SUGGESTED REFERENCES

- *Awesome Library Links with knowledge about recycling*
  http://www.awesomelibrary.org/Classroom/Science/Ecology/Recycling.html
- *The Environmental Protection Agency Website, Climate Change – Greenhouse Gas Emissions*
  http://www.epa.gov/climatechange/emissions/ind_home.html
- *The Environmental Protection Agency Website, Zero Waste: From Philosophy to Practical Implementation*
  http://www.epa.gov/waste/rcc/web-academy/2009/sep09.htm
- *Welcome to Recycling facts*
  http://recyclingfacts.org/

NATIONAL SCIENCE EDUCATION STANDARDS

Grades K - 4, 5 - 8
Science & Technology
Abilities of technological design
Understandings about science & technology

Grades 5 - 8
Physical Science
Properties and changes of properties in matter

Grades K - 8
Science in Personal & Social Perspectives
Personal and community health
Environmental quality
Natural and human-induced hazards
Science and technology in local challenges

**Source: National Science Education Standards, 1996, National Academy Press*

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Science Screen Report FOR KIDS

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ECOLOGY - *The Science of Recycling*

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National Science Foundation
Presidential Awards for Excellence in Mathematics and Science Teaching

CILC
Center for Interactive Learning and Collaboration
www.cilc.org

JETS
Junior Engineering Technical Society
www.jets.org

SYNOPSIS

The average American produces almost 2 kilograms of garbage per day, or 13 kilograms per week and 726 kilograms per year. New technologies are helping scientists find ways to reduce these numbers and recycle many valuable raw materials instead of becoming waste in everyday trash.

This program demonstrates how scientists are utilizing microorganisms to minimize waste and new separation technologies to aid in recycling. Removal of specific valuable metals from appliances, computers and automobiles has become a lucrative business. To help protect our environment, engineers are learning to focus on creating new products with recycling in mind in the design plan.

CURRICULUM UNITS

- ECOLOGY
- ENVIRONMENTAL SCIENCE
- PHYSICAL SCIENCE

RUNNING TIME

14 minutes

BACKGROUND

In the past, waste was collected and deposited in a large pile and buried in the ground. However, disposal of waste to landfills has decreased from 89% in 1980, to 54% in 2007. The number of landfills has declined, but the capacity of each landfill has increased. With rapidly increasing recycling operations, the number of landfills will hopefully continue to decrease.

Environmental concerns have influenced improved landfill policies and materials recovery. Efforts to reduce, reuse and recycle are paying off. The success of recycling programs begins with encouragement of individuals and businesses to separate their trash and recyclables. Present day processing facilities are becoming increasingly more advanced in handling and separating different materials.

Some waste processing facilities rely on biological processes to deal with waste. After waste is sorted and placed in closed containers, microorganisms are used to break down organic materials. To accelerate this process, engineers pump in warm, moist air. Before the process is over, the warm air is condensed and remaining water is sent though a micro-filter to vaporize it and burn off any dangerous gases. The result is toxin-free dry waste. Some larger non-biological materials are separated out and burned.

Magnets and whirlstreams are used to separate metals from nonmetals, and glass and mineral materials are separated on a conveyor belt that uses light to distinguish between which materials are transparent and those that are not.

Extracting precious metals from things such as appliances, cellular phones, computers, and automobiles has also become highly profitable. In the past, what used to be done chemically is now often accomplished through electrolysis.

Modern automobiles are made up of thousands of kilograms of steel, glass, plastic, and hazardous waste and require specific practices in recycling. Many automobile manufacturers are designing their products with the future in mind. They specifically plan for the disassembling process and the possibility of parts for recycling before a car goes into production.

The future of recycling technology is in automated systems and pre-planning of materials as recyclable. Increasingly intelligent separation technology will deal with increasingly complex products. The focus in the future will include saving time and energy while making economic sense.

CRITICAL THINKING EXERCISES

1. Design a chart to represent items students commonly recycle. Analyze the chart to determine where and when students are most likely to think and use the “three R’s. reduce, reuse, and recycle”.

2. Formulate a plan to reduce, reuse and recycle within a controlled environment like a classroom. Judge how this plan is different when applied to larger environments, such as an entire town.

3. Interpret the phrase “Think globally, act locally” in terms of the “three R’s”.

4. Suggest possible uses of landfill spaces one hundred years from now. Will the space ever be usable again?

CAREER POSSIBILITIES

- BIOLOGIST
- CHEMICAL ENGINEER
- ECOLOGIST
- ENVIRONMENTAL ENGINEER
- MECHANICAL ENGINEER
- SANITATION ENGINEER

ADVANCED ORGANIZERS

Prior to viewing this program, students should have some understanding of the following Benchmarks for Science Literacy, Oxford University Press which are excerpted and, in some cases, abbreviated below. Refer to the Benchmarks for more information.

Benchmark 8. The Designed World
Section B: Materials & Manufacturing Grades 3-5

- Naturally occurring materials such as wood, clay, cotton, and animal skins may be processed to change their properties.
- Humans have produced a wide variety of materials, such as steel, plastic, and nylon, that do not appear in nature.
- Discarded products contribute to the problem of waste disposal.
- Sometimes it is possible to use the materials from discarded products to make new products, but materials differ widely in the ease with which they can be recycled.

Benchmark 3. The Nature of Technology
Section B: Design and Systems, Grades 6-8

- Design usually requires taking into account not only physical and biological constraints, but also economic, political, social, ethical, and aesthetic ones.
- All technologies have effects other than those intended by the design, some of which may have been predictable and some not.
- Side effects of technologies may turn out to be unacceptable to some of the population and therefore lead to conflict between groups.

**Benchmarks can be found at www.project2061.org/tools/benchol/bolintro.htm*

VOCABULARY

Computer Aided Design . The part of computer aided engineering concerning the drawing or physical layout steps of engineering design. Often found in the phrase "CAD/CAM".

Electrolysis . . . . . The passage of an electric current through an electrolyte with subsequent migration of positively and negatively charged ions to the negative and positive electrodes.

Infrared Spectroscope . . Any of various instruments used to analyze the component parts of a sample by separating its parts into a spectrum. In a light spectroscope, light is focused into a thin beam of parallel rays by a lens, and then passed through a prism or diffraction grating that separates the light into a frequency spectrum. The intensity of light at different frequencies in the spectrum can be analyzed to determine certain properties of the source of the light, such as its chemical composition or how quickly it is moving.

Palladium . . . . . A malleable, ductile, grayish-white metallic element that occurs naturally with platinum. It is used as a catalyst in hydrogenation, in alloys for making electrical contacts, and jewelry.

Platinum . . . . . A soft, ductile, malleable, silver-white metallic element that usually occurs with osmium, iridium, palladium, or nickel. It has a high melting point and does not corrode in air. It is used as a catalyst and in making jewelry, electrical contacts, and dental crowns.

Rhodium . . . . . A rare, silvery-white metallic element that is hard, durable, and resistant to acids. It is used as a permanent plating for jewelry and is added to platinum to make high-temperature alloys.