: Ask students to think about, and discuss, any solutions that might help the fishing industry.

Step 6: Encourage students to go online to visit the “Center for Marine Conservation” web site to learn about activities taking place to help protect ocean life. The Internet address is www.cmc-ocean.org/.

Step 7: Remind students that Earth’s resources are becoming depleted because of the number of people in our world and because many times people do not think about the consequences of purchasing so many disposable and unnecessary products. Explain to students that as they continue learning about their roles as consumers during this unit, they will talk about how to become wiser consumers.

Assessment

Ask students to make a list of other renewable resources that are in danger of depletion because of overuse.

After listing some renewable resources, ask students to select one of the resources and think about some things that consumers can do to conserve that resource so it does not become depleted so quickly. Instruct students to discuss the environmental cost if the resource was depleted?

Extensions

1. Visit the Monterey Bay Aquarium’s Seafood Watch web site to learn more about which fish they feel are okay for consumers to purchase in grocery stores and restaurants. The Internet address for the Monterey Bay Aquarium’s Seafood Watch is: [www.mbayaq.org.](http://www.mbayaq.org/) Encourage students visiting that web site to keep other classmates updated on the findings.
2. Encourage students to think of ways to reuse some of the trash generated in the classroom in order to keep from having to buy more products, thus using more resources.



Teachers' PET Term Paper

Population Education Training

Got Fish?



Population, Competition, and the Global Fishing Crisis



A Rich Tradition

Fishing is an ancient and universal human practice. People have depended on fish for sustenance and income throughout history, and harvesting from the Earth's waters, whether with nets, hooks, spears, or bare hands, is a ubiquitous part of human society.

Diverse cultures around the world base their diets on seafood. In fact, fish and shellfish make up at least a sixth of the total animal protein consumed on Earth.¹ One billion people, primarily in developing nations, depend on fish for their major source of protein.²

Nations have built their economies on the trade that meets this demand, and the continued health of the marine ecosystem is vital to their stability and growth. Of the estimated 51 million fishers in the world, 95% are from developing countries.³ Here in the United States, commercial and recreational fishing contributes \$15.2 billion to the economy and provides approximately two million jobs.⁴

Where Fish Come From

World fish production comes from three sources: the **marine catch**, the **inland catch**, and **aquaculture**. In recent years there has been a significant shift in the proportions contributed by each of these sources. In 1994, the marine catch--always the mainstay of the fishing industry--provided fully 75% of total production, with the other two sources combined offering the remaining 25%. By 1999, the amounts contributed by each source was closer to 67% and 33%, respectively.⁵ Some of this difference is due to the commercial success of aquaculture which, ironically, can cause varying degrees of damage to wild fish populations, as their habitat is appropriated for farming.

But wild marine species remain the backbone of world fish supply, and so many have reached such dangerously low levels that fisheries around the world are in crisis. Marine biodiversity has been compromised to such an extent that 70% of the world's commercially important fish stocks are **fully fished**, **overfished**, or **depleted**.⁶

Some species have even been driven to commercial, and almost biological, extinction.

The drop in the size and diversity of fish populations jeopardizes the fishing industry, threatening the future of fishers' livelihood and national economies alike.



Where Fish Go

Fish stocks are shrinking partly because demand for this resource is so great. Each year we take more fish from the seas and the supply dwindles as fewer and fewer are left to reproduce. The decrease is also a result of the deterioration of the marine environment, particularly in shallow waters near shores. Fish and shellfish use **estuaries** as spawning grounds. But rising levels of water pollution and destruction of coastal ecosystems make it increasingly difficult for these creatures to find healthy spaces in which they can successfully reproduce.

Rapid human population growth is at the root of both problems. It heightens demand, for as our numbers increase, so does our collective appetite for fish. The industry's drive to satisfy rising need spurs competition and technological advances that continually improve our ability to find and capture fish. Now there are so many people fishing so aggressively that we're exceeding nature's ability to replenish once-abundant stocks. Irresponsible fishing also wastes a vast amount of fish--some 27 million metric tons of bycatch is brought in with the commercial catch every year.⁷

Degeneration of marine habitat is also a direct result of human population growth. Forty percent of the world's people live within 100 kilometers of a coastline⁸, and much of the sewage, trash, industrial pollution, and agricultural run-off produced by these populations finds its way into nearby coastal waters. Inland communities also contribute to ocean contamination, as rivers carry the same pollutants from land-locked population centers out to sea. Approximately 44% of the estuaries in the United States currently suffer from pollution and habitat degradation.⁹ *(Continued on p. 2)*



Fish Phrases

Marine catch: fish captured in coastal waters and on the high seas.¹⁰

Inland catch: fish caught from lakes and rivers.¹¹

Aquaculture: fish farming (conducted in inland and marine settings).¹²

Rilly fished: much-targeted by fishers but still stable.¹³

Overexploited: fished enough to be endangered.¹⁴

Depleted: fish population has crashed.¹⁵

By-catch: unintentionally caught fish, seabirds, marine mammals, etc.¹⁶

Estuary: a water passage where rivers and tidal currents merge.¹⁷



Resources

Fishing Information

NEWSLETTER: Popular Planet Press

The most recent issue of our newsletter for kids in grades 3-6 also focuses on fishing. The cover story offers an age-appropriate description of the marine food chain and how people affect it. Inside are fun games and word puzzles, ideas for how kids can help protect fish and their habitat, and information on selected resources and organizations they can look to for more information. *To obtain a free single copy of this issue, please call 1-800-767-1956. An annual 3-issue subscription for classroom sets of 30 is available for \$7. Please address checks to the ZPG Population Education Program. Subscriptions for one or two copies are available for free.*

WEBSITE: Center for Marine Conservation

Wondering what you can do to help restore ocean health? If you're one of the 2.4 billion people who live within a couple of hours of a coastline, getting involved may be easier than you think. On Saturday, September 15, 2001, the Center for Marine Conservation will sponsor their annual International Coastal Cleanup effort. Over 500,000 people will work to pull trash from our waterways. If you've been looking for a fun and rewarding field trip for your classes next semester, this could be it. Find out more online at: www.cmc-ocean.org/cleanupbrn/about.php3.



BOOK: Cod

Who can resist a book that plugs itself as the "biography of the fish that changed the world"? Author Mark Kurlansky has managed to compile an encyclopedic and entertaining treatment of how this humble groundfish became one of the hottest commodities of the medieval marketplace, and went on to play a major role in shaping a millennium of Western history. This book would make an excellent supplement for secondary level social studies, geography, economics, or environmental studies classes. *Cod, 1997, by Mark Kurlansky, is published by Penguin Books and is available online and at bookstores around the country for \$13.00.*



WEBSITE: The Monterey Bay Aquarium's Seafood Watch



Ever pondered the power of your plate? The choices you make about the seafood you choose at supermarkets and restaurants are an opportunity to support sustainable, responsible fishing practices--so make informed decisions! The Monterey Bay Aquarium has synthesized information from reputable sources to make it easy for you. Updated regularly, this guide includes a key to relevant terminology, and categorizes popular types of seafood as "Best Choices", "Proceed with Caution", and "Avoid." Ratings are a function of three factors: abundance of the wild population, level of bycatch, and environmental impact associated with the fishing or farming practices involved in production. Go to www.mbayaq.org and search for "seafood chart." Then enjoy your selections with a clear conscience. Bon Appetit!

Got Fish? ctd.

What to Do Now

There is a lack of meaningful consensus among nations about fishing rights and practices. Most could do more to limit their contribution to the problem of overfishing. But thus far, rather than discourage detrimental methods among their fleets, governments worldwide have tended to support the status quo through financial backing and lenient regulations.¹⁹ Even if international standards on good practices were to be established, enforcement would be highly problematic. The practical difficulties inherent in attempting to monitor the actions of all fishers are considerable--especially those of the 49 million or so small-scale operators who represent 98% of the industry. It seems inevitable that this predicament should have sur-

facted sooner or later, in light of such swift proliferation in human numbers. The "tragedy of the commons" has struck again, and it is clear that this vital natural resource cannot withstand these population pressures much longer.

Finding and implementing viable solutions to this problem will be one of the great challenges of this century. The future of the fishing industry and the stocks on which it depends hinges on our ability to recognize and respect the natural laws that determine the size of the supply. We must curb our consumption and protect marine environments if we hope to restore this depleted resource and preserve a way of life followed by fishing families for generations. Stabilizing the size of our population will make it much more possible to reach both of these important goals.

Sources: 1, 2, 3, 8, 19 & 10 World Resources Institute website, www.wri.org/coastlines.html. 4 American Oceans website, www.americoceans.org/fish/what.html. 5 Food and Agriculture Organization of the United Nations, www.fao.org/h/default.asp. 6 Greenpeace website, www.greenpeace.org/oceans/overfishing/cont-overfishing.html. 7 & 10 World Wildlife Fund website, www.worldwildlife.org. 9 American Oceans Campaign, *Splash*, Vol. 12, No. 1, Spring 2001. 10, 11, 12 Environmental News Network website, www.enr.com/vot/industry/fisheries/index.asp. 13, 14, 15 Monterey Bay Aquarium website, www.mbayaq.org/ef/efc_oceans/food_chart.html. 17 Webster's Seventh New Collegiate Dictionary, 1976.

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**Be a Solid Waste Survivor – Take the Consumer Challenge
Intermediate**

Desktop Landfills

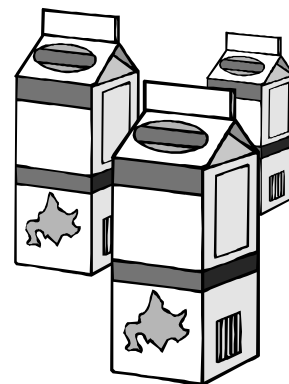
Adapted from “Weigh Your Weight”, from Quest for Less, an EPA Publication

Standard	Practical Living: PL-E-3.1.5 , There are consumer decisions (e.g. reducing, recycling, and reusing) that have positive impacts on the environment.
Activity Description	Students will learn about the amount of waste that they produce as they build a desktop landfill in a gallon milk container.
Materials	One gallon milk jug or carton per student Dry waste items collected throughout the week Scale and permanent marker
Length of Lesson	Approximately one to two hours at the end of a five-day period
Vocabulary Words	Reuse: a type of SOURCE REDUCTION activity involving the use of a product or container for the same purpose or a different purpose. Recycle: to collect, sort, process, and convert materials that would have been thrown away into raw materials used to make the same or new products. Reduce: to decrease the amount of waste, either by using wiser purchasing habits or by reusing or recycling more items. Respond: in this context, the act of reconsidering waste-producing activities and expressing preferences for less waste. Sanitary Landfill: a site where waste is managed in order to prevent or minimize health, safety and environmental impacts.
Essential Question	Where do the things I use come from and what happens to them when I am through with them?
Guiding Questions	When I am through with the things I use, what happens to them?
Skills Used	Problem Solving Communication

Activity

Step 1: Before beginning this activity, collect a class set of clean gallon milk jugs or cartons. Use a sharp knife to cut the top of the jug so it can be opened and closed as items are added to it.

Step 2: Give students a milk container and instruct them to write their name on the container they receive, using a permanent marker. Ask students to leave the container sitting close to their work area in the room.



Be a Solid Waste Survivor – Take the Consumer Challenge Intermediate

Desk top Landfill, *continued*

Step 3: Explain that solid waste becomes trash once we throw it away. The trash thrown away at home and school enters the “municipal solid waste stream”, because it is picked up by a garbage collection company and transported to a local landfill.

Tell students that they will be collecting all of their DRY trash items for the next week while at school and storing the trash items in the milk container. They WILL NOT be adding WET items or food scraps to their collection because this would encourage the materials to begin to decompose.

Explain that the purpose of this activity is to help students become aware of the solid waste they produce, and to encourage them to begin to think seriously about how they might reduce the amount of that waste. Remind students to rinse any containers or plastic cutlery before placing those types of items in their “desk top landfills”.

NOTE: If your school has an active recycling program in place, do not allow students to recycle during this activity. The idea is for students to think of ways to REDUCE the amount of waste they are responsible for producing, rather than relying on recycling to help them. Charge students an Enviro-Bucks dumping fee if they have to put solid waste items into another student’s landfill.

Day 5

Step 1: Ask students to predict the weight of their desktop landfills after collecting items for five class days. Use scales to weigh the trash individually, then add the individual totals together to calculate a class total.

Step 2: Spread trash items out onto a large tarp or sheet. Give students gloves to wear as they begin to separate the trash items into different categories (glass, metal, paper, plastic, reusable, and miscellaneous). Once the trash has been separated, draw students’ attention to the “miscellaneous” pile. Gather that pile of trash and weigh it separately from the rest. Compare that weight to the total weight of the trash. Explain that by recycling, the amount of waste entering the municipal solid waste stream can be reduced drastically.

Assessment

Ask students to write about why they think they generate so much trash. Have students include ways they developed to use less trash throughout the week, due to the size of their landfill. Pose the following question: If the amount of waste homeowners could discard was limited, what steps do you think they might begin to use to reduce the amount of solid waste they produced?

Step 3: Write the national average of waste generated on the board: 4.3 pounds per person per day.

Ask students to calculate the following:

- ◆ How much waste did each student in this class generate per day on average? Is this higher or lower than the national average? If lower, is it because of the limited size of the collection container? (Remind students that they also generated trash away from school that was not collected and weighed.)
- ◆ If each person in your community (population) throws away 4.3 pounds of garbage each day, how many total pounds of garbage are thrown away each day just in your community?
- ◆ How many tons is this? (Help students understand the concept of a ton being 2,000 pounds by comparing one ton to a 4-door compact car.)

Extensions

1. Contact a state or municipal solid waste manager to find out about your community’s trash generation rate. How does it compare to other communities in your county or state? Discuss the results and reasons behind them with students.
2. Have students generate ideas on how they can reduce the amount of waste entering the municipal solid waste stream.

Be a Solid Waste Survivor – Take the Consumer Challenge
Intermediate

The Evolution of Trash

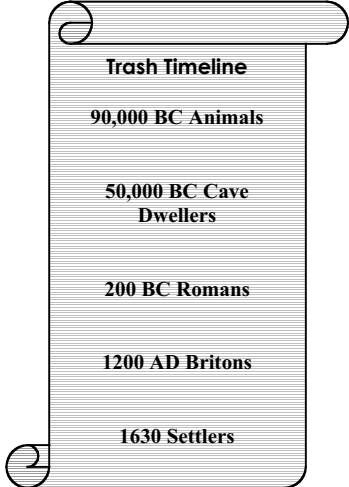
A Skit Adapted from “The Throwaway Three” by Fay Bradley

Standard	Practical Living: PL-E-3.1.5 , There are consumer decisions (e.g., reducing, recycling, and reusing) that have positive impacts on the environment.
Activity Description	Students will learn from participating in this skit that as population and the use of synthetic materials increased, so did solid waste disposal problems.
Materials	Refer to “Prop List” found at the beginning of the skit A time line showing the progression of the skit A copy of the skit for each student (found after lesson plan) Dictionaries for students to use to define words, if needed
Length of Lesson	One to three hours, depending on how the skit is used
Vocabulary Words	There will be some terms used in the skit that will probably need to be defined. Have dictionaries available for students to use if they come upon words they do not understand as they read the skit to themselves.
Essential Question	How do my choices about what I buy and use affect the environment?
Guiding Questions	As a consumer, what can I do to help the environment? How can I generate the least amount of solid waste?
Skills Used	Reading Communication Assimilation of information

Activity

Step 1: Introduce students to the play, “The Evolution of Trash” by telling them that they will be performing a short skit that attempts to explain how solid waste disposal has evolved, in a comical (yet serious) sort of way. Explain that while the skit is fictitious literary writing, parts of it are based on historical truths.

Step 2: After assigning speaking parts for the play, give students about fifteen minutes, or so, to mark their reading parts, silently read through the skit, and look up any unknown words in the dictionary. Encourage students to ask questions if they do not understand any part of the skit.



Be a Solid Waste Survivor – Take the Consumer Challenge Intermediate

“The Evolution of Trash”, *continued*

Step 3: After students have had an adequate amount of time to read through the skit, and mark the part they will be reading out loud, instruct students to prepare for the first oral reading. Ask the narrator to begin the skit, with other students prepared to read when appropriate. After the first oral reading, ask students if there is any part of this skit they still do not understand. Clarify any unknown phrases, or encourage students to look up unknown words in the dictionary.

Step 4: Encourage student input on the level of “professionalism” they would like to aim for with this “production”. (Skip this step if class time is limited.) Extensions could be included to make this lesson one that also combines cultural diversity and change over time, if students become eager about researching the different historical periods mentioned in the skit.

Step 5: If class time is limited, then read the play a few times. Discuss how people from different centuries and different cultures have dealt with solid waste disposal over the centuries, then put the skit on without using props or costumes. Help students arrive at an understanding of how the industrial revolution and wars increased the production of goods, not only in the United States, but around the world. Remind students, also, that as population increases, so does the need for more products. Along with the disposal of what is left over after people are through using any given product, comes an increase in the problems people who operate community waste disposal systems have to manage and deal with on a daily basis.

Assessment

After reading and discussing the skit, “The Evolution of Trash”, ask students to write what they feel has been the most prevalent cause of solid waste problems in our country’s history. Remind students that they need to include at least two or three reasons supporting their position.

Extensions

- 1 . Encourage students to research different groups of people portrayed in “The Evolution of Trash” skit to see if any information about solid waste disposal habits over the centuries can be found.
- 2 . Invite parents or other classes of students to watch the performance.
- 3 . Challenge students to add other historical periods to the play and write a rhyme telling how that group of people disposed of their solid waste.

**Be a Solid Waste Survivor – Take the Consumer Challenge
Intermediate**

“The Evolution of Trash”

A Skit adapted from “The Throwaway Three” by Fay Bradley

(Originally published by the Atlanta Clean City Commission in “Lessons from Litter”. Reprinted in EPA Let’s Reduce and Recycle: Curriculum for Solid Waste Awareness)

PROP LIST:

Monkey masks	Three sweaters: one handmade, two machine made
Banana peel	Lab coat
Orange peel	Nylon stockings
Skins (animal print material)	Plastic bags and containers
Roman helmet	Perma-pressed shirt
Bag of trash	TV dinner
Sack of trash	Small broken appliance
Pilgrim hat	Toy car
Quilt	Four Native American headbands
Coonskin hat	Aluminum cola can
Leather harness or belts	Clear bottle
Engineer’s cap	Flower

Actors and Actresses / Extras:

Speaker 1: Narrator_____	Speaker 13: 3 rd Scientist_____
Speaker 2: Monkey_____	Speaker 14: 4 th Industrialist_____
Speaker 3: Cave Dweller_____	Speaker 15: 4 th Scientist_____
Speaker 4: Roman_____	Speaker 16: 5 th Industrialist_____
Speaker 5: Briton_____	Speaker 17: 1 st Native American_____
Speaker 6: Settler_____	Speaker 18: 2 nd Native American_____
Speaker 7: Colonist_____	Speaker 19: 3 rd Native American_____
Speaker 8: 1 st Industrialist_____	Speaker 20: 4 th Native American_____
Speaker 9: 1 st Scientist_____	Speaker 21: 6 th Industrialist_____
Speaker 10: 2 nd Industrialist_____	Speaker 22: 5 th Scientist_____
Speaker 11: 2 nd Scientist_____	Speaker 23: 7 th Industrialist_____
Speaker 12: 3 rd Industrialist_____	

(Any extra students could be Co-Directors or Prop-Engineers)

The original skit has been adapted to involve more students. Some of the wording used in the original skit has also been updated to include common terms we now use.

This skit is written in rhyme and tries to illustrate how trash has changed over the past 90,000 years. The main theme is that one way to solve the solid waste accumulation problem is to recycle.

Each character should hold a sign showing the period of history he/she represents. This will help make it easier for the audience to follow the story line, if you choose to perform in front of an audience.

Any “trash” props should be thrown into the center of the stage. As the skit progresses, the pile of trash grows larger and larger.

**Be a Solid Waste Survivor – Take the Consumer Challenge
Intermediate**

The Evolution of Trash

Speaker 1: Narrator:	Sit back and relax, for this story will be About animals, humans and garbage throughout history. Now they are all very nice, just like you and me, Who all have a problem, as you will soon see. What shall they do with their garbage and trash?
All:	Why, throw it! Or bury it! Or burn it to ash!
Speaker 2: Monkey (90,000 BC) (Props: monkey masks, fruit peels)	I represent animals, living up in a tree. I get rid of my garbage quite easily! It's organic so I can just lay it around It just decomposes right into the ground.
Speaker 3: Cave Dweller 50,000 BC (Props: Skins)	I am a Cave Dweller who lives on the ground. What do I do with old stuff all around? Why bury it, like bones, in the muck and the mire. Or burn it with leftover skins in the fire.
All:	Yes, throw it, or bury it, or burn it to ash! That's how we <i>always</i> get rid of our trash!
Speaker 4: Roman 200 BC (Props: Roman Helmet, bag of trash)	I am a Roman who lives in the town. Our laws won't allow me to just throw it down. I have to drag it away for a mile, And then I can dump it, forget it, and smile!
Speaker 5: Briton 1200 AD (Props: Sack of trash)	I am a Briton, wary and quick. Down on our street it can get pretty thick, When housewives above want to pitch out their goo, They just heave it out here and yell "Gardy-loo!" It will stay in the alleys until the next rain, Or until our fair London should burn down again.
All:	Oh, what do we do with our garbage and trash: We throw it, or bury it, or burn it to ash!
Speaker 6: Settler 1630 (Props: Pilgrim hat & quilt)	I'm a New World settler. I came without much, Oh, a rifle, an axle, a few tools and such. But everything else I must make with my hands. So I don't throw out much—I use all I can. Cloth scraps become quilts; I reuse my bent nails. It will be a long time 'fore the next trade ship sails.

Be a Solid Waste Survivor – Take the Consumer Challenge
Intermediate

“The Evolution of Trash”, *continued*

Speaker 7: Colonist
1700

**(Props: coonskin hat,
leather harness or
belts)**

I am a colonist; now life's not so tough.
We have trade between cities that brings lots of stuff.
And some things are made by our town folk today.
I could buy a new harness, throw this old one away.
We have pigs and hogs running loose in our street,
If I toss it out there, they'll eat it up neat!
Or I might bury it right over there.
Or I could burn it; no one would care.
You see, the New World is the same as the Old!
We trash makers come from a time-honored mold.

All:

What do we still do with our garbage and trash?
Right! Throw it or bury it or burn it to ash!

Speaker 8: 1st Industrialist
1890

**(Props: Engineer's cap,
three sweaters: - one
handmade and two
machine made)**

I'm the industrialist and now on the scene,
I mass-produce goods with my trusty machine.
This sweater, handmade, took a week, even more,
But now in one hour, I can make forty-four!
I make things so cheaply, you can now afford two,
And throw out twice as much as you used to do.

Speaker 9: 1st Scientist
1950

(Props: Lab coat)

I am the scientist in the new post-war age.
We've learned a few tricks while the war shortage raged.
When we couldn't get natural stuff to process
We invented synthetics to replace the rest.

Speaker 10: 2nd Industrialist
**(Props: Nylon stockings,
plastic bags and
containers)**

Rayons and nylons, acrylics and plastics,
For furniture and clothing and even elastics!
Discard your old woolens and silks and your cotton;
Real wooden toys and washboards are forgotten.

Speaker 11: 2nd Scientist
**(Props: Perma-pressed
shirt)**

Our new stuff will last till forever, you see
Even when it's worn out to you and to me.
Permanent pressed, pre-sized and pre-shrunk,
When dingy and old, it's still permanent "junk".

All:

Now what do we do with our garbage or trash?
We throw it, or bury it, or burn it to ash!

Speaker 12: 3rd Industrialist
**(Props: Plastic bag,
TV dinner)**

We make instant menus that come in a pack.
You just boil the food in its own plastic sack.
Or heat our TV dinner in its tinfoil tray
It's quick; you don't wash it; just throw it away!

Speaker 13: 3rd Scientist
(Props: Broken appliance)

We make lots of TVs and clothes dryers, too.
Don't ask for a trade-in; you're kidding, aren't you?

Speaker 14: 4th Industrialist
(Props: Toy car)

Our new cars all change with each model year,
Don't try to repair them, the cost is much too dear.
Besides, who wants to drive a broken-down car?
It's more fun to drive shiny new ones, by far!

Be a Solid Waste Survivor – Take the Consumer Challenge
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“The Evolution of Trash”, *continued*

Speaker 15: 4th Scientist

It’s the New Think, the NEW that America craves.
So throw out all the old stuff, away to their graves.

Speaker 16: 5th Industrialist

So what if there are more of us buying more goods?
So what if they don’t decompose as they should?

**Speaker 17:
1st Native American
(Props: Headband)**

Now wait just a minute! You cannot fail
To include me in your historic trash tale.
We Natives lived simply, on prairies, in woods,
We made no high trash piles, or mass-produced goods.

**Speaker 18:
2nd Native American
(Props: Headband)**

Let me be your critic, show you where you stand;
And tell you just how you’re defiling our land.
Your new-fangled goods will not rot away.
When you throw them all down they remain where they lay.

**Speaker 19:
3rd Native American
(Props: Headband)**

Then you say you will bury them deep in the ground:
All your urban trash will make quite a mound!
So then you would burn it, in smoldering masses,
And pollute our air with smoky, harmful gases!

**Speaker 20:
4th Native American
(Props: Headband)**

Oh, all of your answers have faults everywhere:
You’ll ruin the water, the land or the air.
What’s more your resources – your minerals, your ore –
Get smaller each year than the year just before.
And what’s more – this old Earth’s not making any more!

**Speaker 21: 6th Industrialist
(Props: Cola cans)**

You’re right. Our resources are shrinking away,
While our garbage problem grows bigger each day.
We’re always converting resources to refuse
Instead of recycling them all for reuse!

(Throw out cola can)

Speaker 22: 5th Scientist

Oh, stop it! Don’t drop it! We’ll think of a way
To make food for cows that’s much better than hay.
Don’t burn it, return it– we’ll make something new,
A vase for your mother, a spyglass for you.
Don’t bury it, carry it – back to the mill.
We’ll make a new blanket to ward off the chill.

(Pick up old quilt and wrap around shoulders.)

Speaker 23: 7th Industrialist

It’s time to progress past the Disposal Age
Make REUSING and RECYCLING the popular rage!
We’ll have to give up old solutions for trash
And all realize that it’s pure balderdash – to just

All

Throw it, or bury it, or burn it to ash!
THE END

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A Trashy Pizza Bulletin Board

Adapted from Waste in Place, “Garbage Pizza”, a “Keep America Beautiful” publication

Standard	Practical Living: PL-E-3.3.2 , To protect all citizens, there are community guidelines (e.g., school inspections, trash collections, water treatment, waste treatment, animal control, immunization) that promote healthy living environments in the community.
Activity Description	Students will create a “trashy pizza” bulletin board as they learn about the amount and types of waste generated in the United States over a one-year period.
Materials	For pizza dough: red bulletin board paper and brown paper bags For Pizza sauce and toppings: glue, stapler, push pins, waste items from following categories – paper, yard waste, wood, metals, glass, food waste, plastics, and other waste (e.g., rubber, leather, textiles, inorganic waste)
Length of Lesson	Approximately one hour each on two different days
Vocabulary Words	Municipal Solid Waste (MSW): waste collected from homes, institutions (e.g., school or hospitals), commercial establishments (businesses and restaurants), and some industries, and taken to sanitary landfills. It is also known as garbage, trash, or refuse.
Essential Question	Where do the things I use come from and what happens to them when I am through with them?
Guiding Question	When I am through with the things I use, what happens to them?
Skills Used	Creativity Organization and Classification

Activity

Step 1: On the day before teaching this lesson, prepare the crust for the “trashy” pizza. Use the Municipal Solid Waste by Weight pie chart template (in sidebar) as guide to enlarge on red bulletin board paper for crust. Section off the crust into slices to represent the different percentages of waste products. Label each slice with the percentage and type of waste it represents. Use twisted, torn strips from large brown paper bags around the outside of the circle for a 3-D crust. Hang the “sliced pizza crust on a bulletin board.



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A Trashy Pizza Bulletin Board, *continued*

Step 2: Also, on the day before the lesson is to be taught, ask students to define the words “garbage” and “trash”. Remind students that another term for garbage and trash is “municipal solid waste”.

Step 3: Brainstorm with students to generate a list of waste items thrown away at home or school. Use the following categories: paper, yard waste, metals, glass, plastics, wood, food wastes, and other. Write student responses on a chart or chalkboard. Ask students if the items listed on the board could be found in a community’s municipal solid waste.

Step 4: Tell students that they will be taking home a note explaining to their parents that they will need to bring some **clean trash items** (like the ones listed on the chalkboard) to school on the following day. Explain that the items will be used in a class bulletin board project. (Either prepare a copy of the “Note to Parents”, or ask students to write the note in “Homework Journals”.)

Dear Parents,

Tomorrow we plan to use clean trash that students bring from home and turn it into a “Trashy Pizza Bulletin Board”. We will be learning about the amount of solid waste collected each year in the Municipal Solid Waste System in the United States.

Please help your child locate some **clean trash items** that would fit into the following categories: paper, yard waste, metals, glass, plastics, wood, food wastes, and “other”.

Thank you for helping us make this “trash” project a success!

Day 2

Step 1: Ask students to look at the “pizza graph” hanging on the bulletin board. Explain to students that they will be pretending that all the waste thrown away in the United States through the municipal solid waste network will fit into the pizza circle. Explain that the pizza has already been “sliced” to represent the different categories of trash that were listed on the previous day in class. Reinforce the fact that the biggest slice, marked “paper” means that more paper is discarded through MSW than any other trash item. Ask students why it is important to know the amount and kinds of waste thrown away. Explain that by knowing this information, communities can plan reusing and recycling programs (yard waste composting, telephone book recycling, school and business recycling programs) to help reduce the amount of waste thrown away, while planning better waste handling options.

Step 2: Explain that the class is going to make a “Trashy Pizza” bulletin board, using the clean trash that students brought to school. Separate the clean trash into the appropriate categories. Ask students to work cooperatively and form relay lines to pass the different trash items over to the bulletin board so they can be tacked or stapled onto the appropriate pizza slices.

Step 3: Once the trashy pizza bulletin board is completed, make student copies of the “Trashy Pizza Solid Waste Math” sheet located at the end of this lesson. Instruct students to answer the questions by using the municipal solid waste graph generated by the Environmental Protection Agency for the year 1998.

Be a Solid Waste Survivor – Take the Consumer Challenge Intermediate

A Trashy Pizza Bulletin Board, *continued*

Step 4: Check student work by referring to the following answers:

1. Paper and Cardboard; Yard Trimmings; Plastics; Food Scraps; Metal; Rubber, Leather and Textiles; Glass; Wood; and Other)
2. 220.2 million tons
3. 135.8 million tons
4. 50.65 million tons
5. 33.75 million tons

Step 5: Encourage students to think of ways to inform other students and the community about the importance of reusing and recycling solid waste. Encourage them to include the message that by reusing and reducing solid waste the sanitary landfills would end up with significantly smaller amount of solid waste to have to manage.

Assessment

Instruct students to write a “Letter to the Editor” of a local newspaper persuading members of the community to reduce the amount of solid waste sent to landfills by recycling and reusing waste items in homes and businesses. Remind students to include facts to support the need for reducing waste.

Extensions

- If a bulletin board is available in a prominent place in your school, you may wish to duplicate this activity on that bulletin board so the information can be shared with the entire school population.
- Plan a classroom recycling project to reduce the amount of waste thrown away each day. If there is not a school wide recycling program in place, investigate starting one.
- Research steps involved in building a compost bin by looking in books or visiting an Internet search tool such as “Google.com”. Send information home by students and encourage them to begin a composting project at home. Investigate starting a composting project at school if there is not one in place.
- Visit the following web site to view art created by 4th and 5th grade students reusing trash: http://www.northcoast.com/~fishhelp/gallery_f/sunset/jones/index.html.

Trashy Pizza Solid Waste Math

Name _____

Date _____

The graph shown on this page depicts an estimate of the amount of solid waste taken to landfills in the United States in 1998. Use the Municipal Solid Waste Composition graph to answer the questions in your math journal, or on another sheet of paper.



1. Order the types of solid waste that entered the municipal solid waste stream in the United States in 1998 from largest to smallest.
2. Add the total tonnage of solid waste represented on the graph to calculate the total amount of solid waste that entered the municipal solid waste stream in the United States in 1998.
3. If all the paper and cardboard, glass, plastic, and metals had been recycled, how many tons of solid waste could have been kept from entering the municipal solid waste stream in the United States in 1998?
4. If all of the yard trimmings and half of the food scraps had been composted, how many tons of solid waste could have been kept from entering the municipal solid waste stream in the United States in 1998?
5. If there had been 100 percent participation in recycling and composting programs in the United States in 1998, how many tons of solid waste would have been taken to landfills? How much less is this amount than the amount calculated in problem number 2?

Be a Solid Waste Survivor – Take the Consumer Challenge
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Follow the Solid Waste Trail

Adapted from “Bio-Bottles”, from Waste a Hidden Resource in Kentucky

Standards	<p>Practical Living: PL-E-3.3.2, To protect all citizens, there are community guidelines (e.g., school inspections, trash collections, water treatment, waste treatment, animal control, immunization) that promote healthy living environments in the community.</p> <p>Practical Living PL-E-3.1.5, Environmental issues (e.g., pollution) should be considered when making consumer decisions (e.g., recycling, reducing, reusing)</p>
Activity Description	Students will investigate and learn about the importance of purchasing reusable and recyclable products by building a compost and landfill model.
Materials	Trash left over from “Trashy Pizza” lesson, if still available Tape and permanent markers Scissors or utility knife to cut plastic bottles Soil Device for making holes in plastic bottle (hole puncher) Two clean 2-liter plastic bottles per student Copies of “Bio-Bottles” for each student
Length of Lesson	Two class periods (30-60 minutes) plus 2 or 3 months to observe
Vocabulary Words	<p><u>Sanitary Landfill:</u> a site where solid waste is managed in order to prevent or minimize health, safety and environmental impacts.</p> <p><u>Composting:</u> the controlled biological decomposition of organic material under aerobic (with oxygen as in a composting bin) or anaerobic (without oxygen as in a landfill) conditions.</p> <p><u>Biodegradable:</u> a term describing an organic substance or material (e.g., paper, grass clippings, food scraps) that can decompose into basic components by bacteria or sunlight.</p> <p><u>Non-biodegradable:</u> an inorganic substance or material that cannot decompose.</p>
Essential Question	Where do the things I use come from and what happens to them when I am through with them?
Guiding Question	When I am through with the things I use, what happens to them?
Skills Used	Reading and Following Directions Conducting a Scientific Investigation Organizing Data and Reporting Results

Be a Solid Waste Survivor – Take the Consumer Challenge Intermediate

Follow the Solid Waste Trail, *continued*

Activity

Step 1: Explain to students that nothing is wasted in nature, because all natural waste is biodegradable, which means it can decompose so it can be fed back into the system. (For more background information, refer to **Teacher Fact Sheets**, “composting” section, located at the front of this publication.) Explain to students that if we (humans) would copy what takes place in the natural environment, then the amount of waste sent to landfills could be drastically reduced. We would also produce a valuable resource that could be used in flowerbeds and yards (composted material).

Step 2: Explain to students that during this lesson they will investigate the decomposition of biodegradable and non-biodegradable materials in a composting bin as compared to a landfill. Write biodegradable and non-biodegradable on a chalkboard or chart. Explain the definitions of each. Ask students to think of examples of materials or products for each category. Encourage students to think of items in several categories, such as food items, yard waste, plastic, glass, rubber products, clothing, etc. List the examples.

Step 3: Ask students to select and gather several items from each category that they have available at home. Ask students to bring the items to school the following day. Either prepare a note to be sent home, or have students write the note in “Homework Journals”. *If you would prefer, use items left from “Trashy Pizza” lesson.*

Step 4: Divide students into teams of four students each. Give each team copies of the student page “Bio-Bottles” (included at end of this lesson), and the materials to make four bottles per team. Ask teams to complete the instructions for the two Bio-Bottle models. (Since it takes two 2-liter bottles to make one Bio-Bottle, each team will end up with two compost bottles and two landfill bottles.) Remind students to label each model as “Compost” or “Landfill”, using permanent markers.

Step 5: Ask each team to predict the outcome of the investigation. For example: What can we expect to see happening inside the different models? Will biodegradables decompose? How long will it take? Will all compost models decompose at the same rate? Why or why not? What factors are different in

Step 5, (continued): the bottles? (number of air holes and microorganisms, which need air and moisture to live)

Step 6: Ask each team to prepare a chart for recording observations: changes in composition, color, size of mass, etc., each week for a period of time (e.g., two or three months). Help teams develop a format if they have trouble completing this step.

Step 7: At the end of this investigation (Use teacher discretion on when to end.) have each team compare results between their Bio-Bottles, then between Bio-Bottles from other teams. Ask students to observe the sealed landfill bottles. What conclusions can they draw about the practice of burying biodegradables in a sealed, sanitary landfill? As consumers, what should you do with your waste products? (**REDUCE, REUSE, RECYCLE! AND RESPOND TO SOLID WASTE DISPOSAL IN A POSITIVE MANNER**)

Assessment

Give each team the opportunity to assess themselves, as a team, by completing a group paper describing what they learned from conducting this investigation, and how their consumer habits have changed.

Extensions

- ◆ Present “Luscious Layered Landfill” activity from primary “Solid Waste Survivor” unit for a tasty “visual” landfill lesson.
- ◆ Make posters or infomercials to share with school and community about the importance of buying reusable and recyclable products so landfills will not fill up so quickly.
- ◆ Have students investigate landfill information and issues on the WebQuest Internet Site:
<http://www.lalc.k12.ca.us/uclasp/ISSUES/landfills/solid1.html>

Bio-Bottles

Biodegradable Versus Nonbiodegradable

Objectives:

Students will do the following:

1. Investigate differences in decomposition between biodegradables and nonbiodegradables.
2. Prepare a chart to record observations.
3. Draw conclusions about disposal of biodegradable materials and products.

Subjects:

Social Studies and Science

Time:

2 class periods, plus 2 or 3 months of observation

Materials:

Cellophane tape, scissors, markers, soil, device for making holes in plastic bottle (warm ice pick, hole puncher, knife blade, or other device); each student brings two clean 2-liter plastic bottles and one item per instructions in Section A; student page (included)

Vocabulary:

biodegradable a term describing a substance or material that can be broken down into simpler compounds by microorganisms

nonbiodegradable not capable of being broken down by microorganisms

Background

In nature, there is no waste. Everything is fed back into the system. Unlike nature, we try to dispose of as much solid waste as possible, including biodegradables. But if we would try to imitate nature by feeding biodegradables back into the system, we would not only reduce the amount of waste hauled to the landfill, but we would also gain a valuable resource!

Procedure

Help students investigate the decomposition of biodegradable materials and nonbiodegradable materials.

A. As a class, write a definition for **biodegradable** and **nonbiodegradable**.

1. Have the class list examples of materials or products for each category. Encourage students to list items in several categories, such as food items, yard waste, and manufactured products, etc.

2. Ask students to select and gather several readily-available items from each category. (Suggestions: carrots, leaves or grass, newspaper)

B. Make Bio-Bottles for investigating differences in decomposition for biodegradables and nonbiodegradables.

1. Divide the class into teams of four students each. Give each team a copy of the student page "Bio-Bottles" (included) and the materials to make two bottles. Ask them to complete the instructions for the two comparisons.

2. Ask each team to predict the outcome of the investigation, for ex-

ample: *How long will it take for the biodegradables to decompose? Will they all take the same length of time? Will the size of an item affect the rate of decomposition? Why? How?*

3. *Will biodegradables in bottles #1 and #3 decompose the same? Why or why not? What factors are different in the two bottles (air and microorganisms, which need air and moisture to live)*

C. Have each team prepare a chart for recording observations: changes in composition, color, size of mass, etc., each week for a period of time (e.g., two or three months).

1. At the end of the period of investigation, have each team compare results between their own two bottles.

2. Have all teams compare their Bottles A. Compare Bottles B. *Were results consistent? If not, what might account for the differences?*

3. *If the sealed containers simulate sealed landfills, what conclusion can you draw about the practice of burying biodegradables in a sealed, sanitary landfill?*

4. *How would you design the investigation differently?*

5. *What else could you investigate about biodegradables and nonbiodegradables? How would you reconfigure the bottles to investigate other differences between biodegradables and nonbiodegradables?*

6. Prepare an educational display and share with other classes.

Be a Solid Waste Survivor – Take the Consumer Challenge
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Preferable Picnic Planning

Standards

Social Studies: SS-E-3.1.3, Every time a choice is made, an opportunity cost is incurred. **Opportunity cost** refers to what is given up when an economic choice is made.

Practical Living PL-E-3.1.5, Environmental issues (e.g., pollution) should be considered when making consumer decisions (e.g., recycling, reducing, reusing)

Activity Description

Students will plan an ecological picnic. They will evaluate the products that will be used at the picnic and plan for the least amount of solid waste disposal.

Materials

Lunch
Durable or reusable plates, silverware, cups, napkins, etc.
Garbage can and a container for recyclable items
Food waste container, if your school composts large scale

Length of Lesson

30 minutes first day and one hour second day

Vocabulary Words

Source Reduction: the reuse of products or materials in order to reduce the amount of municipal solid waste.

Durable: products that can be used more than once and can withstand long use, wear, and decay.

Disposable: products that can be or are usually thrown away after one use or a limited amount of time (e.g., paper plates and cups).

Essential Question

How do I evaluate the choices I make as a consumer in order to reduce the amount of solid waste I produce?

Guiding Question

How can I identify and apply criteria to making my decisions?
(e.g., cost, media and peer pressure, convenience, environmental impact, health and safety)

Skills Used

Communication and Problem Solving
Observation and Classification

Activity

Step 1: Prior to the day of this lesson, select a picnic location, preferably outside, with an inside area as a back-up plan in case of bad weather. Locate and label three containers for recyclable items, garbage and food scraps (that can be composted). Check with the cafeteria manager to see if a bag lunch can be provided for students who forget or are unable to bring lunches from home. Prepare note to parents about the picnic.



Be a Solid Waste Survivor – Take the Consumer Challenge Intermediate

Preferable Picnic Planning, *continued*

Step 2: Explain to students that they are going to help plan a picnic so they can learn how to create less garbage, recycle more, and compost their leftover food items. Introduce the concepts of durable, disposable and source reduction to the class. (Refer to Teacher Fact Sheets, under “Source Reduction” for background information.)

Step 3: Ask students to help compile a list of items that people usually bring to a picnic (e.g., paper plates, plastic utensils, paper napkins, chips, canned or bottled drinks, etc.). Write the items on the chalkboard. Once the list is completed, go back over each item and try to substitute a different item to use in place of the disposable items. Examples might include cloth napkins for paper napkins and silverware for plastic utensils. Also, talk about the importance of buying in bulk, since this will decrease the amount of packaging to throw away at the end of the picnic. For example, large bags of chips are preferable to small individual bags and large jars of juice are preferable to individual juice boxes.

Step 4: Send a note home to parents explaining the picnic. Tell parents that students are trying to keep waste to a minimum so the lunch items need to be placed in reusable containers or contain only a small amount of extra packaging, if possible. Parents could be invited to help as volunteers, or to just enjoy a school lunch with their children. (Refer to sample note on this page.) Encourage students to explain to parents what they have learned about source reduction when they take the picnic note home.

PICNIC / PICNIC / PICNIC / PICNIC / PICNIC

Dear Parents,

We are planning an “environmentally friendly” picnic. The picnic will be taking place this Wednesday at 11:30 A.M. We have an outside spot picked out for our picnic if the weather is nice, and an inside spot located if the weather does not cooperate.

As we continue to learn about ways to be solid waste survivors at school, we are developing strategies to use to help us reduce the amount of solid waste we put in trashcans. Your child will be using some of these strategies as he or she helps pack the lunch to bring to school for this picnic.

Please encourage your child to find reusable containers to pack lunch items in so we do not have a significant amount of garbage at the end of our picnic.

We would like to invite you to join us for our picnic, if you are free on the day we have the picnic scheduled. If you can picnic with us, please send a return note to let us know to expect you. It will work nicely if you can plan to meet us by the office at 11:30 A.M. after you sign in and obtain a visitors' badge.

We hope many of you will be able to attend the picnic. It should be lots of fun!

Sincerely,

Day 2

Step 1: On the day of the picnic, draw a table on the chalkboard, or a piece of chart paper, similar to the one on the following page. Tell students that at the end of the picnic, they will be weighing any trash, food scraps, or recyclable items that are thrown away. (Show the students the three containers that will be used for any solid waste items.)



Step 2: Ask students to predict how many pounds of solid waste they think will be left over in each of the containers at the end of the picnic. Record the guesses of each student in the FIRST row.

Step 3: Weigh each of the containers and record that weight in the THIRD row of the table.

Step 4: Go to the picnic site and have fun! Take the three containers along so students will be able to separate any solid waste items left over at the end of the meal.

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Preferable Picnic Planning, *continued*

Step 5: As students (and parents) finish eating, instruct them to separate any solid waste items that need to be disposed of into the appropriate containers. Have students look at the garbage and discuss ways the amount could have been reduced.

Step 6: Return to the classroom with the students and the three containers of solid waste items to be recycled, disposed of or composted. Weigh the three containers and write the amount in row TWO on the table. Subtract the amount in row THREE (the empty containers) from the amount in row TWO (the containers holding solid waste) to calculate the weight of each of the three types of solid waste. Record the total weight in row FOUR. Discuss how close the predictions were to the real totals. Ask students to think about, and discuss, what would happen if the whole school, or even everybody in America, practiced source reduction as they did for the picnic!

Assessment

Journal

Tell students to think about a disposable item they or their family use regularly. Are there other things that could be used that would create less waste? Would they, or their family, be willing to switch products or change their lifestyles to produce less waste and have less impact on the environment?

Ask students to reflect on why people use disposable items even if they know they make more garbage.

Extensions

1. Collect and weigh leftover lunch garbage on an unannounced day, using the same method as in this lesson. Compare and discuss results.
2. Make fun lunch bags out of old jeans or shorts. Cut off the legs, sew the bottom of the bag just under the pockets, and tie thick ribbon onto the belt loops for handles. Decorate the bag with fabric paint and a variety of other craft items.

Environmentally Friendly Picnic Trash Table

	Recyclables	Food Scraps	Trash	Total
GUESSES				
Actual Weight (with container)				
Subtract Weight of Empty Container				
Total of Each				

Be a Solid Waste Survivor – Take the Consumer Challenge
Intermediate

Inspecting Products

Standards

Social Studies: SS-E-3.4.1, Producers create goods and services; consumers make economic choices about which ones to purchase.

Practical Living: PL-E-3.1.2, Products and services are compared and evaluated based on price, quality, and features.

Activity Description

Students will learn about common marketing techniques and how companies use those techniques to try to persuade consumers to purchase their products. They will also evaluate advertisements, and compare and evaluate similar products.

Materials

Copies of “Product Inspection Guide” for students
Transparency of “Product Inspection Guide” for teacher
Samples of popular product advertisements from magazines
Overhead projector and markers
Class set of “Common Marketing Techniques” at end of this lesson
Two similar products made by different companies

Length of Lesson

Approximately one hour on three different days

Vocabulary Words

Environmentally Preferred Product: an item that has a reduced negative effect on human health and the environment when compared to other products that serve the same purpose. (E.g., products that contain recycled content require less energy or create less waste)

Packaging: a cover, wrapper, container, or “stuffing” in a package designed to store, transport, display, and protect a product and/or attract consumers so they will purchase the item.

Marketing Techniques: techniques used to inform, influence, or persuade consumers to purchase products or services.

Consumer Demand: the persuasive power the buyer has over the manufacturers by choosing to buy certain products more than others.

Durable: products that can be used more than once and can withstand long use, wear and decay.

Essential Question

What process should I use to evaluate the choices I make as a consumer in order to reduce the amount of solid waste I produce?

Guiding Question

How can I identify and apply criteria to making my decisions? (E.g., cost, media and peer pressure, convenience, environmental impact, health and safety.)

Skills Used

Communication and Problem Solving
Writing
Observing, Comparing and Classifying

Be a Solid Waste Survivor – Take the Consumer Challenge Intermediate

Inspecting Products, *continued*

Activity

Step 1: Explain to students the difference between a producer (one who makes products) and a consumer (one who buys, or uses, the products). Tell students that this lesson is going to focus on teaching each of them how to become wiser consumers so they can make better-informed choices that will help them protect the environment.

Step 2: Explain to students that manufacturers sometimes use special “gimmicks”, or strategies, to try to persuade consumers to purchase their products. Ask students if they know of any special techniques used in advertisements or television commercials. Distribute copies of “Common Marketing Techniques” to all students. Read one strategy at a time, then discuss the technique. Show students several advertisements from magazines. Instruct students to match the advertisements with the appropriate marketing technique used.

Step 3: Call on students to give examples of well-known products, whose companies use the different marketing techniques in advertisements for the product. Encourage students to think about each technique carefully, and try to analyze why they think companies pay advertising firms to create and develop the different types of advertisements. Help students understand that consumer demand is what drives companies to “stretch the truth” many times.

Step 4: Continue with this activity until all students have had an opportunity to actively participate. Keep reminding students that they must learn to distinguish fact from fiction when shopping, or when watching or reading advertisements about popular products. Ask students if they can offer any advice on what they might be able to do to become wiser consumers, now they have been introduced to the common marketing techniques used by companies. (Answers should include to do more research, ask people who own the product, check out product rating reports, etc.) Encourage students to take home the copy of “Common Marketing Techniques” to share with parents. Instruct students to watch television commercials at home with other family members and observe closely to try to find any of the specific techniques being used. Ask students to make brief notes beside each technique they see used so they will remember the product’s name to share with the class on the following day.

Day 2

Step 1: Briefly review the activity from the previous day. Encourage students to share any advertisements they watched on television at home the night before with classmates.

Step 2: Ask students if they have ever bought a product after seeing an advertisement or commercial, then been disappointed because the product was not what they expected it to be. Tell students that, in order to be wise consumers, they need to examine products closely, and establish certain criteria, or guidelines, to help them purchase more dependable, better products. Show students a copy of the “Product Inspection Guide” that is found at the end of this lesson. Explain how this guide could help consumers focus on specific aspects of different products when making comparisons. (Make a transparency of the “Product Inspection Guide” and use it on an overhead projector. This will help students see the form clearly as two products are being compared in Step 4.)

Step 3: Show students two of the same type of items, made by different companies. (E.g., shoes, toy cars, hardback books, dishtowels, or clothing). With help from students, examine the two items closely. Complete the “Product Inspection Guide” on the overhead projector as the comparison is being made.

Step 4: Tell students they will have a chance to be “Product Detectives”. Explain that they will each receive a copy of the “Product Inspection Guide” to take home with them. They will ask parents to take them to a store so they can choose two similar products made by two different companies to compare. Assign a reasonable date for the assignment to be parents to take them to a store so they can choose two similar products made by two different companies to compare. Assign a reasonable date for the assignment to be returned to school. (Remember to be sensitive to any students who are unable to visit a store to complete this assignment. Provide some products for them to investigate at school. Be available to help if needed.)

Be a Solid Waste Survivor – Take the Consumer Challenge Intermediate

Inspecting Products, *continued*

Day 3

Step 1: Once homework assignments are completed and returned, ask students to report on their findings.

Step 2: Encourage students to remember to always be wise consumers, and think about buying products made from recycled materials, products that can be reused or recycled, and products that will last a long time.

Extensions

1. Bring in a variety of magazines and catalogues that contain advertisements for students to analyze. Can they find different advertising techniques being used several times in different ads?
2. Ask students to watch television commercials and list different techniques used to try to “hook” the consumer into buying a certain product.
3. Remind students that they can prevent their belongings from entering the waste stream so quickly by taking care of them and buying durable products.
4. Make copies of Consumer Reports and Zillions available for students to read.

Assessment

Ask students to write a “How to Be a Wise Consumer” article, describing steps they will use in the future when preparing to purchase a product.

Remind students to think about the common marketing techniques and the criteria listed on the “Product Investigation Guide”, that they used during the lesson, “Investigating Products”. (This might help them remember some of the things they looked for when comparing the two different products.)

Encourage students to include environmental criteria, as well, to remember when shopping for products.

Common Marketing Techniques

- **Bandwagon Appeal**: Advertisers use this appeal to convince people that everyone is using their product and that he or she should too. These ads say, “jump on the bandwagon and have a good time.”
- **Brand Loyalty Appeal**: Advertisers use this appeal to convince consumers that their brand is better than the rest.
- **False Image Appeal**: Advertisers use false or misleading information (models or professional athletes) to convince a person that he or she will have a specific image if they buy a specific product or service.
- **Glittering Generality**: Advertisers include a general statement that is exaggerated appeal. Mostly the ads are designed to appeal to people with specific concerns. (E.g., “clears up all acne”)
- **Humor Appeal**: This appeal uses a catchy slogan, jingle, or cartoon.
- **Progress Appeal**: Advertisers use this appeal when they introduce a product that is new and improved. It implies that their product is one step ahead of the rest.
- **Reward Appeal**: This type of advertising appeal offers a special prize, gift, or coupon when a specific product or service is purchased.
- **Scientific Evidence**: This type of advertisement includes the results of surveys, or laboratory tests. The advertisement is designed to make people feel that they are making the right choice.
- **Sex Appeal**: Advertisers use this appeal to convince the consumer that people will find him or her irresistible if he or she uses their specific product.
- **Testimonial Appeal**: Advertisers focus on a famous person who gives a statement about a specific product or service.



Product Inspection Guide

Name: _____ Date _____

Name of Product #1: _____ Manufactured by: _____

Name of Product #2: _____ Manufactured by: _____

<u>Cost and What I Get</u> Product #1	<u>What I Like About It</u>	<u>What I Don't Like About It</u>	<u>What Resources Were Used?</u> <u>(Virgin or Recycled Materials)</u>
Product #2			

<u>Will it Last a Long Time</u> Product #1	<u>Can it be reused? How?</u> <u>(Or will it become Waste?)</u>	<u>Rate the Packaging</u>	<u>Is It Environmentally Friendly?</u> <u>Was Excessive Packaging Used?</u>
Product #2			

Directions to Student: Take this form to a store and use it to compare two similar products manufactured by two different companies. Remember to be a good Environmental Detective and inspect the products very closely. Remember to read all labeling very carefully, including the very small print. Use the back of this paper if you need more room. Return your completed inspection guide to school by _____.

(Date)

**Be a Solid Waste Survivor – Take the Consumer Challenge
Intermediate**

Making Wise Buys

Adapted from “Let’s Go Eco-Shopping!” from Quest for Less, an EPA Publication

Standard

Social Studies: SS-E-3.4.1, Producers create goods and services; consumers make economic choices about which ones to purchase.

Practical Living: PL-E-3.1.2, Products and services are compared and evaluated based on price, quality, and features.

Activity Description

Students will research and evaluate school supplies and determine which products are the most ecologically friendly.

Materials

Copies of “Product Inspection Guide” for students
Transparency of “Product Inspection Guide” for teacher
Overhead projector and markers
Five home products with environmental claims on packaging
Five or six packaged school products from book store with environmental claims

Length of Lesson

Approximately one to two hours

Vocabulary Words

Environmentally Preferable Products: products that have a reduced effect on human health and the environment when compared to other products that serve the same purpose. For example, products that contain recycled content, use less packaging, are reusable or recyclable, and require less energy or create less waste during production and manufacture are preferable.

Post-consumer Recycled Content: materials recovered through recycling programs, that are used to make new products.

Essential Question

Where do the things I use come from and what happens to them when I am through with them?

Guiding Questions

How do my decisions as a consumer have consequences for other organisms, including humans, in our environment?

Skills Used

Problem solving
Communication
Research
Observing and classification

Activity

Step 1: Set out the five products brought in from home with environmental claims on the labeling. List their claims on the chalkboard and discuss with students. (Refer to **Teacher Fact Sheets** titled **Recycling** at the front of this publication for more information.)

**Laundry Detergent Environmental
Attribute Claims**

- ◆ 100% post-consumer recycled paperboard used in box
- ◆ 100% post-consumer recycled plastic used in scoop

Be a Solid Waste Survivor – Take the Consumer Challenge Intermediate

Making Wise Buys, *continued*

Step 2: Discuss practices used in product manufacturing industries with students after reading background information in “Products” section of **Teacher Fact Sheets**. Discuss how important it is for manufacturers to change their practices. For example, McDonald’s reduced its napkin size by one inch in 1999. This prevented 12 million pounds of paper from being thrown away. Since 1977, the soft drink industry has reduced the weight of the 2-liter plastic bottles from 68 to 51 grams each. That has kept 250 million pounds of plastic per year out of the municipal solid waste stream. (Source, EPA, 1996, 1999)

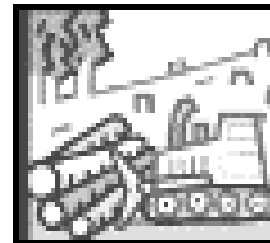


Step 3: Divide students into groups of four or five. Explain that they are going to be checking different school supplies for environmental claims (e.g., binders with recovered-content plastic coating, pencils with recovered-content wood, spiral notebooks with post-consumer content}. Give each group a copy of the Product Inspection worksheet. Ask students to fill a sheet out on each product, then compare their research findings after all products have been investigated. Ask each group to pick one brand that they think represents the most environmentally preferred product.



Step 4: When all groups have prepared their report, ask each group to take turns making class presentations. Group members should all be prepared to defend the product the team has selected by telling specifically what it is about the product that makes it environmentally preferable. During each presentation, offer time for group discussion and feedback from other students.

Check out this Recycled-Content Product Database:
<http://www.greenbiz.com/frame/1.cfm?targetsite=http://www.ciwmb.ca.gov/RCP>



**Be a Solid Waste Survivor – Take the Consumer Challenge
Intermediate**

The Ultimate Enviro-Product Design

A Culminating Performance Task

Standards

- ◆ Practical Living: PL-E-3.1.2
- ◆ Practical Living: PL-E-3.1.5
- ◆ Practical Living: PL-E-3.3.2
- ◆ Science: SC-E-2.1.2
- ◆ Science: SC-E-3.3.3
- ◆ Social Studies: SS-E-3.1.1
- ◆ Social Studies: SS-E-3.1.3
- ◆ Social Studies: SS-E-3.4.1

Activity Description

Students will design and mass-produce an environmentally preferable product made from reusable solid waste. The product will be evaluated based on its durability, the use of recycled materials, its usefulness and if it is environmentally friendly. (Teachers may wish to do this in small groups).

Materials

A note to parents explaining the project
A collection of containers and “junk” that could be reused

Length of Lesson

About one hour on two different days

Essential Questions

- ◆ **How do my family and I depend on the resources in our community and our world?**
- ◆ **How do my choices about what I buy and use affect the environment?**
- ◆ **What process should I use to evaluate the choices I make as a consumer in order to reduce the amount of solid waste I produce?**

Guiding Question

- ◆ What natural resources are needed to make the things I use, and are those resources renewable or nonrenewable?
- ◆ When I am through with the things I use, what happens to them?
- ◆ As a consumer, what can I do to help the environment?
- ◆ What is an environmental cost?
- ◆ What is the difference between wants and needs?
- ◆ How can I identify and apply criteria to making my decisions? (E.g., cost, media and peer pressure, convenience, environmental impact, health and safety)

Skills Used

Creativity and Problem Solving
Writing and Communication

Activity

Step 1: Although this activity is the culminating performance task for this unit, students need to be told about it **at least** one week in advance, and maybe even earlier. They will need time to think of a product to make to sell at the Enviro-Market, and time to save materials to reuse.



Be a Solid Waste Survivor – Take the Consumer Challenge Intermediate

The Ultimate Enviro-Product Design, *continued*

NOTE: It is recommended that the written explanation of the design of the Enviro-Product be done in class, with the manufacturing process taking place at home. It is fine for students to discuss product ideas with family members, because this is a way to get more people to think and talk about source reduction, and the reuse of solid waste items, instead of throwing them away.

Step 2: Review the concepts covered in this unit by asking students to take out their learning journals and jot down five to ten ideas that stand out most in their minds from the “Solid Waste Survivor” unit of study. Give students about five minutes to complete this initial activity, then call on students to share their ideas. Write the ideas on the chalkboard or chart paper as students share them.

Step 3: If not covered in Step 2, remind students that solid waste becomes trash once we throw it away, and it enters the municipal solid waste stream, and has to be disposed of in a sanitary landfill. Emphasize that many of the items that end up in landfills each day could be reused or recycled. Tell students that they will have an opportunity to reuse solid waste items to make an ultimate environmentally friendly product to sell to classmates at the class Enviro-Market.

Step 4: Explain to students that each enviro-product made to sell at the Enviro-Market will be priced according to how environmentally friendly the product is. Classmates will then have an opportunity to buy each other’s products with the Enviro-Bucks earned during this “Solid Waste Survivor” unit.

Explain that each student will receive a set of guidelines to use when designing the ultimate enviro-friendly product. Tell students that it is very important that they follow the design specifications because their final grade will depend on how well they follow the guidelines. Tell students that their product might cost too much for other students to buy if it is not made from recycled materials, or is not environmentally friendly.

Step 5: Tell students that they will be taking a note home explaining the ultimate enviro-product activity to their parents. Explain that the note will also give parents information about how they can help by beginning to save items that might be useful when making the product. Tell students that there are even some web sites listed in the note that they may wish to visit, because there are some great ways to reuse solid waste items listed at the sites. (Personally check these web sites to make sure they are still active before including them in the letter at the end of this unit.)

Step 6: Send home a parent note and rubric sheet that is found at the end of this activity. Encourage students to begin thinking about their product, rather than waiting until right before it is due back at school, since they will have to mass-produce the product.

Product Design Day – One Week Later

Step 1: Ask students to take out their writing journals and a pencil. Explain that they have had at least one week to think about a design for their ultimate environmentally friendly product. Instruct students to draw a picture of the product they plan to manufacture and sell at the Enviro-Market. Instruct students to include a detailed list of the materials used to make their product, how the product is to be used, if it is durable, and if they will be able to make a class set of the product. (Refer to the design rubric at the bottom of the parent note, located at the end of this activity.)

Step 2: Assign a date for the class set of the ultimate enviro-products to be brought to school. This deadline should be set a day or two before the Enviro-Market date so there is time to evaluate and price each product.

Step 3: Assessment for this activity will take place when the enviro-products are brought to school.



Dear Parents,

We are about to prepare for the final activity of our “Solid Waste Survivor” unit of study. You can help your son or daughter at home by saving containers, scraps of ribbon or yarn, Popsicle sticks, cardboard, or any other type of solid waste items that might be reused to create an environmentally friendly product. The product needs to be something that can be mass-produced so it can be sold to classmates in our “Enviro-Market” on _____. I hope that by sending this note home at this early date, you will have enough time to save a variety of containers and other items that will be helpful.

Your child will be asked to write a description of what the environmentally friendly product is, the materials used to make the product and why it is good for the environment in class on _____. I have included a design rubric with this letter, so your child will know specifically how his or her product will be graded.

There are some Internet web sites listed below that you may wish to visit with your child to search for ideas of environmentally friendly products to make from recycled materials. Craft magazines or books may also have some useful ideas.

- ❖ <http://familycrafts.about.com/library/trcrafts/blmilktrt.htm?once=true&>
- ❖ <http://www.thefrugallife.com/milk1.htm>
- ❖ <http://www.geocities.com/Athens/Forum/8424/20uses/index.html>

I hope you and your child have fun thinking about ideas for the ultimate enviro-product made from recycled materials.

Once again, thank you so much for the home support needed to make our school projects such a success!

Sincerely,

**Design Rubric for Intermediate Unit Culminating Project
“Designing the Ultimate Enviro-Friendly Product”**

1. The product has been made completely from recycled items.
2. The product will benefit instead of harming the environment. (Student must be able to explain the benefits in writing as part of the design plan.)
3. The product is durable and will last for a long time.
4. The product will be used by others instead of becoming municipal solid waste.
5. The product can be mass-produced in order to have enough for each of my classmates.



Be a Solid Waste Survivor – Take the Consumer Challenge
Intermediate

Marketing Enviro-Products

Standard	Practical Living: PL-E-3.1.2, Products and services are compared and evaluated based on price, quality, and features. Social Studies: SS-E-3.4.1, Producers create goods and services, consumers make economic choices about which ones to purchase.
Activity Description	Students will prepare their ultimate enviro-products to sell at the Enviro-Market by creating advertisement slogans, commercials, jingles and posters
Materials	A variety of colors and sizes of paper Pencils, markers or poster-paint Magazines and newspapers to use for advertisement ideas Tape player and cassettes for recording songs, if needed
Length of Lesson	About two hours
Vocabulary Words	Marketing Techniques: techniques used to inform, influence, or persuade consumers to purchase products or services.
Essential Question	What process should I use to evaluate the choices I make as a consumer in order to reduce the amount of solid waste I produce?
Guiding Question	How do I make the best choices about what to buy?
Skills Used	Creative Writing Artistic Design

Activity

NOTE: This activity should be presented after “Inspecting Products” and “The Ultimate Enviro-Product” lessons. This activity will reinforce the advertising strategies that were introduced in earlier activities.

Step 1: Once students have developed the design for their “Enviro-Product” and are nearing the end of production, explain that it is time to prepare to market the product. Tell students that during this activity, they will use the marketing techniques they were introduced to in the “Inspecting Products” lesson. Review the different techniques with students. (For definitions of the marketing techniques, refer to the “Inspecting Products” activity in this unit.)

Common Marketing Techniques

- ◆ **Bandwagon Appeal**
- ◆ **Brand Loyalty Appeal**
- ◆ **False Image Appeal**
- ◆ **Glittering Generality**
- ◆ **Humor Appeal**
- ◆ **Progress Appeal**
- ◆ **Reward Appeal**
- ◆ **Scientific Evidence**
- ◆ **Sex Appeal**
- ◆ **Testimonial Appeal**

Be a Solid Waste Survivor – Take the Consumer Challenge Intermediate

Marketing Enviro-Products, *continued*

Step 2: Remind students of the different products and advertisements they analyzed earlier in this unit, if those activities were taught. Ask students to jot down some ideas they think would be strong selling points for the product they have designed to sell at the class Enviro-Market. Explain that one of the best “hooks” that will attract consumers is a catchy name for their product. Encourage students to try to think of several names so they have a variety from which to choose the final name. Also, encourage students to stress the environmentally friendly attributes of their product. Remind students to include the concepts of **REDUCE, REUSE and RECYCLE** in their advertisement and marketing strategies, if possible. (Have newspapers and magazines available for students to use as resources for advertisement ideas, if needed.)

Step 3: Tell students that they will not have the advantages of advertising their Enviro-Product on television, radio or in magazines. They will be able to create posters, banners, handouts, slogans, jingles, or any other strategy they can think of to help get other students interested in purchasing their product at the Enviro-Market.

Step 4: Give students an opportunity to peer conference and share some of their advertising ideas with each other, once the pre-planning stage is completed. Encourage students to offer positive feedback on the strong points of the advertising ideas, as well as suggestions of ways to make the advertisements more powerful selling tools.

Step 5: Have a variety of art supplies available for students to use, once they decide on some advertising designs. Also, encourage students to try to develop some jingles to go with their enviro-products by reminding students of some of the more popular products that are easily identifiable because of the songs. Have tape players and blank cassettes available for students to record their advertising jingles, if needed. Give students in-class time to create their advertising materials, if possible.

Step 6: If there are any available display cases in your school building, or counter space in your classroom, let students set up product displays with some of their created advertising materials prior to Enviro-Market Day. Store the remaining advertising materials created by the students in a secure location until the day of the Enviro-Market activity. (Also, remind students to gather and organize their Enviro-Bucks so they will be ready to purchase products at the Enviro-Market!)

Assessment

Ask students to personally evaluate how effective they think their advertisement campaign is going to be to help sell their enviro-product. Instruct students to include the common marketing techniques they included to help sell their product.

Extensions for the Teacher

1. If you have not already done so, begin soliciting Parent Volunteers to help supervise Enviro-Market Day. Parents can be invaluable assistants to students who might need help setting up their displays. Parents can also help sell products while the product inventors (students) go shopping.
2. Set a date for the Enviro-Market activity, and invite news media to cover the event.

**Be a Solid Waste Survivor – Take the Consumer Challenge
Intermediate**

The Enviro-Market – A Culminating Event

Standard	<p>Practical Living: PL-E-3.1.2, Products and services are compared and evaluated based on price, quality, and features.</p> <p>Social Studies: SS-E-3.4.1, Producers create goods and services, consumers make economic choices about which ones to purchase.</p>
Activity Description	<p>In this final activity students will sell their enviro-products made from recyclable items. The enviro-products will be priced according to how environmentally preferable they are. For example, items that are harmful to the environment will cost much more than items that are environmentally friendly.</p>
Materials	<p>Student products that have been mass-produced Student advertisements Collected Enviro-Bucks</p>
Length of Lesson	<p>About two hours</p>
Essential Question	<p>What process should I use to evaluate the choices I make as a consumer in order to reduce the amount of solid waste I produce?</p>
Guiding Question	<p>How do I make the best choices about what to buy?</p>
Skills Used	<p>Math Skills Communication and Problem Solving</p>

Activity

Step 1: Prior to the scheduled day of the Enviro-Market, decide if there will be enough classroom space for the market, or if it will need to be set up in the cafeteria, or another area of the building. Set a time and date for The Enviro-Market. You can conduct this activity without parents in attendance, or parents can be invited to attend the event.

Step 2: Send a note home to let parents know when their child’s collection of enviro-products needs to be sent, or brought, to school. If parents are invited to the activity, include that invitation in this note.

**Checklist of Things to Do to Prepare for
Enviro-Market Day**

- ✓ **Check on student products**
- ✓ **Check on student advertisements**
- ✓ **Set up a display in building**
- ✓ **Set a date and time**
- ✓ **Secure a room and Parent Volunteers**
- ✓ **Send home note**
- ✓ **Purchase balloons and streamers to hang**

Be a Solid Waste Survivor – Take the Consumer Challenge Intermediate

The Enviro-Market – A Culminating Event, *continued*

Step 3: At least one day prior to this activity, after the rubrics have been completed on each student’s product, assign environmental prices for the enviro-products. Remember to price those products that do not fit the specifications listed in box four on the rubric increasingly higher. This will help students better understand the importance of weighing environmental costs before purchasing certain products. Once the products have been priced, write out the prices on a piece of large chart paper. Also, make small copies so students can have the correct prices posted at each “booth” while the market is taking place.

Step 4: If the classroom is being used for the Enviro-Market setting, enlist the aid of students to begin setting up displays and organizing products on the morning of the activity. If the cafeteria is being used, when it is okay to do so, allow students to help relocate the advertisements and products so the displays can be organized. Parent Volunteers are a wonderful human resource to have available!

Step 5: Once all products and advertisements are in place, remind students to organize their Enviro-Bucks, and prepare to begin the Enviro-Market activity. Give each group about a thirty-second “commercial spot” before the market officially “opens” in order to try to encourage classmates to buy products from their “store”.

Step 6: After the short commercials are completed, discuss some “common courtesy rules” with students. Once the rules have been explained, if Parent Volunteers are on hand to help sell the merchandise, students may begin shopping. If parents have not been invited to help, then schedule students in shifts to shop at the different Enviro-Market stores. Remind students that because the products were mass-produced, there will be enough products for everybody to purchase, as long as there are Enviro-Bucks to spend. Scarcity should not be a problem, if all students followed directions!

Step 7: At the end of this activity, remind students to help clean the area. Donate any leftover products to classrooms throughout the building or send them home by students to give to relatives. Remind students to share information about this activity with family members when they get home.

Assessment / Reflection

Once the Enviro-Market activity is completed, or on the following day, ask students to evaluate the “Solid Waste Survivor” unit. Encourage students to include things they liked about the unit, as well as things they did not like.

Instruct students to think about their buying habits. Ask students to describe any strategies learned in this unit that they are now doing to help the environment.



**Be a Solid Waste Survivor – Take the Consumer Challenge
Intermediate**

**Assessment Rubric for Intermediate Unit Culminating Project
“Designing the Ultimate Enviro-Product”**

4	<ul style="list-style-type: none"> ◆ The product has been made completely from recycled items. ◆ The product will benefit instead of harming the environment. ◆ The product is durable and will last for a long time. ◆ The product is something others will use, rather than becoming MSW. ◆ The product can be mass-produced. ◆ The student clearly explains the product design and gives at least three supporting statements as to why the product is environmentally friendly .
3	<ul style="list-style-type: none"> ◆ The product has been made mostly from recycled items. ◆ The product will benefit instead of harming the environment. ◆ The product is durable and will last for a long time. ◆ The product is something others will use, rather than becoming MSW. ◆ The product can be mass-produced. ◆ The student clearly explains the product design and gives at least two supporting statements as to why the product is environmentally friendly .
2	<ul style="list-style-type: none"> ◆ The product has been made from at least one recycled item. ◆ The product will benefit instead of harming the environment. ◆ The product is somewhat durable. ◆ The product is something others might use. ◆ The product can be mass-produced. ◆ The student explains the product design and gives at least one supporting statement as to why the product is environmentally friendly.
1	<ul style="list-style-type: none"> ◆ The product has been made from at least one recycled item. ◆ The product might benefit instead of harming the environment. ◆ The product is not durable. ◆ The product is something others might use. ◆ The product can be mass-produced. ◆ The student vaguely explains the product design and gives at least one supporting statement as to why the product is environmentally friendly .
Notes	

Be a Solid Waste Survivor



Take the Citizenship Challenge

An Middle Grades Unit of Study for Kentucky Schools

Be A Solid Waste Survivor—Take the Citizenship Challenge
Middle Grades

**A KENTUCKY ENVIRONMENTAL EDUCATION COUNCIL
PRACTICAL LIVING, SCIENCE, AND SOCIAL STUDIES INTEGRATED UNIT**

Standards

Science

S-M-3.5.2, Populations of organisms can be categorized by the function they serve in an ecosystem. Plants and some microorganisms are producers because they make their own food. All animals, including humans, are consumers, and obtain their food by eating other organisms. Decomposers, primarily bacteria and fungi, are consumers that use waste materials and dead organisms for food. Food webs identify the relationships among producers, consumers, and decomposers in an ecosystem.

S-M-3.5.4, The number of organisms an ecosystem can support depends on the resources available and abiotic factors (e.g., quantity of light and water, range of temperatures, soil composition). Given adequate biotic and abiotic resources and no diseases or predators, populations (including humans) increase at rapid rates. Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem.

Social Studies

SS-M-1.3.2, in order for the U.S. government to function as a democracy, citizens must assume responsibilities (e.g., performing community service, voting in elections) and duties (paying taxes, serving in the armed forces) for its functioning.

SS-M-4.4.4

Individual perspectives impact the use of natural resources (e.g., watering lawns, planting gardens, recycling paper).

Practical Living

PL-M-3.1.5

Environmental issues (e.g., pollution) should be considered when making consumer decisions (e.g., recycling, reducing, reusing).

PL-M-3.3.2

Improving environmental conditions (e.g., air and water quality) and preserving natural resources impacts personal and community health.

PL-M-3.3.1

A range of resources and services are provided by community agencies:

- public health department
- fire department
- police department
- family resource centers
- hospitals
- nonprofit organizations (e.g., American Heart Association, American Red Cross, American Cancer Society)

Unit Overview

Lesson	Title and Description of Activities, Essential and Guiding Questions and Standards
#1	<p>“Family Values” – Students will explain how they and their families currently dispose of all solid waste at home. They will also begin to think and talk about what they perceive as current natural resource and solid waste issues.</p> <p>Standard: Social Studies SS-M-4.4.4</p> <p>Essential Question #1: How do people in my state and community develop their beliefs and perspectives on natural resource and solid waste issues?</p> <p>Guiding Question:</p> <ul style="list-style-type: none"> ◆ How do my family’s traditions history affect how we deal with solid waste?
#2	<p>“When I Was Young” -- Students will learn how solid waste disposal has changed over time by interviewing older adults from the community.</p> <p>Standard: Social Studies SS-M-4.4.4</p> <p>Essential Question #1: How do people in my state and community develop their beliefs and perspectives on natural resources and solid waste issues?</p> <p>Guiding Questions:</p> <ul style="list-style-type: none"> ◆ How do my family’s traditions and history affect how we deal with solid waste? What roles do such factors as media and peer pressure, packaging and convenience affect how we generate solid waste?
#3	<p>“A Growing Concern” – Students will learn about geometric growth patterns, especially in world population, about diminishing natural resources, and the increasing production of solid waste.</p> <p>Standard: Science, S-M-3.5.4</p> <p>Essential Question #2: How do human actions concerning solid waste management in my community and state affect the balance of ecosystems?</p> <p>Guiding questions:</p> <ul style="list-style-type: none"> ◆ How does the improper disposal of solid waste affect Kentucky’s ecosystems? ◆ What are the health, environmental and political consequences of improper waste disposal?
#4	<p>“Enviroscapes” – This activity uses an Enviroscope tabletop model (which can be borrowed from a variety of sources) to help student’s learn how watersheds become polluted and what can be done to prevent such pollution.</p> <p>Standard: Science, S-M-3.5.4</p> <p>Essential Question #2: How do human actions concerning solid waste management in my community and state affect the balance of ecosystems?</p> <p>Guiding questions:</p> <ul style="list-style-type: none"> ◆ How does the improper disposal of solid waste affect Kentucky’s ecosystems? ◆ What are the health, environmental and political consequences of improper waste disposal?

Unit Overview	
Lesson	Title and Description of Activities, Essential and Guiding Questions and Standards
#5	<p>“Solid Waste Detectives” – students use scientific ways of thinking and knowing to investigate hypotheses about solid waste in their communities.</p> <p>Standard: Social Studies, SS-M-4.4.4, Practical Living, PL-M-3.1.5</p> <p>Essential Question #1: How do people in my state and community develop their beliefs and perspectives on natural resources and solid waste issues?</p> <p>Guiding questions:</p> <ul style="list-style-type: none"> • How does the improper disposal of solid waste affect Kentucky’s ecosystems? • What are the health, environmental and political consequences of improper waste disposal?
#6	<p>“Out of Sight, Out of Mind” – Students learn about karst topography and how improper disposal of solid waste can pollute underground water sources.</p> <p>Standard: Science: S-M-3.5.4, S-M-3.5.2</p> <p>Essential Question #2: How do human actions concerning solid waste management in my community and state affect the balance of ecosystems?</p> <p>Guiding questions:</p> <ul style="list-style-type: none"> ◆ How does the improper disposal of solid waste affect Kentucky’s ecosystems? ◆ What are the health, environmental and political consequences of improper waste disposal?
#7	<p>“Trash Town” – Students learn about the costs involved in waste management.</p> <p>Standard: Practical Living, PL-M-3.1.5</p> <p>Essential Question #3 – How can we, as citizens of our state and communities, analyze and evaluate the political, economic, health and environmental issues related to solid waste management?</p> <p>Guiding Question:</p> <ul style="list-style-type: none"> ◆ What are the health, environmental and political consequences of improper waste disposal?
#8	<p>“In Business for Yourself”-- Students interview local business people in order to learn how different businesses deal with natural resource and solid waste issues.</p> <p>Standard: Practical Living, PL-M-3.1.5</p> <p>Essential Question #3: How can we, as citizens of our state and communities, analyze and evaluate the political, economic, health and environmental issues related to solid waste?</p> <p>Guiding Question:</p> <ul style="list-style-type: none"> ◆ What decisions has your community made about solid waste? ◆ Have other communities made other decisions?
#9	<p>“Getting to Know Us” – By conducting a panel discussion with people involved in their community’s solid waste program, students learn about how their community deals with solid waste and about how they personally can help reduce solid waste.</p> <p>Standard: Social Studies, SS-M-1.3.2, Practical Living, PL-M-3.3.1</p> <p>Essential Question: How can we, as citizens of our state and communities, analyze and evaluate the political, economic, health and environmental issues related to solid waste?</p>

Unit Overview	
Lesson	Title and Description of Activities, Essential and Guiding Questions and Standards
#9	<p>“Getting to Know Us” cont.</p> <p>Guiding Questions:</p> <ul style="list-style-type: none"> ◆ What state and local agencies are sources of accurate and current information on Solid waste management? ◆ What other sources and services are available? ◆ What decisions have your state and community made about solid waste management?
#10	<p>“Surviving through Service” – A Culminating Event. In this culminating activity, groups of students plan and implement a community service project related to solid waste. All standards are covered and information gathered on all essential and guiding questions may be used.</p>

Integration

Language Arts

- Keep a journal of your family’s solid waste habits.
- Read Little House on the Prairie or Hatchet to see different ways of thinking about waste and reusing natural resources.
- Write a story about a molecule that is dumped into a sinkhole, and what the molecule might see along the way as it travels through the water system
- Create a brochure that lists all the resources in the state and community that help people deal with solid waste.

Technology

- Create a web page that lists all the resources in the state and community that help people deal with solid waste.
- Use a global positioning instrument to find the highest point in the watershed directly around your school.
- Take digital photos of littering and illegal dumps in your community. Put these into a Power Point presentation to show at a meeting of the city council or solid waste board.

Arts and Humanities

- Use interviews of older people in the community (from the activity, “When I was Young”) to create a skit that shows a typical day in the life of a person your age, 60 years ago.
- Make a mural of how illegally dumped solid waste gets into streams and rivers
- Do a photo essay of the most beautiful places in your community. Provide a copy to your local tourist bureau.

Integration (cont.)

Math

- Using the Internet, find an estimate of the total amount of trash produced by the average American each day. Then find the same estimates for at least six other countries. Make sure some of the countries are in the third world. Make a chart illustrating your findings.
- Do a genealogical chart of your family. Find out the total number of children each set of your great grandmothers had. Assume that each of those children had two children and each of those children had two children, etc. How many children in your generation would be descended from your great grandmothers. Multiply that number by the average amount of trash produced by an American each year.

Science

- With a parent or other adult, walk (or boat) along a local stream or river. Keep records of the kinds of trash you see. Write a hypothesis about how each kind of trash might affect the wildlife in that stream. Contact the Kentucky Department of Fish and Wildlife and discuss your hypotheses with a biologist. Their website address is <http://www.state.ky.us/agencies/fw/index.htm>
- With your parents' permission, dig a hole in your backyard. Place bits of solid waste in the hole. These should include (at least) food scraps, plastic, aluminum, grass clippings and paper. Keep a record of what you bury. Wait one year and dig the hole again. What is left?

Social Studies

- Locate all the landfills in Kentucky. Remember, landfills are legal places to dispose of solid waste. Contact the Division of Waste Management for assistance. (Their website is <http://www.nr.state.ky.us/nrepc/dep/waste/dwmhome.htm>). Using a Kentucky road map, figure out how far your school is from the nearest landfill.
- Have a discussion with your family about whether or not they think there should be penalties for dumping trash illegally

Be A Solid Waste Survivor – Take the Citizenship Challenge
Middle Grades

Family Values

Standard

Social Studies: SS-M-4.4.4

Individual perspectives impact the use of natural resources (e.g., watering lawns, planting gardens, recycling paper).

Activity

Students will learn how they and their families currently dispose of all solid waste at home. They will also begin to think and talk about what they perceive as current natural resource and solid waste issue.

Materials

Questionnaire Form (included)

Length of Lesson

One half hour the first day to go over the form and add questions if desired, one–two hours a second day to assemble information from all the questionnaires

Vocabulary Words

Solid waste— wastes such as containers and packaging, food scraps, yard trimmings, and miscellaneous inorganic wastes from households, and some commercial establishments.

Compost—a crumbly, earthy decomposing organic matter (e.g., leaves, food scraps) created in a controlled environment.

Recycling—collecting, sorting, processing, and converting materials that would have been thrown away into raw materials used to make the same or new products.

Dumps—site where waste is disposed of in an unmanaged, uncovered area. Current landfill restrictions have made dumps illegal.

Essential Question

How do my family’s traditions and history affect how we deal with solid waste?

Skills Used

Research, communication and analysis

Be A Solid Waste Survivor – Take the Citizenship Challenge Middle Grades

Family Values, cont.....

Activity

Step 1: Tell students that every family deals with solid waste differently depending on where they live, how they have gotten rid of trash in the past and how much solid waste they have. Tell them that they are going to ask questions about how their families deal with solid waste. Explain what a questionnaire is and tell them they will ask their families questions about solid waste and also observe what their families do with solid waste. Explain that after they have gotten answers to the questions, all the information will be brought into class and assembled. Tell the students that the answers are entirely confidential. (You might want to explain how questionnaires are used in a variety of contexts.)

Step 2: Pass out the questionnaire forms and go over the questions with the students. Ask if students would like to add any questions to the questionnaire. Tell them not to put their names on their questionnaires since they will be confidential.

Step 3: Give students at least a week to fill out and return questionnaires. When all questionnaires are returned, a teacher should put all the data together in aggregate form, and then dispose of the original questionnaires. When data has been aggregated, have students use the data to get answers to the following questions.

- How many bags of trash does the average family produce each week?
- What percentage of families has curbside collection?
- What percentage of families dispose of any waste themselves (by burning, composting, etc.)
- What percentage of families recycle any of their waste?
- What type of trash makes up most of the solid waste produced by the families in the class?

Assessment

Since this is an introductory lesson, there is no need to do a formal assessment although you may want to make sure each student has completed the analysis and understands the questions

Extensions

1. Encourage students to start a journal examining how people in their community deal with solid waste.
2. Have students keep lists throughout the unit of all the different kinds of things their families throw away.

Be a Solid Waste Survivor – Take the Citizenship Challenge
Middle Grades

Family values, cont...

Solid Waste Family Questionnaire

Note to teachers and students: These questions can be used to find out how families in your class deal with solid waste. The purpose of the questions is simply to gather information on how ALL families deal with ALL solid waste, not how a particular family does. Make sure all questionnaires are anonymous and that no one puts their name on the questionnaires.

Question #1: Does our family have curbside garbage collection?

- Yes
 No

Question #2: If there is no curbside collection, where does our family take its garbage?

(Check all those that apply)

- designated dumpsters
 local dump
 centralized trash collection
 other

Question #3: About how much trash does our family produce each week as measured in large 30 gallon plastic bags.

_____ bags. (If your family uses another size, see how much each bag holds and translate that into 30-gallon size - e.g. three, 10-gallon bags equal one, 30-gallon bag. No need to be exact. We are only getting estimates.)

Question #4: Does our family use any other method to deal with waste? (check all that apply)

- burn
 recycle
 compost
 other

Question #5: What do people in our family do with large items they no longer need such as refrigerators or automobiles?

- call local officials to get them picked up
 take them to a landfill or other similar site
 other

Question #6: What material makes up MOST of our family's trash?

- paper (boxes, diapers, newspaper) metal (cans, pie plates)
 plastic (milk jugs, butter tubs) other
 food scraps (potato peels, leftovers)

Be a Solid Waste Survivor – Take the Citizen Challenge
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“When I Was Young . . .”

Standard	Social Studies: SS-M-4.4.4 , Individual perspectives impact the use of natural resources (e.g., watering lawns, planting gardens, recycling paper).
Activity Description	Students will learn about how solid waste disposal has changed over time by interviewing older people from the community.
Materials	Interview questionnaire (to be developed by students) Pencil and extra paper.
Length of Lesson	Approximately one to two hours in class plus a homework assignment.
Vocabulary Words	Recycling —collecting, sorting, processing, and converting materials that would have been thrown away into raw materials used to make the same or new products. Reuse —a type of source reduction activity involving the recovery or reapplication of a package, used product, or material in a manner that retains its original form or identity.
Essential Question	How do people in my state and community develop their beliefs and perspectives on natural resource and solid waste issues?
Guiding Questions	How does my family’s traditions and history affect how we deal with solid waste? What role do such factors as media and peer pressure, packaging, and convenience affect how we generate solid waste?
Skills Used	problem solving, research, communication



Activity

Step 1: Review the meaning of the vocabulary words with students. (For more background information refer to the **Teacher Fact Sheets** found at the beginning of this publication.)

Step 2: Explain to students that they will be writing and conducting an informal survey with older people (at least 70 years old) from the community. Explain that the intent of the survey is to try to determine how buying habits and solid waste disposal have changed over the past 75 years. Tell students that our society has not always produced so much solid waste. At one time, especially in rural areas, people produced much of what they used. This meant that

they did not buy things in packages. Also such items as plastic and styrofoam were not widely used until after WWII.

Step 3: Encourage students to think of their own daily lives and how those lives would look if they rarely went to the store. Ask them to create a set of questions that they might want to ask older people about their early lives and how they dealt with solid waste. Make sure the questions are open ended enough to encourage older people to talk to the students.

Be a Solid Waste Survivor – Take the Citizen Challenge Middle School

“When I Was Young . . .”, *continued*

Step 4: After students have completed writing the survey questions, give them the letter to parents (attached) and make sure they take the letter home. Tell students that they should have their parents help them decide whom to interview. Give students several days to complete the interviews.

Step 5: When all students have completed the interviews, allow them to share their findings with other students. Talk about how their lives are different from how older people lived when they were young. How has the way we deal with solid waste changed? What can we learn from older people in our community that will help us do a better job dealing with solid waste issues.

Ideas for survey questions

1. When and where were you born?
2. Did you grow up in a rural or urban area?
3. How did your family make a living?
4. Did your family produce as much trash as families do today?
5. If, not can you explain why?
6. Where did you get clothing and food?
7. Did you take your lunch to school? If so, what did you wrap it in.
8. Did you eat out? If so, how was the food wrapped?

Extensions

1. Have students videotape interviews and edit tapes to do a presentation to other classes, a nursing home, etc.
2. Have students read Little House on the Prairie or Hatchet and write answers to these questions. How did the characters in these books use natural resources? Did they produce a lot of solid waste? Why not?

Assessment

Ask students to make a list of the things they have in their homes that the older people they interviewed did not have in their homes when they were growing up. Have them also list what kind of packages these things came in.



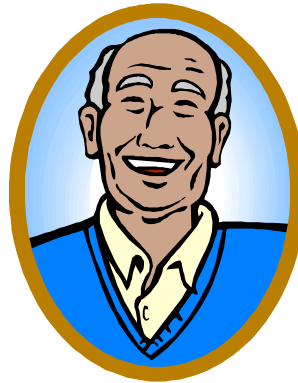
Dear Parents:

We are studying how our community deals with solid waste. This week, your child has helped design a questionnaire the whole class will use to interview older people in our community about how they lived and how they dealt with solid waste when they were young. We would like for each student to interview someone who is at least 70 years old. They may or may not have lived in your community or county for their whole lives but they should live in the community now.

Could you please help your child identify someone to interview and then help them contact that person. Make sure the person to be interviewed knows that the interview will take at least a half an hour. If your child has decided to tape or video the interview, make sure they have the permission of the person they interview.

Thank you for helping your child with this assignment. Please call me if you have questions.

Sincerely yours,



**Take the Solid Waste Survivor – Take the Citizenship Challenge
Middle Grades**

A Growing Concern

(Adapted from “Waste a Hidden Resource in Kentucky”)

Standard	S-M-3.5.4, The number of organisms an ecosystem can support depends on the resources available and abiotic factors (e.g., quantity of light and water, range of temperatures, soil composition). Given adequate biotic and abiotic resources and no diseases or predators, populations (including humans) increase at rapid rates. Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem.
Activity	Students will learn about geometric growth patterns, especially in world population, about diminishing natural resources, and the increasing production of solid waste
Materials	Peanuts or pistachios, a clear bowl, pencils and paper, newspapers
Length of Lesson	1 hour
Vocabulary Words	Natural resources, consumption, renewable, nonrenewable, geometric, arithmetic
Essential Question	How do human actions concerning solid waste management in my community and state affect the balance of ecosystems?
Skills Used	Calculation, research, analysis

Be a Solid Waste Survivor – Take the Citizenship Challenge Middle Grades

A Growing Concern, continued

Activity

Step 1: Explain to students the difference between arithmetic and geometric growth. Begin by having students compare the following sets of numbers and filling in the missing numbers in each series.

2-4-6-8-10-12 ___ ___ 20

2-4--8-16-32-64 ___ ___ 1024

Have the students use the equations $3(n+1)$ and 3^n to generate values for $n=1,2,3,4$, and 5.

Step 2: Have students fill in genealogical charts to see how population grows exponentially. Talk about population growth. Have students visit some population growth websites. (Note: many of these websites talk about birth control. You should judge the maturity level of students before making this assignment.)

Step 3: Tell students that they are going to participate in an activity that simulates the geometric use of natural resources and the production of solid waste.

Place three students in the front of the room. Put one hundred peanuts (or pistachios if any student in the class is allergic to peanuts) in a clear bowl on a table in the front of the room. Also on the table, place another clear bowl or a newspaper.

Have each student take two peanuts, eat them and put the shells in the other bowl or on the newspaper. Repeat this in groups of 3 until all students participate (and all get peanuts!)

Step 4: Repeat step 3, starting again with one hundred peanuts and 3 students. (Empty shells into another container and save.) As before, have the first 3 students eat 2 peanuts and place the shells in the bowl or on the newspaper. However, when the second set of 3 students comes up, have each one take 4 peanuts. The next set takes eight; the next set takes 16 and so forth.

Lead the class in discussing how the second demonstration was different from the first. Tell them that the peanuts represented natural resources and the shells represent solid waste. Help students define renewable resources and nonrenewable resources. Ask the students to think about what it means that we have a growing world population AND a growing use of natural resources and solid waste.

Step 5: Ask students to imagine that everyone in their town had shared the peanuts and left the shells on the table. How would they dispose of the “solid waste”? Brainstorm different ideas and what the results of each idea might be.

Step 6: Bury some of the shells on the school grounds as compost. Ask students what they think will happen to the peanuts. Ask students if all solid waste will biodegrade?

Step 7: If there is a safe place to do so (such as a science lab) burn the shells. Place some of the ashes in a beaker of water and stir. Ask students if they would like to drink the water with the ash in it.

Be a Solid Waste Survivor - Take the Citizenship Challenge)
Middle Grades

A Growing Concern, continued

Assessment

1. Have students define renewable and nonrenewable resources and give three examples of each.
2. Ask students to begin with the number 8 and write down the next six numbers that show arithmetic growth and the next three numbers that represent geometric growth. (Students may need calculators for this exercise)
3. Tell students that you can see into the future and you know that each of them will have two children and that each of those children will have two children and each of those children will have two children. How many great-grandchildren will each of them have?

Journal activity

Tell students that, because of overpopulation, China has a one-child policy. Couples that have only one child receive rewards in the form of special benefits for their child but couples that have more than one child are sanctioned. Sanctions may include the loss of jobs for the parents.

Ask students to write an essay saying why they think China has such a policy and giving their opinion of this policy. Tell them to support their opinion.

Extension

Have students write a skit in which ten people are working in an office 10X10 feet square. Each person produces 30 sheets of waste paper a day but there is only one very small trashcan that is emptied once a week.

The skit should show how they deal with the trash and how well they get along with each other in such small space.

Tell students that in many parts of the world, people actually live in spaces this small.



Take the Solid Waste Survivor – Take the Citizenship Challenge
Middle Grades

Enviroscapes

Standard

S-M-3.5.2, Populations of organisms can be categorized by the function they serve in an ecosystem. Plants and some microorganisms are producers because they make their own food. All animals, including humans, are consumers, and obtain their food by eating other organisms. Decomposers, primarily bacteria and fungi, are consumers that use waste materials and dead organisms for food. Food webs identify the relationships among producers, consumers, and decomposers in an ecosystem.

S-M-3.5.4, The number of organisms an ecosystem can support depends on the resources available and abiotic factors (e.g., quantity of light and water, range of temperatures, soil composition). Given adequate biotic and abiotic resources and no diseases or predators, populations (including humans) increase at rapid rates. Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem.

Activity

Students use a tabletop Enviroscope display model to visually see how improper solid waste disposal can affect surface and ground water.

Materials

An Enviroscope model, small bits of newspaper (See box on the following page for where to borrow a model.)

Length of Lesson

Approximately 1 hour.

Vocabulary Words

Sinkhole, watershed, nonpoint source pollution, Enviroscope, biodegradable, tributary

Essential Question

How do human actions concerning solid waste management in my community and state affect the balance of ecosystems?

Skills Used

Observation, problem solving, communication

Be A Solid Waste Survivor – Take the Citizenship Challenge
Middle Grades

Enviroscapes, continued

Activity

Step 1: Borrow an Enviroscope tabletop display unit. (See box below for where to borrow a model.) These units are models of a small community, including a farm, subdivision, forest, sewage treatment plant, factory, and construction site. The model is contoured and a stream runs through the entire “watershed”.

By sprinkling dry tempura paint or powdered soft drink mix on the model and then making it “rain” with a spray bottle of water, students can easily see how nonpoint source pollution gets into our water. (See www.enviroscapes.com/ for more information.)

Step Two: Follow the easy directions on the model to show students how rainwater flows down hill and carries material with it into streams, rivers and ground water. Use small bits of newspaper to show how solid waste is also distributed in watershed.

Step 3: Allow students to work with the model in small groups and experiment with putting the solid waste (bits of newspaper) on different parts of the model. Since this activity uses kinesthetic learning, make sure all students get to spray water, place “trash” etc.

Step 4: Have students clean the model and put it away neatly so it can be returned and used again by another class.



Assessment

Give each student a map of the watershed in which his or her school is located. (See www.kywater.org/watch/ky.htm)

Ask students to mark the headwaters of this watershed. (They may need a little help seeing which way the water flows.) Tell them to imagine that an empty milk jug is thrown into their watershed at the headwaters. Tell them to try and draw a line from where the jug enters the watershed to where it would end up if nothing stopped it.

Have each student count the number of tributaries along the river. Ask them to explain in writing what would happen if people along all the tributaries of the river threw all their milk jugs in the waterways.

Where to borrow an Enviroscope

Enviroscope models are very expensive. Therefore schools rarely own them. However, there are many places to borrow them. These include some local Cooperative Extension and Natural Resource Conservation Service offices, the Division of Water and the Kentucky Environmental Education Council’s (KEEC) resource schools. To find the address and phone numbers of these offices, go to the KEEC website, www.state.ky.us/agencies/envred/ or call, toll free, 800 882-5271.

**Be the Solid Waste Survivor – Take the Citizenship Challenge
Middle Grades**

Solid Waste Detectives

Standard	<p>SS-M-4.4.4, Individual perspectives impact the use of natural resources (e.g., watering lawns, planting gardens, recycling paper).</p> <p>PL-M-3.1.5, Environmental issues (e.g., pollution) should be considered when making consumer decisions (e.g., recycling, reducing, reusing). Academic Expectation 2.1</p>
Activity	Students use scientific ways of thinking and knowing to gather information and suggest solutions to local solid waste problems. Many students may need some help from family members with their investigations. Teachers may choose to let each individual student do a project or divide the class into small groups.
Materials	Depending on students' choice of research projects, materials may include notebooks and pencils, computers, cameras, calculators, maps
Length of Lesson	At least two hours in class plus time at home to gather information.
Vocabulary Words	<p>Hypothesis—An explanation accounting for a set of facts that can be tested by further investigation.</p> <p>Data—Information organized for analysis.</p> <p>Evidence—The data on which a conclusion may be based.</p> <p>Investigation—To observe or inquire into in detail.</p>
Essential Question	How do people in my state and community develop their beliefs and perspectives on natural resource and solid waste issues?
Skills Used	Formulating hypothesis, gathering data, conducting investigations, communicating results

Be A Solid Waste Survivor – Take the Citizenship Challenge
Middle Grades

Solid Waste Detectives, continued

Activity

Step 1: Tell students they are going to become scientific detectives in order to find out about solid waste problems in their community. Explain to them that scientists and social scientists use a process to come up with answers to questions they have and to problems they want to solve. Tell students they are going to be following the same process (sometimes called the scientific method) to come up with their own ideas for solving solid waste problems.

Step 2: Go over Academic Expectation, 2.1 (Scientific Ways of Thinking and Knowing) with students and let them ask questions and begin to get an understanding of this process

Step 3: Ask each student (or group if you have chosen to do the activity as a group project) to write several hypotheses about solid waste issues in your community, which he or she (or the group) would like to investigate. You may need to prompt students with ideas.

Step 4: Work with students to make sure they have hypotheses that can be investigated with the tools and skills they have. Send a note home to parents letting them know what you are doing and that their student may need help gathering data for this project

Step 5: Have students begin to gather data. Be available to help them think through the kinds of data they need and the best way to gather it. Ask the librarian to visit your class and help students find data sources.

Step 6: Once students have gathered data, allow time in class in which to analyze the information and placed it in a graph, chart, essay, power point or other communication tool.

Step 7: Using the data they have analyzed, have each student come up with an idea to help reduce solid waste problems in your community.

Step 8: Hold a “Solid Waste Detective Fair” in the classroom so students can share their findings and ideas. Invite parents and the people students have interviewed during the unit.

Possible ideas for hypothesis

1. Some roads and streets in my community have more litter than others.
2. The majority of material in the landfill used by my community is glass.
3. People in my community dispose of less trash than the average American.
4. People in my community produce more trash than people in Germany.
5. More aluminum cans are recycled in my community than any other material.



Be a Solid Waste Survivor – Take the Citizenship Challenge
Middle Grades

Solid Waste Detectives, continued

Sample Model for Investigation

Fast Food Investigation

Form Hypothesis: People eating at fast food restaurants use more paper products than they actually need.

Collect data: Take a pencil and notebook to a local fast food restaurant on at least two different occasions. Go during a busy period such as dinner. Make sure you have a parent or other adult with you. Tell the manager that you are studying how people deal with solid waste and you would like to observe how many napkins, etc. people pick up. Tell him or her you will be sure not to disturb the customers.

Once you have permission, sit near the area where people get napkins, straws, etc. For a set amount of time (half an hour to an hour) observe people picking up napkins, straws, ketchup, lids and other paper or plastic products. Try and count how many of each item each person picks up and how many people are in their party. You will not always be able to get an exact count but make an effort to get as close a count as possible without disturbing the customers or letting them know you are counting. (Remember, if they know you are observing them, it is likely to change their behavior!)

Be sure and write down an identifying number for each person, how many people in their party and how many of each item they take. Have the person with you take down each person's approximate age and their gender. It will be helpful if you have a data-collecting sheet such as the one below.

Person ID	# in party	Approx. Age	Gender	#straws	#condiments	#sugar/sweetener	#napkins	Other Observations
#1	3	35	F	6	12	0	10	
#2	1	60	M	0	0	4	3	Coffee only
#3	4	25	M	8	15	6	10	2 small kids
#4	5	70	F	3	4	3	5	

At the end of the time period, thank the manager and go to a quiet place and make sure your information is written clearly enough that you will be able to understand it later.

**Be a Solid Waste Survivor – Take the Citizenship Challenge
Middle Grades**

Solid Waste Detectives, continued

Sample Models for Investigation

Fast Food Investigation (cont.)

Conduct Analysis: Look at the data you have gathered. Answer the following questions.

- Look at the each person you observed. How many of them took more paper/plastic products that they actually needed? What percentage is this of the total number of people you observed?
- Ask the same questions about the males you observed. About the females you observed.
- Ask the same questions about people over 40 and people under 40.
- Count the total number of people who were using the paper/plastic products (total number in all parties) and the total number of napkins taken. Approximately how many napkins is that per person.

Communicating your results. Make a chart showing the results of one or more of the questions you have asked or do a PowerPoint presentation showing your results. A chart might look like the one below.

	All Males	All Females	All Under 35	All Over 35	Whole sample
Percentage of people taking more napkins than they needed	28%	76%	62%	31%	65%
Percentage of people taking more straws that needed	27%	75%	65%	42%	52%


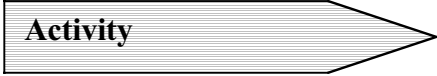
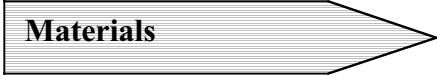


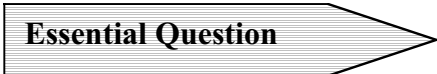

Review hypothesis: Look at your original hypothesis. Based on the data you collected, was it correct or incorrect?

Based on your findings and your original hypothesis, what might be done to reduce solid waste at local fast food restaurant?

Take the Solid Waste Survivor – Take the Citizenship Challenge
Middle Grades

Out of Sight, Out of Mind

(Adapted from “Waste a Hidden Resource in Kentucky”)

 <p>Standard</p>	<p>S-M-3.5.2, Populations of organisms can be categorized by the function they serve in an ecosystem. Plants and some microorganisms are producers because they make their own food. All animals, including humans, are consumers, and obtain their food by eating other organisms. Decomposers, primarily bacteria and fungi, are consumers that use waste materials and dead organisms for food. Food webs identify the relationships among producers, consumers, and decomposers in an ecosystem.</p> <p>S-M-3.5.4, The number of organisms an ecosystem can support depends on the resources available and abiotic factors (e.g., quantity of light and water, range of temperatures, soil composition). Given adequate biotic and abiotic resources and no diseases or predators, populations (including humans) increase at rapid rates. Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem.</p>
 <p>Activity</p>	<p>Students make models of sinkholes to learn about karst topography and how improper disposal of solid waste can pollute underground water sources.</p>
 <p>Materials</p>	<p>For every four students, have the following materials: One can of sliced beets and juice; eight, 2-liter bottles; two, 3” long pieces of 1” diameter tubing, limestone gravel; soil; a small piece of sod; water; cellophane tape; scissors; copies of student pages (attached).</p>
 <p>Length of Lesson</p>	<p>Approximately 1- _ hours.</p>
 <p>Vocabulary Words</p>	<p>Sinkhole—A natural depression in a land surface communicating with a subterranean passage. Watershed—A region draining into a river, river system, or body of water. Nonpoint source pollution—Water pollution that comes from many diffuse sources.</p>
 <p>Essential Question</p>	<p>How do human actions concerning solid waste management in my community and state affect the balance of ecosystems?</p>
 <p>Skills Used</p>	<p>Observation, communication, problem solving, following directions</p>

Be A Solid Waste Survivor – Take the Citizenship Challenge Middle Grades

Out of Sight, Out of Mind, cont...

Activity

Step 1: In this activity, students will “build” sinkholes to demonstrate how improper disposal of solid waste gets into our drinking water. Divide the students into teams of four. Ask each team to help assemble the materials for the lesson. (Note: You may buy sod at a local nursery, or, since you will only need about one square foot for the whole class, ask if you can dig it up on the school grounds and then reseed it when you are through. (Reseeding and watering are good lessons in horticulture for students).

Step 2: Give each team of students the demonstration page and make sure they have all the materials they need. Ask each team to complete parts 1-3. Have each team prepare a chart for recording their results.

Step 3: Ask each team to predict the outcome of the demonstration and record their predictions. Complete part four of the instructions and record results on prepared charts. Ask each team to arrange its bottles from least to most polluted.

Step 4: Ask groups to answer the following questions and record their answers.

- ✓ Have the bottles for each team been rank ordered the same?
- ✓ Was the change in water color the same for each group?
- ✓ How did the water in bottles A and C compare?
- ✓ If they were different, what might have accounted for the difference?

Assessment

As a homework assignment, ask each student to do the following (some research will be required).

- ✓ Look for waste that has been dumped into a stream or river near where you live. What kinds of trash were dumped? Write a paragraph describing what one of these types of waste might do to the water system.
- ✓ Find out in which river’s watershed you live.
- ✓ Based on the demonstration you did in which beets were used to represent leakage from waste materials, what conclusions can you draw about the practice of dumping waste material directly on the land or in a stream?
- ✓ What do you think “Out of Sight—Out of Mind” means in this context?

Journal Activity

Have students imagine they are molecules of soda pop that have leaked from a can thrown into a sinkhole. Have them write a story about their travels and who or what they might meet along the way. Encourage illustrations.



Out of Sight, Out of Mind

1

Make 4 demonstration columns, following steps below for each column.

Bottle #1

Cut bottom 2½" down

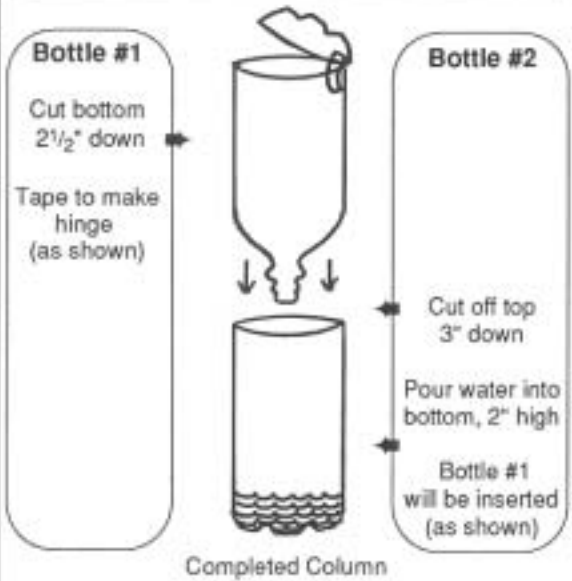
Tape to make hinge (as shown)

Bottle #2

Cut off top 3" down

Pour water into bottom, 2" high

Bottle #1 will be inserted (as shown)

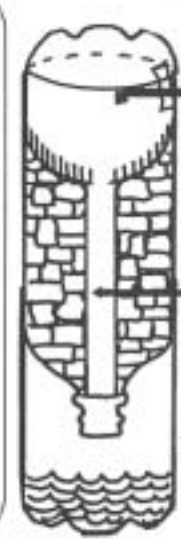


Completed Column

2

Prepare 2 columns, following steps below. Label them Sinkhole A and Sinkhole B.

1. Insert tube in Bottle #1, as shown.
2. Pack stones around it--higher at edges and lower in the center.
3. Lay sod on top, as shown.
4. Insert Bottle #1 into Bottle #2, as shown.



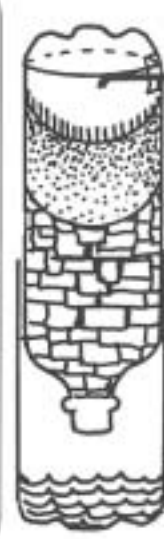
Simulated:

- Sinkhole
- Groundcover
- Underlying limestone
- Opening into caverns below
- Groundwater (underground stream or pool)

3

Prepare 2 columns, following steps below. Label them Watershed C and Watershed D.

1. Pack stones in bottle as shown--higher at edges and lower in the center.
2. Add a layer of soil, slightly packed down, higher at edges and lower in the center, as shown.
3. Lay sod on top, as shown.
4. Insert Bottle #1 into Bottle #2.



Simulated:

- Watershed
- Groundcover
- Underlying soil
- Underlying limestone
- Groundwater (underground stream or pool)

4

Conduct the Investigation.

1. On top of the sod in Columns A and C, place layers of sliced beets and their juice. This material contains coloring that can be traced to the underground water. The beets represent trash and other waste material thrown into a sinkhole or on another part of the land in a watershed.
2. Measure equal amounts of water to sprinkle into the centers of Columns A and B and sprinkle equal amounts onto the surface of Columns C and D. (Columns C and D will require more water.) Pour enough water into the columns until it runs through to the underground water. This represents the water that drains into sinkholes and from the watershed following a heavy rain.

**Take the Solid Waste Survivor – Take the Citizenship Challenge
Middle Grades**

Trash Town

(Adapted from the EPA Office of Solid Waste Publication “Quest for Less”)

Standard

PL-M-3.1.5, Environmental issues (e.g., pollution) should be considered when making consumer decisions (e.g., recycling, reducing, reusing).

SS-M-1.3.2, in order for the U.S. government to function as a democracy, citizens must assume responsibilities (e.g., performing community service, voting in elections) and duties (paying taxes, serving in the armed forces) for its functioning.

Activity

This lesson teaches student the costs involved in proper waste management. It also helps them understand one way in which taxes are used for the good of all. .

Materials

One copy of Trash Town worksheet per student (attached), pencil and paper, calculators (optional)

Length of Lesson

One hour

Vocabulary Words

Landfill-- a site where waste is managed to prevent or minimize health, safety, and environmental impacts.

Tipping fee—A fee to bring trash to a landfill.

Recycle-- collecting, sorting, processing, and converting materials that would have been thrown away into raw materials used to make the same or new products.

Essential Question

How can we, as citizens of our state and communities, analyze and evaluate the political, economic, health and environmental issues related to solid waste management?

Skills Used

Computation, problem solving



Be A Solid Waste Survivor – Take the Citizenship Challenge
Middle Grades

Trash Town, continued

Activity

Step 1: Photocopy and distribute the *Trash Town* worksheet to each student. Introduce the following concepts to your class (refer to the teacher fact sheet titled “Solid Waste” for more information).

- ✓ It costs us money to dispose of our garbage. The more garbage we generate, the more money we pay for disposal.
- ✓ Most landfills charge a fee for accepting trash. This is called a tipping fee. Sometimes communities use tax dollars to collect and dispose of solid waste. Either way, society has to pay to get rid of its solid waste.
- ✓ We can save money by recycling, composting, reusing or reducing instead of just throwing out more and more garbage.
- ✓ We can earn money by recycling because recycled materials can be sold to manufacturers.

Step 2: Pass out calculators to each student. Ask the students to carefully read the *Trash Town* worksheet and complete the math problems related to the town’s disposal and recycling practices. (Teachers may choose whether this worksheet should be completed in groups or individually.)

Step 3: Conduct a Pay-as-you-Throw (PAYT) experiment in your classroom or lunchroom. Hand out the same amount of fake money to each student and charge him or her fees based on how much they throw away each day (e.g. \$1 per plastic bag, \$2 per aluminum can, etc.). Keep this up for one week and see if students can reduce the amount of trash they throw away by the end of the week. The five student with the most “trash” money left at the end of the wee can “buy” prizes such as candy bars, one “free” homework assignment etc.

Step 3 (cont.)

Explain to students that over 4,000 communities already have PAYT programs where citizens are charged based on the amount of solid waste they throw away. Have students visit the website <www.lexingtonma.org/swat/info/pdf> To read how one community (Lexington, Massachusetts) is trying this approach.

Assessment

1. Collect the *Trash Town* worksheets and evaluate the computations and answers.
2. Have students write a paper comparing traditional waste disposal (tax supported landfills, tipping fees) and PAYT systems. Ask them to list at least three advantages or disadvantages to each strategy, choose which system they think is best and explain why.

\$

Take the Solid Waste Survivor – Take the Citizenship Challenge
Middle Grades

In Business for Yourself

Standard	<p>Practical Living, PL-M-3.1.5, Environmental issues (e.g., pollution) should be considered when making consumer decisions (e.g., recycling, reducing, reusing).</p> <p>Social Studies, SS-M-1.3.2, in order for the U.S. government to function as a democracy, citizens must assume responsibilities (e.g., performing community service, voting in elections) and duties (paying taxes, serving in the armed forces) for its functioning.</p>
Activity	<p>In this activity, students interview people in the business community about how they deal with solid waste.</p>
Materials	<p>Paper and pencils, U.S. maps, questionnaires (included), and local telephone directories.</p>
Length of Lesson	<p>Three to four hours over several days</p>
Vocabulary Words	<p>Recycle-- collecting, sorting, processing, and converting materials that would have been thrown away into raw materials used to make the same or new products.</p>
Essential Question	<p>How can we, as citizens of our state and communities, analyze and evaluate the political, economic, health and environmental issues related to solid waste?</p>
Skills Used	<p>Interviewing, communicating, graphing, analysis</p>



Be A Solid Waste Survivor – Take the Citizenship Challenge Middle Grades

In Business for Yourself, cont.....

Activity

Step 1: Explain to students that most businesses create solid waste but most businesses dispose of solid waste properly. Explain that this happens for several reasons. First, like all citizens, most business people want to have a clean environment. Also, businesses are “regulated”. In other words, there are laws governing how they deal with solid waste. The few businesses that don’t follow these regulations often must pay fines. Finally, recycling or reducing solid waste is often more cost effective than just throwing it away.

Discuss different kinds of businesses with which students are familiar such as fast food, clothing retailers and grocery stores. Using the telephone directory, have students list local businesses and the kinds of solid waste that these businesses might produce.

Step 2: Tell students they are going to interview local business people about how they deal with solid waste. Review the attached questionnaire and allow students to use it as a guide to create their own set of questions.

Assign each student (or pair of students) at least one local business. Have them write to the business telling them that they will be calling in a few days to ask questions about how they deal with solid waste. (A sample letter is included.) Enclose a copy of the questionnaire in the letter so business people can have a few days to gather information that may not be readily available. (Note: you may want to assign students more than one business if possible in case the business people they are calling do not have time to be interviewed.)

Step 3: Review telephone etiquette with students and do some role-playing in which students

Step 3: (cont.) practice calling and conducting the interview.

Step 4: Have students make the calls. (Cell phones may be helpful.) Remind them to be sure and record the information they are gathering.

Step 5: Make sure students write thank you notes to business people who participated in the interviews.

Step 6: As a class, review what students have learned in the interviews. Use national and state maps to mark where some of the materials used by local businesses originate. Record all information from multiple-choice answers gathered by the class. For example, for Question #2 on the sample survey, “Where do most of your materials come from?” record the number of businesses in which the person being interviewed answered “locally”; the number who answered “Kentucky”; the number who answered “U.S.”; etc. Make sure you prominently display all the responses (on chart paper or the blackboard) as well as the total number of business people who were interviewed.

Evaluation

1. Using the data gathered by the class, ask each student to figure what percentage of businesses interviewed recycle. (Divide total number of businesses that recycle by total number of businesses).
2. Ask students to explain in writing whether they think recycling is good or bad for business. Ask them to list the pros and cons of recycling in their answer.

Be a Solid Waste Survivor-Take the Citizenship Challenge
Middle Grades

In Business for Yourself, cont....

*Sample letter to local business people
concerning solid waste survey*

Mr. John Doe
Best Business
Goodtown, KY 40000

Dear Mr. Doe:

My class is learning about how our citizens and our community deal with solid waste. We know that businesses have to deal with a lot of solid waste and that disposing of solid waste is part of the cost of doing business. We are trying to find out more about how businesses in our community dispose of, and recycle, solid waste and what it costs to do that.

We are conducting a survey of businesses in our community and I would like to call you to conduct the survey on (date) _____, at (time) _____. If this is not convenient, could you please call me to set up another time? My number is _____.

A copy of the survey is enclosed so you can get an idea of the kinds of information we are gathering. If you have any questions, you can reach my teacher at the address below.

Teacher's name _____
School _____
School address _____
School Phone number _____

Thank you very much for your help with this project.

Sincerely yours,

(Student(s) name(s))

Journal Activity

Ask students to describe their interview with a local businessperson. Did they learn anything surprising about doing business? Would they like to go into business for themselves? Why or why not?

Extension

1. Ask students to keep a list of everything they or their families purchase in one week. Make sure the lists are as complete as possible. Then ask students to choose one product and write down everything that had to happen to produce that product and get it to the store where they bought it. (Make sure they include the energy it takes for delivery and production). Ask them to include all raw materials, manufacturing processes, transportation, packaging, etc.
2. Using the description of how their product was produced and delivered, ask them to list as many businesses as possible that were involved in the process.
3. Finally, ask if they have ideas on how packaging for the products they buy could be reduced?

**Be a Solid Waste Survivor – Take the Citizenship Challenge
Middle Grades**

In Business for Yourself, cont....

**Be a Solid Waste Survivor
Middle Grades**

Sample Community Business Survey

1. What kinds of materials/products does your business use or sell.

2. Where do most of these materials come from?
 locally
 Kentucky (where)
 U.S. (where)
 Overseas (where)
3. What kinds of containers are used to ship most materials to you?
 cardboard boxes
 wooden crates
 Styrofoam or other plastics
 metal containers
 other (describe)
4. What do you do with the containers?
 reuse
 throw away
 recycle
 other (describe)
5. If you throw them away, how do you do that?
 regular trash pick up
 fee-based hauler
 take them to landfill
 other
6. If you pay to have your trash picked up, how much does that cost you per month?
\$ _____
7. What (and how many) regulations do you have to follow in dealing with solid waste?

8. If you recycle or reuse containers, does that save your business money or cost your business money?
 saves money to recycle/reuse
 costs money to recycle/reuse

Be the Solid Waste Survivor – Take the Citizenship Challenge
Middle Grades

Getting to Know Us

(Adapted from “Waste a Hidden Resource in Kentucky”)

Standard	<p>Practical Living, PL-M-3.3.1, A range of resources and services are provided by community agencies:</p> <ul style="list-style-type: none">• public health department• fire department• police department• family resource centers• hospitals• nonprofit organizations (e.g., American Heart Association, American Red Cross, American Cancer Society)
Activity	<p>Social Studies, SS-M-1.3.2, in order for the U.S. government to function as a democracy, citizens must assume responsibilities (e.g., performing community service, voting in elections) and duties (paying taxes, serving in the armed forces) for its functioning.</p> <p>Students invite local people, whose jobs deal with solid waste in some way, to participate in a panel discussion on local solid waste issues.</p>
Materials	<p>Local telephone directories, very large post-it notes, Internet access, thank you notes</p>
Length of Lesson	<p>Two hours to prepare, one hour for the panel discussion and one hour to “debrief”</p>
Essential Question	<p>How can we, as citizens of our state and communities, analyze and evaluate the political, economic, health and environmental issues related to solid waste?</p>
Skills Used	<p>Interviewing, communicating, graphing, analysis</p>

Be A Solid Waste Survivor – Take the Citizenship Challenge Middle Grades

Getting to Know Us, cont...

Activity

Step 1: Explain to students that many people in their community and county have jobs in which they deal with solid waste issues. Tell students that in this activity they will find out who these people are and invite them to class for a question and answer session.

Step 2: Brainstorm as a class who in your community might deal with solid waste or solid waste issues. Examples might include the mayor, county judge executive, sanitation workers, solid waste coordinators, landfill operators, and owners or operators of recycling facilities. Use phone directories or the Internet to find addresses and phone numbers for these people. If student need more help, have them contact the Kentucky Division of Waste Management at (502- 564-6716 or www.nr.state.ky.us/nrepc/dep/waste/dwmhome)

Step 3: Choose a date several weeks in advance and have students write to those who will be invited (use letter written to businesspeople in previous activity as a guide). Make sure the letter asks those who are invited to RSVP. (Note: If invitees do not respond, you will have to call them to find out if they will attend.)

Step 4: Divide the class into four groups. Tell each group to write at least ten questions that they want to ask panel members. Tell them to write some questions that could be asked of any panelist (e.g. Do you recycle at home?) and some that are specific to those with particular jobs. (e.g. What do solid waste coordinators do?) Make sure that students understand that the questions must be polite and should ask for specific information.

Step 5: Have all groups put their questions on very large post it notes and put them on the board or a blank wall. Working together, students should arrange the questions in the order they think they should be asked.

Step 6: Before the day of the panel, be sure to assign some students to ask questions, some students to be recorders, others to be hosts. On the day of the panel, make sure your room (or other space) is set up so that the students can see and hear the entire panel. It would be a good idea to have large nametags for everyone. Conduct the panel. Make sure students thank guests after the panel and then write thank you notes as well.

Step 7: Have students who were recorders to write down their notes. Share those with the rest of the class. Give students a chance to “debrief” after the panel discussion. Did panelists give the answers they expected? What new information did they learn?

Assessment

Ask each student to write about the person who they thought had the most important job dealing with solid waste. Ask them to describe that person’s job and give at least two reasons they thought so.



**Be the Solid Waste Survivor – Take the Citizenship Challenge
Middle Grades**

Surviving Through Service – A Culminating Event

Standard	S-M-3.5.2 S-M-3.5.4 SS-M-1.3.2 SS-M-4.4.4 PL-M-3.1.5 PL-M-3.3.2 PL-M-3.3.1
Activity	In this culminating activity, students are divided into small groups and use what they have learned in the unit to plan and implement service projects in the school or community.
Materials	Materials will differ, depending on the type of project. Volunteers may be needed to assist with service projects. You may want to contact the local solid waste coordinator and parents to alert them volunteers will be needed.
Length of Lesson	Several hours in class to prepare and then several hours outside of class to carry out the projects.
Vocabulary Words	All vocabulary learned in the unit
Essential Question	All questions in the unit
Skills Used	All skills learned in the unit

Be A Solid Waste Survivor – Take the Citizenship Challenge Middle Grades

Surviving Through Service, cont...

Activity

Step 1: Make sure your principal, site-based council and parents know the students are going to be involved in designing service projects. Make sure you follow any rules that deal with such projects.

Step 2: Explain to students that they are going to use the knowledge they gained in the solid waste unit to design a service project that will help the community deal with solid waste problems. Tell them they will be divided into small groups and each group will decide on, plan and carry out a project. Explain that, while the project must be realistic, they must also provide a real service to the community.

Step 3: Tell students they should begin by choosing a solid waste issue they want to address. This might be littering, illegal dumping, the need to reduce solid waste at its source, etc. It may be anything they have studied in the unit. Then they must list the reasons this issue is a problem. Tell them to list as many reasons as they can think of.

For example, students might list littering as the problem they want to address. Reasons littering is a problem would include:

- Waste in streams and rivers can damage ecosystems
- Litter discourages tourism
- It costs taxpayers money to clean it up
- It can be a health hazard

Tell students they must also come up with at least one-way to address the problem.

Step4: Do some brainstorming as a class to help stimulate thinking about what kinds of projects students might plan. Tell them projects might fall into several categories. Categories might include (among others)

- Action projects (e.g., cleaning up a creek)
- Research projects (e.g. finding out which street near the school has the most litter and providing that information to the mayor)
- Educational projects (e.g., teaching younger children about a solid waste issue)

Step 4 (cont.):

- Informational projects (e.g., creating a brochure that lists all the offices in your community that deal with solid waste and what each office does.)
- Artistic projects (e.g. make a mural to put in city hall or other public building.)

Step 5: Help students think through their projects and write down their plans step by step, then list all materials and assistance they will need. Make sure all students have a chance to participate in both planning and implementation.

If projects will be outside of school, make sure parents are aware of the projects and give permission for their children to participate.

Step 6: Students carry out projects.

Extension

Set aside a class period for students to share their experiences and any products they have created. (Note: students who have done action projects should take photos of their project and may even want to put them into a PowerPoint presentation.)

Make sure that each group includes a discussion of the problem and the reasons they chose this problem to address.

Invite local media, parents, and local officials to the sharing session.

Be a Solid Waste Survivor – Take the Citizenship Challenge
Middle Grades

Assessment Rubric for Middle Grades Unit Culminating Project

4	Students create a plan that identifies at least one solid waste issue and at least three reasons this issue is a problem in their community. Their plan identifies a service project that would address this problem and they carry out the service project. The project creates a product (brochure, PowerPoint, photo essay, research report) that can be used to promote better solid waste practices in the community.
3	Students create a plan that identifies at least one solid waste issue and at least two reasons this issue is a problem in their community. Their plan identifies a service project that would address this problem and they carry out the service project.
2	Students create a plan that identifies at least one solid waste issue and at least one reason this issue is a problem in their community. Their plan identifies a service project that would address this problem and they carry out the project.
1	Students create a plan that identifies at least one solid waste issue and at least one reason this issue is a problem in their community.
Notes	

Glossary of Terms

Glossary of Terms

This glossary defines unfamiliar terms specifically related to solid waste and the environment; some words listed in the activities under “Vocabulary” will not be found in this glossary.

Aerobic—with oxygen. During the composting process, certain bacteria need oxygen to break down the mix of organic materials. This is known as aerobic decomposition.

Anaerobic—without oxygen. In a landfill, certain bacteria decompose organic materials without oxygen and create methane gas through a process known as anaerobic decomposition.

Ash (also **combustion ash**)—solid residue that remains after the combustion, or burning, of waste.

Backyard composting—the homeowner’s practice of collecting leftover kitchen scraps (excluding meats and fats) and yard trimmings for decomposition in a private compost pile. Backyard composters can use their compost as a soil enhancement for their gardens.

Bacteria—single-celled microorganisms. Certain types of bacteria break down organic materials (using an *aerobic* and/or *anaerobic* process).

Bedding—organic material, such as shredded newspaper, used to retain moisture and allow proper air circulation and drainage to provide a healthy environment for worms in a *vermicomposting* container.

Biodegradable—materials that can *decompose*, usually by bacteria or sunlight, into basic components. Most organic materials (paper, grass clippings, food scraps), under the right conditions, are biodegradable.

Biodiversity (also **biological diversity**)—indicated by the numbers of different species of plants and animals found in a natural environment. Many different species of plants and animals within an ecosystem is indicative of a healthy environment.

Brownfields—abandoned or unused industrial and commercial land that cannot be developed or expanded because of real or perceived contamination with toxic substances.

Bulk—when food or other products are sold unpackaged or in large volumes to reduce packaging waste. Consumers who buy one large bottle of juice rather than many small containers of juice, for example, are “buying in bulk.”

Byproduct—excess material or waste produced in addition to the primary product. Sludge is a byproduct from the manufacture of paper, for example. Many manufacturers look for innovative ways to reuse or recycle the byproducts created during the production process to reduce waste.

Castings—manure from red wiggler worms that can be used as a soil conditioner to provide aeration, drainage, and nutrients to soil.

Climate—the average course or condition of weather over a period of years based on conditions of heat and cold, moisture and dryness, clearness and cloudiness, wind and calm, applied to a specific location or globally. Southern Florida, for example, has a sunny, dry, warm climate.

Closing the loop—purchasing products made from recycled materials. Recycling is a cycle. It is not enough simply to collect recyclables for manufacture into new products. People must then buy products made with recycled content, thus closing the loop.

Combustion/Incineration—a rapid chemical process that produces heat, gas, ash, and usually light through burning. This process is one option for the disposal of municipal solid waste. It can also be used as a treatment or disposal option for hazardous waste. See combustor, waste-to-energy.

Combustor/Incinerator—a facility for the controlled burning of waste. Burning municipal solid waste can reduce its volume and weight. Some facilities capture energy from the steam or heat that is produced during the burning process. (See waste-to-energy.) Burning hazardous waste can be considered a form of treatment and can reduce the hazardous components of the waste.

Compaction—the act or process of pressing materials together to occupy the smallest volume possible; a common practice at a sanitary landfill.

Compost—a crumbly, earthy, sweet-smelling mixture of decomposing organic matter (e.g., leaves, food scraps) created in a controlled, thermophilic environment that is often used to improve the texture, water-retaining capacity, and aeration of soil.

Composting—the controlled biological decomposition of organic material under aerobic or anaerobic conditions. Organic materials are broken down (decomposed by microorganisms) into compost, also known as humus. Composting can occur in a backyard bin, a pile, long windrows, or in a vermicomposting container.

Conservation—the protection or wise use of natural resources that ensures their continuing availability to future generations; the intelligent use of natural resources for long-term benefits.

Consumption—the amount of any product or resource (e.g., material or energy) used in a given time by a given number of consumers.

Contamination—the process of adding one substance to another substance, such as motor oil to water, that reduces its quality; to make impure or unsafe by contact with potentially harmful substances.

Corrosive—a substance capable of dissolving or breaking down other substances (especially metals) or causing skin burns. A corrosive has a ***pH level*** below 2 or above 12.5.

Decompose—to break down into basic components, given the right conditions of light, air, and moisture; refers to materials such as food and other plant and animal matter.

Deforestation—the clearing and removal of trees from a forested area.

Disposable—products or materials that can be or are usually thrown away after one use or a limited amount of time. For example, used paper plates are disposable.

Disposal—refers to the process of throwing away unwanted materials. These materials are placed in a landfill or combusted rather than recycled, reused, or composted.

Disposal cell—a fixed area in a ***sanitary landfill*** where waste is disposed of, compacted into the smallest space possible, and then covered with soil on a daily basis.

Durable—goods that can be used more than once and withstand long use, wear, and decay. Appliances are examples of durable goods.

Dump—site where waste is disposed of in an unmanaged, uncovered area. Current landfill restrictions have made dumps illegal. See sanitary landfill.

Ecosystem—community of plants and animals that interact with one another and with the surrounding nonliving environment. Examples of ecosystems include ponds, forests, and beaches.

Effluent—waste material discharged into the environment; refers to the treated liquid emitted from a manufacturing facility or municipal wastewater treatment plant.

Emission—the discharge of gases or particles, such as from a smokestack or automobile engine.

Energy—capacity for a system or an object to do work (i.e., cause a change by pulling, pushing, or heating). Energy generated from incineration, for example, can be harnessed to provide electrical power for communities.

Environment—the external conditions that influence the development and survival of an organism or population; usually refers to air, water, land, plants, and animals.

Environmental impact—the effect of an activity or substance on the environment.

Environmentally preferable products—those products that have a reduced effect on human health and the environment when compared to other products that serve the same purpose.

For example, products that contain recycled content, require less energy or create less waste during production and manufacture, use less packaging, or are reusable or recyclable are preferable.

Flammable—describes a substance that ignites and burns.

Food chain—the transfer of food energy from one organism to the next. As one example of a simple *food chain*, an insect consumes a plant and is then consumed by a bird.

Food web—the complex and interlocking networks of food chains within ecosystems where plants and animals coexist and depend on one another for energy needs.

Fossil fuels—fuels such as petroleum or coal formed over millions of years from the remains of ancient organic materials.

Geothermal energy—the internal heat of the earth collected from underground concentrations of steam or hot water trapped in fractured or porous rock.

Global climate change—natural or human induced change in the average global temperature of the atmosphere near the Earth's surface. This condition poses serious dangers around the world, potentially prompting such disasters as flooding, drought, and disease.

Grasscycling—refers to a method of source reduction whereby grass clippings are left on the lawn rather than bagged and set out for collection.

Greenhouse effect—the excessive trapping of heat in the Earth's atmosphere by a blanket of gases. Gases such as water vapor, methane, and carbon dioxide exist naturally and help retain the Earth's normal surface temperature. Changes in the normal volume of gases in the atmosphere, due to human-induced activities, are believed to contribute to global climate change.

Greenhouse gas—gas such as methane, nitrous oxide, ammonia, sulfur dioxide, carbon dioxide, and certain chlorinated hydrocarbons that affects the overall heat-retaining properties of the Earth's atmosphere. A build-up of these gases creates a warming of the Earth's atmosphere, thus changing the global climate.

Ground water—water stored in porous spaces of soil and rock underground. Many communities depend on ground water for their drinking water.

Habitat—an area where a living organism is typically located that provides adequate food, water, shelter, and living space for survival.

Hazardous waste—waste that is often produced in large quantities by businesses and industrial facilities that can be defined as toxic, ignitable, corrosive, or reactive. This type of waste is regulated by a law called the Resource Conservation and Recovery Act (RCRA) to

minimize risks to human health and the environment.

Household hazardous waste—small quantities of unused or leftover hazardous products used in the home that become waste. Paints, pesticides, and some cleaners are examples of household hazardous waste. Caution must be taken when handling, storing, or disposing of these products.

Humus—the organic portion of soil; a substance resulting from the decay of plant and/or animal matter by microorganisms.

Ignitable—capable of burning; will catch fire at temperatures less than 140° F.

Incineration—see combustion/incineration.

Incinerators—see combustor/incinerator.

Integrated waste management—the complementary use of a variety of waste management practices to safely and effectively handle municipal solid waste. These practices include source reduction, recycling, composting, combustion, waste-to-energy, and landfilling.

Landfill—see sanitary landfill.

Landfill reclamation—the process whereby old disposal cells are excavated to recover recyclable items.

Landfilling—the process of hauling waste to a landfill cell for disposal.

Leachate—occurs when precipitation seeps through a landfill and mixes with toxic and nontoxic liquids, some of which are created during biological decomposition. A sanitary landfill usually has a leachate collection system where leachate is collected from the landfill and treated to prevent the contamination of ground water.

Leachate collection system—a system of layers and pipes, located between the primary and secondary liners in a landfill, designed to capture all leachate and prevent groundwater contamination.

Leachate recovery facility—a special facility designed to collect liquids leaching out of a landfill to remove harmful or particulate materials.

Life cycle—the complete cycle of events occurring over the lifetime of an animate or inanimate object. For example, in the life cycle of a plant, seeds are dropped in the ground; soil, water, and compost help the plants grow; the plants drop seeds; the plants die and become compost; new seeds grow into new plants. A product life cycle is the series of steps involved in manufacturing; distributing; using; reusing, recycling, or ultimately disposing of

a product.

Liner—a layer of plastic or clay placed in a sanitary landfill to prevent leachate from escaping and contaminating surrounding ground water.

Manufacturing—the process of turning raw materials into a product or good by hand or machinery.

Methane—a colorless, odorless, flammable gas formed by the anaerobic decomposition of organic waste in a landfill. Methane also is a greenhouse gas that contributes to global climate change. Many sanitary landfills have a system in place for methane gas recovery. These facilities collect some of the methane and sell it as a source of energy for heating buildings, manufacturing products, or other uses.

Microorganisms—organisms of microscopic size, such as bacteria, amoeba, and viruses.

Municipal—properties, goods, and services owned or operated by a city or county government.

Municipal solid waste—wastes such as durable goods, disposable goods, containers and packaging, food scraps, yard trimmings, and miscellaneous inorganic wastes from households, some commercial establishments (e.g., businesses or restaurants), institutions (e.g., schools or hospitals), and some industrial sources. It does not include nonhazardous industrial wastes, sewage, agricultural waste, hazardous waste, or construction and demolition waste. Also known as garbage, trash, refuse, or debris.

Municipal solid waste landfill—see sanitary landfill.

Natural resources—raw materials or energy supplied by nature and its processes (e.g., water, minerals, plants). Trees are a natural resource used to make paper, and sunlight is a natural resource that can be used to heat homes.

NIMBY (Not In My Backyard)—a term indicating the attitude of individuals who oppose siting a disposal facility in their communities.

Nonrenewable resources—naturally occurring raw materials that are exhaustible and become depleted more quickly than they naturally regenerate. Some nonrenewable resources, such as peat, petroleum, and metals, are only available in limited quantities, take a long time to form, and are used up rapidly.

Nontoxic—does not contain substances that are harmful, poisonous, or destructive.

Oil (crude oil)—unrefined liquid petroleum.

Open dumps—the outdated, unsanitary practice of discarding waste in unlined, unprepared land sites.

Organic—from a living organism (e.g., plant, animal, person, or bacteria). Also refers to a product grown or manufactured only with natural materials (e.g., corn grown with compost and not chemical fertilizer or pesticides; shampoo made from plants instead of human-made chemicals).

Organism—a living body made up of cells and tissue; examples include trees, animals, humans, and bacteria.

Packaging—a cover, wrapper, container, or stabilizer (e.g., strapping or pallet) designed to store, transport, display, and protect a product and/or attract purchasers.

Pathogen—an organism that causes disease, such as e. coli or salmonella typhi bacteria.

Pay-As-You-Throw (PAYT)—see unit-based pricing.

Petroleum—a fossil fuel extracted from natural deposits deep in the Earth; consists of a mixture of solids, liquids, and gases that are physically separated (refined) into products such as gasoline, wax, asphalt, and petrochemical feedstocks, which are the building blocks of many plastics. Also sometimes known as oil (crude oil).

pH—a measure of acidity or alkalinity. The pH scale ranges from 0 to 14. A substance with a value less than 7 is acidic, 7 is neutral, and above 7 is alkaline.

Pollutant—a liquid, gas, dust, or solid material that causes contamination of air, water, earth, and living organisms.

Pollution—the contamination of soil, water, or the atmosphere by the discharge of harmful substances.

Pollution prevention—preventing or reducing pollution where it originates, at the source—including practices that conserve natural resources through increased efficiency in the use of raw materials, energy, water, and land. See waste minimization.

Postconsumer content—percentage of materials recovered by consumers (from the municipal solid waste stream). For example, a newspaper might be made from 30 percent recovered newsprint.

Postconsumer materials—materials recovered through recycling programs (i.e., materials recovered from the municipal solid waste stream, not from internal industrial processes). These materials are often used to make new products. Newspapers that are recycled by consumers, for example, are a postconsumer material used to make newsprint.

Preconsumer content—percentage of materials salvaged for reuse from the waste stream of a manufacturing process (rather than from consumers) subsequently used to manufacture a product.

Processing—see manufacturing.

Product—item manufactured by hand or by industry for consumers to purchase and use.

Pulp—a mixture of fibrous material such as wood, rags, and paper, ground up and moistened to be used in making paper or cardboard.

Raw materials—unprocessed materials used in the manufacture of products. These unprocessed materials can be either natural substances such as wood or metals or recovered materials such as crushed glass from residential recycling.

Reactive—tending to react spontaneously with air, solids, or water, explode when dropped, or emit toxic gases.

Recovered material content—see *recycled content*.

Recovered materials—materials used in a manufacturing process that are obtained from municipal recycling programs or collected from industrial processes (e.g., short paper fibers left over after making high-grade paper may be used to make paperboard).

Recovered resources—see *resource recovery*.

Recycling—collecting, sorting, processing, and converting materials that would have been thrown away into *raw materials* used to make the same or new products.

Recycling loop—the cycle of collecting and processing, manufacturing products with recycled content, and purchasing products containing recycled materials. Consumers “close the recycling loop” when they buy recycled-content items.

Recycled content—also known as recovered material content, is the percentage of material a product is made from that has been recovered from consumers in the *municipal solid waste stream (postconsumer content)* plus any industrial materials salvaged for reuse (*preconsumer content*).

Recyclable—material that still has useful physical or chemical properties after serving its original purpose and can be reused or remanufactured to make new products. Plastic, paper, glass, steel and aluminum cans, and used oil are examples of recyclable materials.

Residential—refers to homes and neighborhoods.

Resource Conservation and Recovery Act (RCRA)—a set of regulations that control the management of hazardous waste to protect human health and the environment.

Resource recovery—the process of obtaining materials from waste that can be used as raw materials in the manufacture of new products or converting these materials into some form of fuel or energy source. An integrated resource recovery program may include recycling,

waste-to-energy, composting, and/or other components.

Resources—materials used to make products, generate heat, produce electricity, or perform work. See *natural resources*, *nonrenewable resources*, and *renewable resources*.

Renewable resource—naturally occurring raw material that comes from a limitless or cyclical source such as the sun, wind, water (hydroelectricity), or trees. When properly used and managed, renewable resources are not consumed faster than they are replenished.

Reusable—material that can be used again, either for its original purpose, or for a new purpose.

Reuse—a type of *source reduction* activity involving the recovery or reapplication of a package, used product, or material in a manner that retains its original form or identity.

Runoff—water, usually from precipitation (rain), that flows across the ground—rather than soaking into it—and eventually enters a body of water. Sometimes carries substances, such as soil or contaminants, into a water body.

Sanitary landfill—a site where waste is managed to prevent or minimize health, safety, and environmental impacts. To develop a sanitary landfill, communities excavate soil and install an impermeable liner, made of plastic or clay, to prevent the contamination of *ground water*. Waste is deposited in different cells and covered daily with soil. Sanitary landfills often have environmental monitoring systems to track performance and collect *leachate* and *methane gas*. Some landfills are specially designed to handle hazardous waste.

Solid waste—see *municipal solid waste*.

Source reduction (also known as **waste prevention**)—any change in the design, manufacture, purchase, or use of materials or products (including packaging) to reduce their amount or toxicity before they become *municipal solid waste*. Source reduction also refers to the *reuse* of products or materials.

Sustainability—social and environmental practices that protect and enhance the human and natural resources needed by future generations to enjoy a quality of life equal to or greater than our own.

Thermophilic—“heat loving,” or surviving well in high temperatures. In the composting process, heat-loving microorganisms break down food scraps and yard trimmings into a crumbly, soil-like substance.

Tipping fee—a fee assessed for waste disposal in a sanitary landfill, waste-to-energy plant, or composting facility for a given amount of waste, usually in dollars per ton. Fees are established based on disposal facility costs and the amount disposed of at the facility.

Toxic—containing compounds that pose a substantial threat to human health and/or the environment.

Unit-based pricing/PAYT (Pay-As-You-Throw)—a system in which residents pay for municipal solid waste management services per unit of waste (by weight or volume) collected rather than through a fixed fee. Residents, for example, might purchase a sticker to place on each bag of waste set out at the curb—the price of the sticker covers the solid waste management service costs for the volume of the bag.

Vermicomposting/vermiculture—a method of composting using a special kind of earthworm known as a red wiggler (*Eisenia fetida*), which eats its weight in organic matter each day. Over time, the organic material is replaced with worm castings, a rich brown matter that is an excellent natural plant food.

Virgin materials—previously unprocessed materials. A tree that is cut into lumber to make pallets is an example of a virgin material. Lumber recovered from broken pallets to make new pallets is not a virgin material but a **recyclable material**.

Virgin resources—raw materials that must be mined or captured from the Earth for use in the creation of products or energy.

Waste—see **municipal solid waste**.

Waste management—administration of activities that provide for the collection, source separation, storage, transportation, transfer, processing, treatment, and disposal of waste.

Waste management hierarchy—the preferred way to manage solid waste is to first practice **source reduction**, then recycle and compost, and finally to combust waste at a **waste-to-energy** facility or place it in a **sanitary landfill**.

Waste minimization—includes reducing waste before it is even generated (see **source reduction**) and environmentally sound recycling. Often used in relation to hazardous waste.

Waste prevention—see **source reduction**.

Waste-to-energy—a process in which waste is brought to a facility and burned to generate steam or electricity.

Waste-to-energy facilities—specially designed waste management facilities where waste is burned to create energy, which is captured for use in generating electricity.

Waste stream—the total flow of solid waste generated from homes, businesses, and institutions that must be recycled, incinerated, or disposed of in landfills.

Windrow—large, elongated pile of **yard trimmings** or other organic materials used in the

composting process, typically turned by a machine. Municipal composting programs often use windrows for large-scale composting of ***yard trimmings***.

Yard trimmings—grass, leaves, tree branches, brush, tree stumps, and other compostable organic materials that are generated by homes, schools, or businesses.



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