Waste Reduction Module

Background: Waste is created by production and consumption. This unit examines what our society consumes, how media and population influence consumption, life cycles of products and waste within the school. It asks students to think of ways to reduce consumption.

This unit creates multiple sub-sections. Teachers can choose to implement part or all of these lessons.

Unit components and assignments:

I. Introduction to waste: Trash Can Quiz/Fun Facts; Ecological footprint—Math, Science, Social Studies, English
II. Media in our minds—English, Social Studies
III. Consumption and Culture—Math
IV. Life Cycle of a Product—Science, Social Studies
V. School Waste Audit—Math, Science, Social Studies, English
Extensions—Writing option
Community Waste Audit
VI. Composting—Science, but other subjects could use this with Toyota
VII. Reduction Rap—Social Studies, English
Extensions—Newspaper Sleuth—Social Studies, English
Making Recycled Paper—Science, Art

Lesson One:

Introduction: Trash Can Quiz/Fun Facts; Ecological footprint
Footprint survey is also referenced in the Energy Module.

Website Sources: This lesson is adapted from

- http://www.greenschools.net/documents/trashcanquizscript.doc
- http://www.earthday.net/footprint/

Subject Area: Math, Science, Social Studies, English

Kentucky Connections:

- Core Content: MA-HS-1.2.1; MA-HS-2.2.1; RD-11-2.0.7; RD-11-4.0.2; SC-HS-3.5.1; SC-HS-4.7.1; SC-HS-4.7.2; SC-HS-4.7.5; SS-HS-3.1.1; SS-HS-3.4.3

Materials:

- Trash Can Quiz statistics
- Trash can
- A variety of types of trash
- Internet access if possible.
- Ecological Footprint Survey

Length of Lesson: One class period. The Ecological Footprint Survey would be easiest to complete online in class or at home. Students could report their results.

Vocabulary Words: resource, ecological footprint, landfill, recycle

Essential Questions:

- What type and amount of waste does our society produce?
- What type and amount of waste does my family produce?

Guiding Questions/Outcomes:

- Students will learn how much trash and what type of trash is thrown away.
- Students will determine how much trash and waste they generate at home.
- Students will see how many planets would be needed if everyone lived and consumed as they do.

Skills Used:

- Observing
- Calculating
- Comparing

Activity:
1) The Trash Can Quiz is taken from
http://www.greenschools.net/documents/trashcanquizscript.doc

2) The Ecological Footprint Survey is taken from http://www.earthday.net/footprint/
This survey is also referenced in the Energy Module.

If technology is not available for a class, you can print a different survey from http://www.wrwcanada.com/09ecofootprint.htm. The units of measure are hectares on this site.

Trash Can Quiz
Fun Facts About Trash and Recycling
Adapted from the clickable garbage can developed
by Environmental Defense

Have your students take the "Trash Can Quiz" and see how much you know about the treasures we throw away. This activity helps students understand the "materials flow" of many products we use, from the natural resource through manufacturing and disposal. Happy reducing, re-using, recycling, and rotting! And remember, we cannot consume our way to sustainability – reducing and re-using are crucial, not just recycling.

How to do the Activity
Bring in a small garbage can filled with typical items thrown away: plastic water bottle, soda can, office paper, banana peel, tin can, leaves or grass clippings, newspaper. Call on

students one at a time to come up, close their eyes (or blindfold), reach in and pick out a treasure…. then surprise them with these amazing statistics (below) by asking a series of questions about how much we throw away in the U.S., how much recycling could save, and what can be made from recycled materials. These statistics are national for the U.S. and are from a variety of years (1990's and beyond). You can often go to your local waste management authority's website and get localized statistics and information for your area.

Sample Script

For each item chosen by a student from the trash can, ask questions like the following:

- What is it? (a can, a bottle, a piece of paper, etc.)
- What is it made of? (glass, metal, etc.)
- What resources are used to make this? (glass is made from sand, paper is made from trees, plastic is made from oil, cans are made from aluminum that is made from bauxite, etc.)
- Where does this resource come from? (sand comes from desert, rivers; trees for paper come from forests in US, Canada, Indonesia, Amazon; oil comes from Alaska, South America, Africa, Texas, Middle East; etc.)
- How much of this item do you think Americans use? (see the statistics below)
- Can this item be re-used? Can it be recycled? Can it be rotted?
- Can you make the same thing out of the recycled item – is it a closed loop? (a new bottle can be made from recycled glass; a new soda-can can be made from recycled aluminum; a new plastic bottle CANNOT be made from recycled plastic, but other plastic items like carpet, fleece jackets, or plastic lumber can be made from recycled plastic bottles; new paper can be made from recycled paper; new soil can be made from composted banana, etc.)
- How much could we save if this item were recycled, re-used, or rotted? (see statistics below)

Have fun with this! Express amazement about the amount of resources we use and how much we can save. Ask students if they can imagine these amounts. Ask if they know how to express some of these very large numbers. Ask them what they think.

GLASS BOTTLES

We throw away enough glass bottles and jars to fill two TransAmerica (the pyramid building in San Francisco) buildings *every two weeks.*

Glass never wears out -- it can be recycled forever. We save more than a ton of resources for every ton of glass recycled -- 1,330 pounds of sand, 433 pounds of soda ash, 433 pounds of limestone, and 151 pounds of feldspar. A ton of glass produced from raw materials created 384 pounds of mining waste. Using 50% recycled glass cuts it by about 75%.

ALUMINUM CANS

American consumers and industry throw away enough aluminum to rebuild our entire commercial airfleet *every three months.*

Aluminum smelting requires A LOT of energy. Making a new can from recycled aluminum can save up to 95% of the energy required compared to "virgin" aluminum (made from all new resources).

Aluminum recycling rates have dropped from a high of 65% and are now about 63%. Americans use about 350 aluminum cans per person per year. In 2001, Americans ***did not*** recycle 51 billion cans.

Recycling 1 aluminum can saves enough energy to run a laptop computer for 4 hours. In the U.S., we throw away cans representing about 200 billion hours of electricity – that's a lot of power plants!

PLASTIC BOTTLES AND PLASTIC BAGS

Americans go through 2.5 million plastic bottles *every hour*, only a small percentage of which are recycled.

In 2002, 4-5 *trillion* plastic bags were used globally.

Americans throw out 100 billion plastic bags per year, only about 0.6% of the bags are recycled.

Plastic can be recycled to make fleece fabric, carpet, sleeping bags, artificial lumber, and other products. The City of San Francisco passed a law banning the use of plastic grocery bags, to be phased in over the next few years.

PAPER

Every week more than 500,000 trees are used to produce the *two-thirds* of newspapers that are never recycled.

In the U.S. on average, we use 730 pounds of paper per person per year. In Japan the average is 500 lbs/person/year; in India the average is about 10 lbs/person/year. In the U.S., this amounts to about 31.5 million tons of printing and writing paper per year, requiring about 535 million trees (most from virgin fiber) and 12 billion gallons of oil for its manufacturing.

The U.S. Declaration of Independence was written on hemp paper.

In the last year, logging in the Southeastern U.S. resulted in a loss of land about the size of New Jersey (5 million acres). In fact, the area of natural pine forest there has declined in size from 72 million acres in 1953 to 33 million acres in 1999. This is where most of the trees used to make paper come from (an astonishing 26% of the world's supply, to be exact), and it's clearly in critical danger. As if this doesn't sound doomsday-ish enough, global production in the paper sector is expected to increase by 77% between 1995 and 2020.

In the landfill, where 80% of discarded paper ends up, the decomposition of paper produces methane, a greenhouse gas with 21 times the heat-trapping power of carbon dioxide. The EPA cites landfills as the single largest source of methane emissions to the atmosphere, with paper representing about 38% of the municipal solid waste stream. Within schools the percentage of paper in the waste stream is even higher, almost 50%! According to the California Integrated Waste Management Board, which analyzes schools' waste on a district-by-district basis, Alameda County schools alone dispose of more than 11,700 tons of paper waste every year. San Diego runs through more than 24,000 tons, and Los Angeles schools go through a whopping 75,600 tons of paper annually.

Using 1 ton (40 cases) of 30% Post-Consumer Waste Copy Paper saves the equivalent of:

* 7.2 trees [forty feet in height and 6-8 inches in diameter] (Conservatree, www.conservatree.org)
* 2,100 gallons of water, 1,230 kw hours of electricity, and 18 pounds of air pollution (Californians Against Waste, www.cawrecycles.org)

Using 1 ton (40 cases) of 100% Post-Consumer Waste Copy Paper saves the equivalent of:

* 24 trees,
* 17 million BTUs of energy
* 2,108 pounds carbon/yr (for comparison, emissions from 1 car = 11,000 lbs/yr);
* 8,750 gals water (<1 swimming pool);
* 1,124 lbs garbage (Environmental Defense Paper Calculator)

YARD WASTE AND FOOD WASTE

Every year we dispose of *24 million tons* of leaves and grass clippings, which could be composted to conserve landfill space.

Americans throw away about 10% of the food we buy, equivalent to 21 million shopping bags full of food going to the landfill. In 1995, we threw away 48 million tons of food. On average, Americans generate about 106 pounds of food waste per person per year. Less than 3% of the food waste is composted. Meanwhile, more than 27 million Americans are considered "food insecure" without enough to eat.

IRON AND STEEL

We throw away enough iron and steel to *continuously* supply all the nation's automakers.

Recycled steel cans are used to make new steel products including cars, bridges, lawnmowers, stoves, and construction materials. Over 5400 BTU's of energy are conserved for every pound of steel recycled . The steel industry's annual recycling saves the equivalent energy to electrically power about 18 million households for a year. Every time a ton of steel is recycled, 2500 pounds of iron ore, 1000 pounds of coal and 40 pounds of limestones are preserved.

SOURCES AND RESOURCES

1. Environmental Defense, clickable garbage can, www.environmentaldefense.org
2. The World Watch Institute, *Good Stuff: A Behind-the-Scenes Guide to the Things We Buy*, http://www.worldwatch.org/pubs/goodstuff/
3. Thomas Recycling Companies, *Kids' Page*, http://www.thomasrecycling.com/facts.htm
4. EarthWorks Group. 1990. The Recycler's Handbook. Berkeley, CA: The EarthWorks Press.
5. Paper saving estimates, www.papercalculator.org, published by Environmental Defense.
6. California Integrated Waste Management Board, http://www.ciwmb.ca.gov/Schools/WasteReduce/default.htm
7. San Mateo County, Recycle Works Program, http://www.recycleworks.org/schools/s_audits.html
8. Earth Team's *SchoolNeutral* Carbon Calculator, http://www.earthteam.net/GWCampaign/calculate.html
9. NRDC's Green Squad, a virtual school tour and environmental assessment, www.nrdc.org/greensquad/
10. Redefining Progress' Ecological Footprint Quiz, www.myfootprint.org

Media and Consumption

Lesson Two: Why We Buy What We Buy, "Media in Our Minds"

Website Sources:
- http://www.saskwastereduction.ca/wrw/wrwactivities2005.htm

Subject Areas: English, Social Studies, Science

Kentucky Connections:
- Core Content: RD-11-3.0.8; RD-11-3.0.3; RD-11-5.0.4; RD-11-5.0.7; RD-11-4.0.1; SC-HS-3.1.1; SC-HS-3.2.3; SC-HS-3.3.2; SC-HS-3.4.3; SC-HS-4.7.1; SC-HS-4.7.2; SC-HS-4.7.5; SS-HS-3.1.1; SS-HS-3.2.3; SS-HS-3.3.2; SS-HS-3.4.3

Materials:
- *Brave New World* copies
- Newspapers, including the ad sections
- Magazines geared toward different audiences
- Optional—taping of a television show and the advertisements used in the show (taping the Superbowl for the ads is a good way to do this.)
- Blank paper
- Glue
- Scissors

Length of Lesson: 2-3 class periods

Vocabulary Words: consumption, audience, disposable, reusable

Essential Questions:
- How does the media influence what we want to buy?
- How does the media aim its ads at various audiences?

Guiding Questions/Outcomes:
- Students will be able to explain how advertisers target teens.
- Students will be able to discuss disposable versus reusable products.
- Students will be able to discuss advertising in *Brave New World* excerpt and compare that prediction to our society.

Skills Used:
- Observing
- Understanding written word
- Calculating
- Comparing

Activity:

1) Students can read the first three paragraphs of Chapter 3 in *Brave New World.* This is a brief section.
2) Ask students how our world compares to the world foretold by Aldous Huxley.
3) Use the "Media in Our Minds" activity to have students consider how media impacts what we want to buy. This also leads to discussion of how the target audience impacts advertisers.

Go to this link for "Media in Our Minds" and "Advertising Alternatives" projects:
http://www.saskwastereduction.ca/wrw/wrwactivities2005.htm

The text is printed here:
Media In Our Minds:
The first of the Three Rs is "Reduce" - in other words, if you don't buy something to begin with, you don't need to find a way to dispose of it. The media has a huge effect on our purchasing practices.

In small groups, have students create a collage of advertisements that encourage consumption. Each group then discusses and makes notes on the following questions:

- How does advertising affect what we want to buy?
- Did anyone find ads encouraging recycling or waste reduction? Why or why not?
- What is the difference between the ads aimed at young people and the ads aimed at adults?

Each group will then show its collage to the class and discuss responses to the questions.

Extension:
Have students monitor television programming for an evening (or longer) and report back on the following:

- What kinds of consumption patterns are modeled by characters in television programs?
- How much time is devoted to advertising and how much to programming?
- What kinds of products are advertised during kids' programs? Sports shows? The news?
- How often (in programs or advertisements) are "new", "more", "bigger", and "better" emphasized? Why?

Advertising Alternatives:
The first of the Three Rs is "Reduce" - in other words, you can choose alternative products that create less waste. Advertising has a huge effect on our purchasing practices and often encourages us to make poor choices. What if ads told us the truth about products?

Materials:
Blank paper (8.5x11), drawing utensils, collage materials (old magazines, newspapers, flyers, etc.), glue and scissors.

Method :
Have each student identify a product that is obviously designed to be wasteful (i.e. all or part of it is disposable and probably not recyclable). Then have students think of alternative products or methods which would produce little or no waste in comparison.

Examples: disposable razors vs. reusable razor blades, individually wrapped snacks vs. reusable containers, throwaway makeup removers vs. washcloths
Based on these contrasting products, have students design a print ad which criticizes the wasteful product and promotes the reusable/durable alternative. The ads can be drawn by hand and incorporate elements of collage.

Discussion:

- How does advertising convince us to buy wasteful products?
- How do you think we would behave if the waste-producing aspects of every product had to be identified?

Assessment: Discussion

Consumption and Culture

Lesson 3: Population Growth and Exponential Function
This lesson is adapted from
http://www.ciese.org/curriculum/popgrowthproj/activity7.html and *Precalculus, Graphing and Data Analysis*; Michael Sullivan, Michael Sullivan III, Prentice Hall, 1998.

Website Sources:

- http://www.ciese.org/curriculum/popgrowthproj/activity7.html
- http://www.census.gov/main/www/popclock.html
- http://www.census.gov/population/estimates/nation/popclockest.txt
- http://www.census.gov/ipc/www/idbsum.html
- http://www.triplepundit.com/pages/waste-footprint-ii-by-the-numb-002783.php

Subjects: Math, Science, Social Studies
This could also be connected to a literature class that is reading *Brave New World*.

Kentucky Connections:

- Core Content: MA-HS-5.1.1; MA-HS-5.1.4; SC-HS-4.7.1; SC-HS-4.7.2; SC-HS-4.7.5; SS-HS-5.3.3; SS-HS-5.3.6

Materials:

- scientific calculator
- computer with internet access

Length of Lesson: 1-2 class periods

Vocabulary Words: linear, exponential, function, growth rate, growth factor

Essential Questions:

- Is the population of the U.S. growing exponentially?
- What implications does this have on our environment?

Guiding Questions/Outcomes:

- Students will be able to use an exponential function to predict and compare population values of the U.S.
- Students will be able to analyze the accuracy of the Malthusian Growth Model.
- Students will be able to calculate the effects that U.S. population growth has on U.S. waste production.

Skills Used:

- Observing
- Modeling
- Predicting
- Comparing
- Analyzing
- calculating

Activity: Thomas Malthus and Population Growth

Introduction

In response to the poverty and misery among the lower classes, Thomas Malthus wrote *A Summary View of the Principle of Population* in 1830. In this article, Malthus contended "population, when unchecked, increases in a geometrical (exponential) progression of such a nature as to double itself every twenty-five years." Malthus also felt the rate of increase in the output of agriculture "would fall short, beyond all comparison, of the natural increases of population in a geometric progression." This shortfall would cause population growth to subside.

Population growth has long been a concern. Living on a planet with limited resources necessarily implies the planet has an upper bound at which it can sustain a population. Malthus felt the misery of his time was a direct result of exponential increases in population combined with linear increases in agricultural output. Of course, we now know that agricultural output has increased faster than linear so Malthus' doomsday predictions did not come to fruition. However, do populations grow exponentially as Malthus proposed? Let's take a look at an exponential model.

When looking at population growth over a short period of time, it may appear to follow a linear function.

- **Optional:** Use the US Population Clock at http://www.census.gov/main/www/popclock.html and record the U.S. population

at regular intervals such as every 1/2 hour for a few hours or every 24 hours for a week. Determine the best function for this data.

While a linear function can be used to model population growth that has a constant increase or decrease in the number of people, an exponential function can be used to model population growth that has a constant percentage change in population.

Since the average annual percent change in a population (growth rate) is often relatively constant during a short period of time, it is not uncommon to fit an exponential model to population data.

Exponential Function
Constant Growth Rate
Model

$$f(t) = ab^t$$

$f(t)$ = population after t years

a = initial value

b = base or growth factor

t = time in years

This exponential model, also called the Malthusian Growth Model after Thomas Malthus, can be used to predict population during a period when the population growth rate remains constant.

1. From the U.S. Census Bureau's Historical National Population Estimates, 1900 to 1999 at http://www.census.gov/population/estimates/nation/popclockest.txt, record the estimated national population in 1999 and the estimated average annual percent change (growth rate given in percent) for that year.

2. Assuming that the growth rate remains constant, give an equation to express the population as a function of t, the number of years after 1999. Remember:

   $f(t)$ = Population t years after 1999

   a = Population in 1999

   b = Growth factor = 1 + growth rate in decimal form

   t = number of years after 1999

   Example: In July 1964 the population was 191,888,791 and the growth rate was +1.39 % or 0.0139.

The growth factor = 1 + 0.0139 = 1.0139

This means that the population in 1964 was approximately 1.0139 times the population in 1963.

An equation to find the population *t* years after 1964 would be:

$f(t) = (191{,}888{,}791)(1.0139)^t$

3. Using the equation you determined for 1999 data, predict the population in 2000, the current year, and 2020.

4. Compare your results to the estimated values given in the International Database (IDB) Summary Demographic http://www.census.gov/ipc/www/idbsum.html for the U.S. as well as the U.S. Population Clock at http://www.census.gov/main/www/popclock.html. How close were your results? Why might they be different?

5. Using the U.S. census data "Population, Housing Units, Area Measurements, and Density: 1790-1990" at http://www.census.gov/population/censusdata/table-2.pdf and the average annual growth rates that you calculated, record the national population for any year prior to 1970 and the average growth rate for that year. Assuming that the growth rate remained at this value, give an equation to express the population as a function of *t*, the number of years after your selected year.

6. Using this equation, predict the population in 2000, the current year, and 2020.

7. Compare your results to the estimated values given in the International Database (IDB) Summary Demographic at http://www.census.gov/ipc/www/idbsum.html for the U.S. as well as the U.S. Population Clock at http://www.census.gov/main/www/popclock.html. How close were your results? Why might they be different?

8. From what you've learned, is this exponential model good for predicting population in the short term? In the long term? What about over thousands of years? Explain your reasoning.

9. Thomas Malthus was quoted above as saying that populations will double every twenty-five years. Find the mathematical model, using the exponential constant growth rate model, which would follow his prediction. What is the growth rate? How accurate is this function for the population statistics you've been using for recent years?

10. **Optional:** Using the constant growth rate model and U.S. population and growth rate data from 1999, predict when the U.S. population will reach 400 million.

Assume the growth rate remains constant. When will it reach 500 million? When will the population double in size from its present value? Why might your results differ from those given in the International Database (IDB) Summary Demographic at http://www.census.gov/ipc/www/idbsum.html?

Closing

1. Does population grow exponentially? Explain your reasoning.
2. Why is population growth an important issue when thinking about environmental problems?
3. Make a list of leading global environmental problems. How many of these are the direct or indirect result of overpopulation?
4. In 1990 the average American was sending 3.1 pounds of trash to landfills each day. On the brighter side, today that figure has been reduced to 2.5 pounds but only because the recycling rates have doubled in the past 17 years. (http://www.triplepundit.com/pages/waste-footprint-ii-by-the-numb-002783.php) Assuming a constant average of 2.5 pounds of waste per day for each American, calculate how much trash in pounds would be sent to landfills this current year compared to 2020.

Assessment

Discussion of closing questions

Product Life Cycle

Lesson 4: Life Cycle of a Product
This activity was adapted from
http://www.saskwastereduction.ca/wrw/wrwactivities2005.htm#productlife

Subject Areas: Social Studies

Kentucky Connections:

- Core Content: SS-HS-3.1.1; SS-HS-3.3.1; SS-HS-3.2.3

Materials Needed:

- Internet access

Length of Lesson: 2 class periods, possibly one if students are given resources rather than required to research

Vocabulary Words:

- life cycle
- alternative

Essential Questions:

- How do we determine life cycle of common objects?
- What is the life cycle of objects I use often?

Guiding Questions/Outcomes:

- Students will understand the life cycle and ecological impact of items we use.

Skills Used:

- Observing
- Calculating
- Comparing

Activity: The link for this activity is
http://www.saskwastereduction.ca/wrw/wrwactivities2005.htm#productlife

The text is printed below.

Product Life Cycle Activity:

Objective: The student will be able to list and understand the life-cycle and environmental impact of products that they use. Students will also gain an appreciation for product complexity and for how challenging it is to gather this type of information.

Age Level : Grade 8-12

Method: Help students to trace the life cycle of a favorite product to determine the environmental impact of the things people purchase, from the raw materials to the disposal of the waste product.

1. Select an everyday product: a cell phone, a carrot, a T-shirt, …

2. Try to find out everything you can about the product:

a) What is the product made from? Try to identify the different materials that the product is made from and consider where these materials come from and how they are processed.

b) How is the product made? What types of pollution were produced in the making of the product?

c) How is the product packaged? Where do the packaging materials come from? (Packaging materials have their own life cycles, too).

d) How far away was the product manufactured? How was it transported to you? What are the environmental impacts of that transportation?

e) How long will the product last?

f) What happens to the product after you are through with it? Can it be given away? Can it be recycled? Does it need to be thrown in a landfill? What are the environmental impacts of the product's disposal?

3. Can you find alternatives to the product that will have fewer environmental impacts?

4. Can you use the product in ways that will decrease its effect on the environment?

Assessment: Completion of product life cycle questions—This could be presented in a speech or in written form.

Additional Resources

What is the "life cycle of a product"? www.worldwise.com/lifcycas.html

Sample Life Cycle Analyses (from the U.S. Environmental Protection Agency)

- The life cycle of a cell phone: www.epa.gov/epaoswer/education/pdfs/life-cell.pdf
- The life cycle of a CD/DVD: www.epa.gov/epaoswer/osw/students/finalposter.pdf

Stuff: The Secret Life of Everyday Things (1997) by John C. Ryan and Alan Thein Durning, Seattle: Northwest Environment Watch.

Excerpt on Computers: www.csc.calpoly.edu/~jdalbey/Public/secretlife.html

"Cradle-to-Cradle" design example: www.interfacesustainability.com

Waste reduction video on line: http://www.storyofstuff.com/

Lesson 5: Reduction
This lesson was adapted from http://www.wrwcanada.com/02wasteauditS.htm.

Subject Areas: Science, Social Studies, Math
Writing is in the EXTENSION section.

Kentucky Connections:

- Core Content: MA-HS-1.2.1; MA-HS-2.2.1; SC-HS-4.7.1; SC-HS-4.7.2; SC-HS-4.7.5
  - EXTENSION: WR-HS-1.1.0; WR-HS-1.1.3; WR-HS-1.2.0; WR-HS-1.2.3; SS-HS-1.1.3; SS-HS-1.3.3

Materials:

- Copies of Sample Waste Audit

Length of Lesson: Two class periods

Vocabulary Words:

- waste audit

Essential Questions:

- What type and amount of waste does our school produce?
- How does our school dispose of waste?

- How could we reduce waste and increase the amount of recycled waste?

Guiding Questions/Outcomes:

- Students will learn how much waste they produce at school.
- Students will learn ways to reduce waste.

Skills Used:

- Gathering information
- Charting
- Observing
- Calculating
- Analyzing

Activity: http://www.wrwcanada.com/02wasteauditS.htm

A Sample Waste Audit to Perform

There are some excellent resources available on the internet to help you set up environmental programs at your school. One particularly informative site we found is the Waste Wise Schools site by EcoRecycle. You can download lots of useful information from there including instructions for conducting a school waste audit and how to set up a waste minimization program.

A School Waste Audit

Use this form to conduct a waste audit of your school. The totals indicated with the letters **G H I J R** and **C** are used in calculations for parts of the audit. Waste refers to all the unwanted materials produced by the school: garbage placed in trash cans, materials put out for recycling and organic material that is mulched or composted.

School Population:

Students_____

Staff_____

Total_____ **Date of Audit _____**

1. Sources of Your School's Waste:

Place ticks (✓) in the table to indicate the source(s) of each type of waste in your school.

Type of Waste	**Source**						
	Classrooms	Staffroom	Office	Canteen	Cleaners	Garden	Other
Paper and Cardboard							
Glass							
Plastic							
Cans							
Other Metals							

Timber							
Garden Waste							
Food Waste							
Chemicals							
Other							

2. What Happens to Your School's Waste?

Place ticks (✓) in the table to indicate how each type of waste in your school is disposed. In the last column write in estimates for the composition of your school's waste.*

Type of Waste	**Method of Disposal**				**Est.% of school's waste (by weight)**
	Mainly Recycled	Mainly Composted	Mainly to trash cans	Mainly to Drains	
Paper and Cardboard					
Glass					
Plastic					
Cans					
Other Metals					
Timber					
Garden Waste					
Food Waste					
Chemicals					
Other					

*Sample bins from different sources, weighing different types of waste.

3. Recycling in Your School

Complete the table for each material recycled by the school.

Material Recycled	**Amount Collected** (bags/bins per year)	**Estimated Weight** (kg per year)	**Income** ($ per year)
Total	**N/A**	**R**	**I**

4. Quantities of Garbage Produced by Your School

What size trash bin does your school have? _____ ft^3

How many trash bins does your school have? _____

How many full bins of garbage are collected by the waste contractor each week? _____

What is the total amount of garbage produced by your school in one week? _____ ft^3

What is the total amount of garbage produced by your school in one year (assuming 40 weeks in the school year)? _____ ft^3

If 1 cubic foot of "loose" garbage weighs approximately 9 pounds, what is the weight of garbage produced by your school in one year? _____ Lbs. G

How much garbage is produced per student in your school? _____ Lbs.

How much organic material (food scraps and garden waste) is composted each week? _____ Lbs.

How much organic material (food scraps and garden waste) is composted in one year? _____ Lbs. **C**

5. The Total Amount of Waste Produced by Your School

Method of Disposal	Amount Produced per Year (kg)
Trash cans	**G**
Recycling	**R**
Composting	**C**
Total	

The total amount of waste produced by your school each year is:
_____ lbs. or _____ ton

6. The Total Cost of Waste Disposal for Your School

Estimate the cost for each form of disposal. Write these figures in the table.

Method of Disposal	Cost ($) per year
Trash bin(s)	**H**
Recycling	
Composting (tools, bins, fertilizer)	
Total	**J**

Calculate the net cost of waste disposal by subtracting **Total I** (Table 3) from **Total J** (Table 6).

The net cost of waste disposal for your school is $ _____ per year.

*Created by PBS **Briter Solutions** peter@briter.com.au*

Writing Extension: Students could use this information to create an editorial or feature article relating to their school's waste.

Students can use the task sheet below to help them write the piece:

Waste-Related Writing Task

Our recent lessons have focused on waste in our school. You have conducted research on what our school consumes. You now must choose one change you can make in consumption and decide on a format that will help you get your message out to a specific audience.

Assignment:

- Select a specific change in waste/consumption you think can and should be implemented by your target audience (audience possibilities: students, school board, etc.).
- Write a persuasive piece convincing your audience that change is needed and explaining how they could make the change (format possibilities: speech, proposal, formal letter, feature article, editorial commentary, editorial).

- Your purpose is to convince your target audience that waste is a serious issue in today's society and to convince that audience to make the change you suggest. Be sure you also explain to them not only **why**, but **how** they should implement the change.

Note: If you would like to propose a different angle or waste issue, it will need to be approved by the teacher.

(Remember – your opinions are only valid if you can offer convincing evidence to support them.)

First - analyze your target audience and their need-to-know.

These questions will help you choose your angle and narrow focus:

What is going to give them a reason to even read what you have written or listen to what you have to say? (i.e. Why should they care?)
What kinds of information will they want (or need) to know?
Why do they need the information?
What do you want them to do when they finish reading or hearing your speech?

Here are some tips that will help you write an effective persuasive piece:

1. Your opening paragraph should:
   - hook your audience by engaging your reader's interest and enticing them to **want** to keep reading ***(Make your first sentence powerful.)***
   - provide some context for your audience, so they will understand
     what the current situation or problem is **and**
     why you, personally, are concerned
   (Otherwise, they may not think it's a problem, or they may not understand your concern.)

2. The last sentence of your opening paragraph must establish the purpose of the piece. **(This is your position sentence.)**

3. You will need at least 2 or 3 supporting paragraphs that contain your arguments (as the topic sentence) and at least 2 kinds of evidence or support to convince your audience.

4. Write using a respectful tone. A sarcastic or angry tone is not persuasive.

5. If you include research results, select the information you include based on audience interest and ***need-to-know***. (*What will be the most convincing evidence?*)

6. Remember - your conclusion needs to circle back to your focus and you must also end with a call-to-action (What do you want your audience to **do**?)

Extension: Community Waste Audit

Explore http://www.wrwcanada.com/03communityeffort.htm for a community waste audit for students.

Lesson 6: Composting
The compost demonstration was adapted from
http://www.saskwastereduction.ca/wrw/wrwactivities2005.htm

Subject Areas: Science

Kentucky Connections:
- Core Content: SC-HS-4.6.1; SC-HS-4.6.4; SC-HS-4.6.5; SC-HS-4.6.7; SC-HS-4.7.1; SC-HS-4.7.2; SC-HS-4.7.3; SC-HS-4.7.5

Materials:
- Green materials: green grass clippings, vegetable/fruit food scraps, other green plant material
- Brown materials: fall leaves, brown grass clippings, straw, chopped cornstalks or other dead bulky garden plants. (This activity is designed to use browns; the ratios of materials will not be correct if shredded paper, sawdust or woodchips are used)
- Water
- Soil
- 4 liter ice cream pails (ideally one per participant)
- Name tags with colored paper inserts to designate groups (i.e. blue for water, black for soil, green for green materials, brown for brown materials)
- 1 garden fork
- 1 tarp

Length of Lesson: The demonstration takes around 15 minutes, but with set-up and discussion, the lesson will take at least one class period.

Vocabulary Words:
- composting
- micro-organisms
- carbon
- nitrogen
- aerobic and anaerobic respiration
- nutrient cycles

Essential Questions:
- What materials can be composted?
- How does composting work?

Guiding Questions/Outcomes:
- Students will understand the composting process.

Skills Used:
- gathering information
- charting

- observing
- calculating
- analyzing

Activity:
Compost—This demonstration was found at
http://www.saskwastereduction.ca/wrw/wrwactivities2005.htm

Hands-On Compost Demonstration

What is compost? Compost is "ready to use" soil organic matter. It is dark, crumbly, and sweet smelling, and is made by arranging a mixture of materials in bins or open piles.

Activity Objective: to give participants a simple but meaningful compost - making experience.

Age level: kindergarten to adult (This could be done with a class, an environmental club, or as an activity for care-partners. It could also be organized as a learning event for parents and children.)

Number of people: 15-30

On-line Compost Details:

How-to compost information: www.saskwastereduction.ca/composting/compost

Carbon to nitrogen ratios: compost.css.cornell.edu/OnFarmHandbook/apa.taba1.html

Compost micro-organisms: compost.css.cornell.edu/microorg.html

Summary of Activity: Participants are organized into groups that represent the main ingredients of compost: green materials, brown materials, water, air and soil. With the exception of the person designated as Air, participants are grouped according to the relative amounts used in the compost-making process and provided with pails of material. The compost materials are added gradually and mixed with a fork by 'Air.' The demonstration takes about 15 minutes to complete.

Concepts and associated activities:

Science: micro-organisms at work; nutrient cycles; aerobic and anaerobic respiration; importance of carbon, oxygen and nitrogen in living systems

Social Studies: 'wastes' as resources, co-operative activity

Mathematics: ratios, the concept of units

Literature : incorporate a writing exercise (poems, paragraphs, short stories), make this hands-on activity more dramatic by giving group members spoken lines and'performing' it for an audience.

Materials: Quantities will vary with number of participants.

- Green materials: green grass clippings, vegetable/fruit food scraps, other green plant material

- Brown materials: fall leaves, brown grass clippings, straw, chopped cornstalks or other dead bulky garden plants. (This activity is designed to use browns; the ratios of materials will not be correct if shredded paper, sawdust or woodchips are used)
- Water
- Soil
- 4 liter ice cream pails (ideally one per participant)
- name tags with coloured paper inserts to designate groups (i.e. blue for water, black for soil, green for green materials, brown for brown materials)
- 1 garden fork
- 1 tarp

Group Sizes: The majority of participants will be Browns or Greens. For this activity, we will use relatively equal numbers of Browns and Greens. Here is a breakdown for a group of 25 students plus one adult.

- 9 Greens
- 10 Browns
- 4 Water
- 2 Soil
- 1 Air (adult with fork)

Location: This is an outdoor activity.

Advance preparation:

- Spend some classroom time beforehand talking about compost—let them see and smell finished compost and look at the kinds of materials used to make compost.
- Gather the materials and equipment. The browns store easily but the greens need to be quite fresh to avoid odors and messiness.
- Prepare colored tags and divide participants into their groups.
- Assign a narrator (teacher or student) to explain the reason for adding different materials. (A script is available on-line. See www.saskwastereduction.ca/wrw/school under “composting activity”.)

Activity

1. Place tarp on ground and assemble participants with filled pails in hands. ‘Air’ should be poised by the pile and can act as narrator.
2. Give a few short words of introduction.
3. Invite 5 Browns to come forward and start the pile (If chunky browns are available, this is where to use them.) Have Air spread out the materials with a fork to a 10-15 cm. depth.
4. Invite 5 Greens to add their materials. Again Air spreads materials to even layer.
5. Invite 1 Soil to sprinkle their pail of soil on the pile.
6. Invite 1 Water to sprinkle their water on the pile.
7. Have Air gently mix the ingredients (a little messy if chunky browns are used)
8. Repeat the sequence, with the 3 remaining waters added to the larger pile.
9. Discuss how the materials will change as the composting process occurs. If possible, have a sample of finished compost available so participants can see the end product.

10. Make sure the materials used in this demonstration get added to a functioning compost pile when you are through with them.

Lesson 7: Reduction Rap

Website Sources:
- http://www.saskwastereduction.ca/wrw/wrwactivities2005.htm
- http://www.wrwcanada.com/pdf/School_Kit_EN_2007.pdf
- http://www.wrwcanada.com/activitiesI.htm

Subject Areas: Social Studies, English

Kentucky Connections:
- Core Content: WR-HS-1.1.0; WR-HS-1.1.2; SS-HS-3.4.3

Materials:
- paper and pen

Length of Lesson: Two class periods (one to write the rap and one in which students perform or record the raps)

Vocabulary Words: theme

Essential Questions:
- How can we reduce waste in various aspects of our lives?

Guiding Questions/Outcomes:
- Students will demonstrate knowledge of how to reduce waste.

Skills Used:
- creative writing
- performance

Activity: Waste Reduction Rap
http://www.saskwastereduction.ca/wrw/wrwactivities2005.htm

Method: In small groups (3 or 4 students), have students write a short rap about a Waste Reduction Week theme or a theme related to waste where they live. They can check out the Saskatchewan Waste Reduction Council website (www.saskwastereduction.ca/wrw) for sources of inspiration. Also visit the Waste Reduction Week website, www.wrwcanada.com. Potential themes for the rap include waste reduction in the following areas:

- at home
- when traveling
- at work

- at school
- during recreation
- when shopping
- in your community

Have students perform their rap for the class. They should write it so that all group members have a chance to take part. Encourage them to be creative and have lines where several of them speak at the same time, along with solo lines.

Extension: If students are very enthusiastic, consider recording the raps and posting them on www.youtube.com.

Extensions:

- Newspaper Sleuth - could be used in any subject area http://www.wrwcanada.com/05d_fungame.htm
- Making Recycled Paper

Newspaper Sleuth

Waste is a part of almost everything we do. For the next week, look through your local or national newspaper to discover waste management topics.

Be creative and look in every section of the newspaper such as the letters to the editor, comics, event listings, editorials, business, travel, entertainment... you may even find something in the classified ads!

Assignment: Write a report or make a display of the common themes, which run through some or all of the articles.

1. **Making Recycled Paper:**Science, Art

http://www.wrwcanada.com/10paper.htm

How to Make Recycled Paper

Making recycled paper is messy. It is also a lot of fun. Someone will have to use a food processor and an electric iron. Both can be dangerous. So make sure that you get help on today's project because it is a big one. It is best to do this with some friends and family. That way you can spread the mess and the fun around.

Materials:

- 2 full newspaper pages torn into 2-inch squares
- food processor
- 2 tablespoons white glue
- 2 or 3 cups water
- sink with 4 inches water
- old panty hose
- coat hangers
- electric iron

Optional:

- insect screen
- strainer
- food coloring
- dryer lint

You're going to first make the frames that you'll use to make paper with. Undo the coat hanger and use the wire to make a flat square about 6 by 6 inches big. Stretch one leg of the panty hose over it. Take your time; it could snag. If you put tape on the ends of the wire, it will snag less. Make sure it is tight and flat.

Tie knots in the hose. Use the other leg for another piece of paper. You will need one frame for every piece of paper you make. You might want to make more than one or two.

Put a handful of the paper and some water into the food processor. Close the food processor and turn it on high. Keep adding paper and water until you have a big gray blob. You may have to add a little more water to keep things moving smoothly. Keep the food processor on until all the paper has disappeared. Then leave it on for 2 whole minutes.

Put the glue in the sink water and add all of the paper pulp you just made. Mix it really well. Use your hands.

Mix up the sink water again and then scoop the frame to the bottom of the sink. Lift it very slowly. Count to 20 slowly while you are lifting. Let the water drain out for about 1 minute. Mix up the sink every time you make a new piece.

Try other things like the screen or a strainer. Try adding lots of food coloring, or lint, or leaves, to the food processor.

Now you have to hang the frames on a clothesline or put them out in the sun. Wait until they are completely dry with no dampness at all. You can then gently peel off the paper.

Have a grown-up use the iron - set on the hottest setting - to steam out your paper. You Can keep making paper until the pulp is all strained out of the sink.

See how strong your paper is. Trim it with scissors. Write on it. It is strong.

P.S. Don't be fooled. When a bag or a box says that it is 100% recyclable that means that you can recycle it. It does not mean that it is made out of recycled paper.

TOYOTA CONNECTIONS

- TMMK sorts cafeteria waste into four categories: cans, plastic bottles, compostable, and other noncompostable material. In addition to these main waste streams, break rooms and administrative offices also sort used paper and cardboard.
    - Most of TMMK's paper waste is recycled to make usable paper products such as paper towels.
- Lineside and process waste (from manufacturing) is also properly sorted.
- Cans and plastic bottles are baled and sold for recycling. Proceeds go to the Team Member Benevolent Fund. In financial emergencies, team members may apply and receive financial assistance from this fund.
- TMMK pays a fee to a waste-to-energy facility to incinerate noncompostable waste. Burning the waste generates clean energy resulting in a positive use instead of a negative (landfill) use of waste. This helps TMMK maintain Zero-Landfill.
- Compostable material is consolidated and transferred to the on-site composter. The resulting compost is used in TMMK's greenhouse and the vegetable garden. TMMK composts about 1.5 tons of waste every working day.