

Waste Reduction Module

Kaizen: Continuous Improvement

I. Introduction: Cafeteria Waste Audit

Background: When a school begins to investigate solid waste issues one area of concern is cafeteria waste. A large portion of this waste can be separated into compostable and noncompostable waste. The first step in developing a compost program is to conduct a cafeteria waste audit.

For additional information on conducting cafeteria waste audits visit the following websites:

- www.oregongreenschools.org/waste_audits.cfm
- <http://darkwing.uoregon.edu/~recycle/Book/HTML/Chapter%2004.htm>

Subject Area: Mathematics, Practical Living, Science

Kentucky Connections:

- Learner Goals: #1, #2, #4, #5, #6
- Academic Expectations: 1.11, 1.12, 1.16, 2.1, 2.7, 2.8, 2.10, 2.13, 2.33, 4.2, 5.1, 5.4, 5.5, 6.1, 6.2, 6.3
- Core Content 4.1: MA-06-1.1.1, MA-06-1.1.3, MA-06-1.3.1, MA-06-4.1.1, MA-06-4.1.4, MA-07-1.1.1, MA-07-1.1.3, MA-07-1.3.1, MA-07-1.4.1, MA-07-4.1.1, MA-07-4.1.4, MA-08-1.1.3, MA-08-1.3.1, MA-08-1.4.1, MA-08-4.1.1, MA-08-4.1.4, PL-06-3.1.04, PL-06-4.3.03, PL-07-3.1.04, PL-07-4.3.03, PL-08-3.1.04, PL-08-4.3.03, SC-07-4.6.4, WR-M-1.1.0, WR-06-1.1.3, WR-07-1.1.3, WR-08-1.1.3, WR-M-1.2.0, WR-06-1.2.3, WR-07-1.2.3, WR-08-1.2.3, WR-M-2.3.0, WR-06-2.3.3, WR-07-2.3.3, WR-08-2.3.3, WR-M-2.4.0, WR-06-2.4.3, WR-07-2.4.3, WR-08-2.4.3, WR-M-3.5.0, WR-06-3.5.3, WR-07-3.5.3, WR-08-3.5.3, WR-M-3.6.0, WR-06-3.6.3, WR-07-3.6.3, WR-08-3.6.3

Materials:

- 5 forty-gallon plastic waste containers
- plastic trash bags
- Poster board
- Scales
- Gloves

- Calculator

Length of Lesson: One 60 minute class period for planning and one lunch period to conduct the cafeteria waste audit.

Vocabulary Words:

- Compost: A mixture of decaying organic matter which can be used to improve soil structure and provide nutrients.
- Decompose: To separate into components or basic elements; to rot.
- Disposable: Products or materials that can be or are usually thrown away after one use or a limited amount of time.

Essential Question: What percentage of cafeteria waste consists of compostable waste?

Guiding Questions/Outcomes:

- Students will plan a school cafeteria waste audit.
- Students will work cooperatively in groups.
- Students will conduct a school wide cafeteria waste audit.

Skills Used:

- Observing
- Comparing
- Organizing
- Planning
- Calculations

***Decomposition Facts**

Apple – 3 to 4 weeks
Sheet of paper – 1 month
Cotton glove – 5 months
Leather boot – 40 to 50 years
Tin can – 50 to 80 years
Aluminum can – 200 to 500 years
Plastic six pack ring: 450 years
Plastic jug – 1 million years
Styrofoam cup: forever
Piece of steel - forever

Activity:**• Planning - Day I:**

- Invite the cafeteria manager and custodian to the planning meeting.
- Divide the class into 4 groups.
- Assign Group A to prepare an announcement for school-wide broadcast giving the date, time, and purpose of the cafeteria waste audit. Announcements should be made each day for one week prior to the audit.
- Assign Group B to prepare posters for display in the cafeteria announcing the date, time, and purpose of the cafeteria waste audit. Posters should be hung on the same day the announcements start.
- Assign Group C to make large posters and flyers listing the types of foods and paper products that can be composted. Flyers should be distributed to each classroom at least two days prior to the audit. On the day of the audit, the large posters should be on display above the appropriate waste container.
- Assign Group D to make the following signs for the cafeteria waste containers:
 - COMPOSTABLE FOOD and PAPER WASTE
 - NONCOMPOSTABLE FOOD WASTE
 - MILK and JUICE CARTONS
 - SOFTDRINK CANS and PLASTIC BOTTLES
 - PLASTICWARE AND DISPOSABLE TRAYS.

****Cafeteria Waste Appropriate for Composting:**

- All fruits (peels and cores)
- Fresh or cooked vegetables
- Salad (without dressing)
- Plain bread
- Rice/beans
- Paste (red sauces without meat, oil or butter)
- Peanut butter and Jelly sandwiches
- Nut shells/hulls
- Coffee grounds
- Egg shells
- Paper napkins
- Paper plates
- Paper bags

Noncompostable Food Waste:

- Liquids (juice, mild, soda, etc.)
- Meat (hamburger, hot dog, deli meats, etc.)
- Greasy/Oily foods (mayonnaise, salad dressing, butter, french fries, etc.)
- Mayonnaise salads (macaroni, potato, cole slaw, etc.)
- Dairy products (pizza, cheese, milk, butter, etc.)

• **Day II:**

- On each of the forty-gallon waste containers tape a sign designating the type of waste.
- Check with the office to determine the length of the lunch period. Divide the period into 20 minute blocks.
- Divide the class into groups of four and assign each group a 20 minute block to monitor the waste cans.
- Each group should remind their fellow students to place their lunch waste into the proper container.
- As the bags of waste are emptied they should be weighed and the weights recorded on the data sheets.

Assessment:

- The students will calculate the percentage of:
 - compostable food and paper waste
 - noncompostable food waste
 - milk and juice cartons
 - aluminum cans and plastic bottles
 - plasticware and disposable trays
- Students will produce pie charts and bar graphs illustrating their results.
- Students will prepare a bulletin board to display the results for the staff and student body.

Extensions:

- Have students write a letter to the principal and Site Based Decision Making (SBDM) Council describing their results.

***Decomposition facts were gathered from sources such as the Bureau of Land Management and the Oregon Department of Environmental Quality.**

**** “Urban Ecology Waste Reduction Project” Columbia University**

Toyota Connection

- TMMK sorts cafeteria and break room waste into four categories: cans, plastic bottles, compostable, and other noncompostable material.
- Cans and plastics are baled and sold for recycling. Proceeds go to the Employee Benevolent Fund. In financial emergencies, team members may apply and receive financial assistance from this fund.
- TMMK pays a fee to Covanta, a waste-to-energy facility located in Indianapolis, Indiana, to burn noncompostable waste. Burning the waste generates energy resulting in a positive use instead of a negative (landfill) use of waste.
- Compostable material is consolidated and transferred to the on-site composter. The resulting compost is used in TMMK’s greenhouse and the vegetable garden.

Student Data Sheet

Name _____

Date _____

Cafeteria Waste Weights

	Bag 1	Bag 2	Bag 3	Bag 4	Bag 5	Bag 6	Bag 7	Bag 8
Compostable Food and Paper Waste								
Non-Compostable Food Waste								
Milk and Juice Cartons								
Aluminum Cans and Plastic Bottles								
Plasticware and Disposable Trays								

Totals

	Total Weights	% of Total Waste
Compostable Food and Paper Waste		
Noncompostable Food Waste		
Milk and Juice Cartons		
Aluminum Cans and Plastic Bottles		
Plasticware and Disposable Trays		

II. TMMK fieldtrip observations:

Describe the sorting system used in the cafeterias and employee break rooms.

TMMK is committed to being a zero landfill plant. What does that mean?

What percentage of materials used to produce Toyota cars is recyclable? _____

Some materials are shipped to TMMK on wooden pallets. What happens to these pallets? _____

What items did you find in the compost sample you “mined”?

How does TMMK use the compost produced on-site? _____

III. Conclusion: Worms: The Ultimate Composter

Background: Many waste reduction programs are centered around the concept of recycling. Composting engages students in the entire process of recycling: collection, sorting, and the production of a new product.

For more information on classroom composting visit the following websites:

- <http://www.gardenweb.com>
- <http://cpmcnet.columbia.edu/dept/physio/schools/318/complp.html>
- <http://www.vtrecyclers.org/wastekit/compost.htm>
- <http://web.mit.edu/civenv/K12Edu/activities/gardens.html>

Subject Area: Practical Living, Science

Kentucky Connections:

- Learner Goals: #1, #2, #6
- Academic Expectations: 1.11, 1.16, 2.1, 2.3, 2.4, 2.30, 6.1, 6.2, 6.3
- Core Content 4.1: PL-06-3.1.02, PL-06-3.1.04, PL-07-3.1.02, PL-07-3.1.04, PL-08-3.1.02, PL-08-3.1.04, SC-06-1.1.2, SC-06-4.7.1, SC-07-1.1.1, SC-07-4.6.4, SC-07-4.7.1
-

Materials:

- Plastic bin (at least 9 X 13 inches) with a lid
- Coarse paper materials (newspaper, paper towel, cardboard)
- 1 pound of red worms
- Watering can
- Small flower pot (plastic water bottles that have had the top cut away may be substituted)
- Bean seeds/flower seeds
- Potting soil
- Commercial plant food
- Rubber gloves

Length of Lesson:

- One 30 minute period to prepare the compost bin.
- Five minutes each day to add fruit scraps to bin and check water level.
- One 30 minute period (approximately 6 weeks after setting up bin) for planting seeds.
- Five minutes daily to record observations.

Vocabulary Words:

- Aeration: Exposure to air.
- Compost: Mixture of decayed or decaying organic matter used to fertilize soil. Compost is usually made by gathering plant material, such as leaves, grass clippings, and vegetable peels, into a pile or bin and letting it decompose as a result of the action of aerobic bacteria, fungi, and other organisms.
- Organic: Derived from living organisms.
- Decomposers: An organism, often a bacterium or fungus, that feeds on and breaks down dead plant or animal matter, thus making organic nutrients available to the ecosystem.
- Decomposition: Breakdown or decay of organic material.
- Feasible: Doable.
- Habitat: The natural environment of an organism.
- Niche: The function of an organism in its environment.
- Propagate: To cause (an organism) to multiply or breed.
- Vermicomposting: The process of using worms and associated organisms to break down organic waste into material containing nutrients for plant growth.
- Windrow composting: Involves stacking compostable materials into long piles that are turned regularly with a special compost turner.
- Worm bin: Container designed to accommodate a vermicomposting operation.
- Worm castings: Worm excrement.
- Worm tea: Worm urine that contains plant growth regulators and other bio-fertilizers.

Essential Question: How can food waste be used to produce compost?

Guiding Questions/Outcomes:

- Students will construct a classroom worm compost bin.
- Students will use compost produced in their compost bin to grow plants.

Skills Used:

- Observation
- Organization
- Comparing
- Planning

Activity:

- **Preparing a compost bin:**

- Students should make 3 holes equally spaced $\frac{3}{4}$ inch from the bottom on each end of the container.
- Holes should be lined with a fine mesh screen to prevent the worms from escaping and for aeration.
- Line the bin with moistened paper (see materials for list of appropriate paper). Paper should contain the same amount of moisture as a moistened sponge.
- Add the red worms.
- Food materials should be added to the bin as needed. Be careful not to overload the bin with food.
- Water should be added as needed.
- Cover the bin with a lid.

- **Using compost as fertilizer:**

- After 6 weeks the worm castings (compost) will be ready for harvesting.
- Divide the material inside the compost bins into 4 or 5 cone shaped piles. The worms will burrow into the compost material to avoid the light. Students should scoop off the top of each pile. Any worms accidentally harvested should be returned to the compost bin.
- Each pair of students should have 3 small flower pots labeled A, B and C.
- Fill pot A three-fourths full with potting soil. Add 1-2 flower seeds, water and place in a well-lit area.
- Fill pot B three-fourths full with potting soil. Add 1-2 flower seeds, fill remainder of pot with compost, water and place in a well-lit area.
- Fill pot C three-fourths full with potting soil. Add 1-2 flower seeds, follow directions on the container for the appropriate amount of commercial fertilizer, water and place in a well-lit area.

***Food Waste Appropriate for Composting:**

- All fruits (peels and cores)
- Fresh or cooked vegetables
- Salad (without dressing)
- Plain bread
- Rice/beans
- Paste (red sauces without meat, oil or butter)
- Peanut butter and Jelly sandwiches
- Nut shells/hulls
- Coffee grounds
- Egg shells
- NO MEAT, CHEESE, or FATS

- Check the containers each day and water as needed.
- As soon as sprouts are seen, record daily heights of the three plants.

Assessment:

- Have students draw and label the digestive system of a red worm. What is the worm’s niche in its habitat?
- Compare the growth rates of the three plants. How did the plant fertilized with compost compare to the plant fertilized with commercial fertilizer? What was the purpose of pot A in this activity?

Extensions:

- Have students repeat the experiment comparing the effects of different food waste on the growth and reproduction of the worms.
- Have students prepare an outdoor compost bin or kitchen compost bin for use at home.

** “Urban Ecology Waste Reduction Project” Columbia University.

TMMK Composting Operation

1. Approximately one ton of compostable material is collected per day from TMMK’s six cafeterias, employee break areas, and grounds-keeping activities.
2. This material is consolidated and transferred to the composting site where it is placed on a conveyor belt, shredded, and mixed before it goes into the composter.
3. The composter is turned two times each day. This allows it to maintain the constant temperature of 140-160° F that is required for bacterial growth.
4. After 10-14 days the compost is taken out and placed in windrows.
5. After 6 months the compost is screened to remove debris.
6. The compost is used as soil additives, mulch, top-dressing on turf and to propagate plants.
7. Some compost is wrapped in cheese cloth bags and seeped in water for 24 hours. This produces a liquid called compost tea.
8. Compost tea contains good bacteria and nutrients. It is used as fertilizer and to decrease insect populations.
9. The gardens at TMMK produce pumpkins for Halloween, vegetables that are given to God’s Pantry, and cotton.
10. TMMK will soon begin testing the feasibility of purchasing compostable flatware for use in the cafeteria.

Student Data Sheet

Name _____

Date _____

Plant Growth Rates

	Pot A	Pot B	Pot C
Week 1			
Week 2			
Week 3			

1. What was the purpose for Pot A? _____
2. Where does the red worm fit in the food chain? _____
3. Which flower pot had the greatest growth rate? _____
4. What are 2 practical applications for composting?
 - A. _____
 - B. _____
5. How did plant growth in the pot with commercial fertilizer compare to the pot with compost? _____

6. What are the advantages of using:
 - Commercial fertilizer? _____

 - Compost? _____

