

# Teachable MOMENTS

NUMBER 9, FEBRUARY 22, 2008

## Is It Easy Being Green? Zero Waste in Your Community

What does *Zero Waste* mean? How could your town or city work toward zero waste? What strategies would be best to implement in your school?

### To the Teacher

*Environmental awareness! Go green! Sustainability! Global warming! Recycling! Eco-friendly!* These are all expressions that have infiltrated everyone's lives, not only in news reports but also in popular culture. Through films (*An Inconvenient Truth*) and celebrity events (the Live Earth Concerts), awareness is increasing about the importance of reducing waste and toxins from the environment. Use this teachable moment to have students explore what zero waste is and how it impacts their community.

In most industries, and in homes, individuals term items they cannot use as *waste*. However, what one person might consider waste, another may see as a resource. In zero-waste systems, all items that might be considered waste are recycled into a useful resource. Some countries are now importing waste products from the United States, converting them into useful products,

and reselling the items back to this country. One example is metals. China is importing wrecked cars from the United States, converting them into useful metals, and selling metal-based products back to the United States.

The Zero Waste Alliance examines the entire energy and material use of a manufacturing process, and works to recycle or reuse all “wastes” to produce useful items. The results have included increased profits resulting from significant cost savings, improved environmental performance, and stronger local economies (Zero Waste Alliance 2007).



### NSES Standards Addressed

**Unifying Concepts and Processes:** Evidence. Models and Explanations (p. 117)

**NSES (9–12) A4, 6:** Formulate and Revise Scientific Explanations and Models Using Logic and Evidence, Communicate and Defend a Scientific Argument (p. 175)

**NSES (9–12) B1, 2, 3, 5, 6:** Physical Science—Structure of Atoms, Structure and Properties of Matter, Chemical Reactions, Conservation of Energy and the Increase of Disorder, Interactions of Energy and Matter (pp. 178–180)

**NSES (9–12) D2:** Earth and Space Science—Geochemical Cycles (p. 189)

**NSES (9–12) E2:** Understandings about Science and Technology (p. 192)

**NSES (9–12) F1, 4, 5, 6:** Science in Personal and Social Perspectives—Environmental Quality, Natural and Human-induced Hazards, Science and Technology in Local, National and Global Challenges (pp. 197–199)

**NSES (9–12) G1, 2:** History and Nature of Science—Science as a Human Endeavor, Nature of Scientific Knowledge (pp. 200–201)

## Topic for Research and Discussion . . . and more

This topic is best formatted as a discussion. Recycling is a familiar topic to students, but few have heard of *zero waste*. A discussion will allow your students to explore different aspects of the sciences.

### How Do I Lead a Discussion?

Discussion works best when your classroom is a place where students are able to openly explore their thinking. Students shouldn't worry about being corrected by you or other students. If probing for understanding does not come naturally to your students, you may need to coach them. Explain that paraphrasing and questioning encourages discussion. Developing these skills in your students will also help in later use of dialogue techniques.

It is helpful to set ground rules for discussion. Your class can either create ground rules or use the sample set provided in the *What Is a Discussion?* handout. You will probably find it helpful to post and review rules before each discussion. The rules should clearly remind your students to keep things positive—students should work toward clarification and common understanding, not argue. Your students should not question their classmates' explanations based on logic or evidence. This is what scientists do to assure new theories pass the rigors of close examination. Their challenges are questioning the evidence linked to an explanation and identifying bias or unsubstantiated beliefs. This is the nature of science (American Association for the Advancement of Science 1990). Therefore, a key focus in your classroom discussions should be on evidence in support of explanations.

To prepare students for discussion, help them understand how to compose a good explanation. This involves both forming a logical argument and selecting suitable evidence to support it. To help students develop these skills, provide them with background on simple argument construction with deductive and inductive reasoning. In small groups, students can then analyze statements from the media to identify conclusions and their supporting assumptions.

Your students may also need experience in analyzing how well evidence or data support a premise. You may want to have students examine data for fallacies, and then have small groups analyze scientific

explanations from the media that include data. After these experiences, students will be better able to compose and share their own explanations of phenomena supported by data from laboratory observations.

### Investigation Question

What is zero waste? How could your community work toward zero waste?

Have students begin by identifying all the types of "waste" produced by the school. They will research zero waste by selecting a current news article on one strategy that might apply to use in their town or city. They will identify any chemistry involved and any possible application of the strategy in their town or city. Finally, they will identify two strategies that would be best to implement in their school.

If your students have not used news media reports in the classroom before, it is best to have them do so for a few weeks before this discussion. A simple format is to have each student select one news article about a science topic relevant to the course. Have students write a summary that includes the author's conclusion and three to four key points. Also have them identify any errors in presentation of science concepts, using the Student Summary: Discussion to help them spot any fallacies that they find in the author's arguments. Articles should be brought to class and made available for other students to read. When students arrive in class, have them share their reports in groups of three. Groups then share with the class any errors or fallacies they identify.

### Related Web Sites

#### Kids Recycle! Waste Reduction

[www.kidsrecycle.org/reduction.php](http://www.kidsrecycle.org/reduction.php)

This site provides resources that help teachers and students examine ways they can reduce their own waste as well as that of their school.

#### ScienceDaily: Search results for "zero waste"

[www.sciencedaily.com/search/?keyword=Zero+Waste](http://www.sciencedaily.com/search/?keyword=Zero+Waste)

ScienceDaily compiles news releases from various sources and lists the stories by headlines. It is a commercial site, so there is substantial advertising.

#### Zero Waste Alliance

[www.zerowaste.org](http://www.zerowaste.org)

This is a nonprofit partnership of universities, government, businesses, and other organizations working to develop, promote, and apply zero-waste strategies.

#### Zero Waste, Grassroots Recycling Network

[www.grn.org/zerowaste/index.html](http://www.grn.org/zerowaste/index.html)

This is a nonprofit site with tools that individuals, towns, and businesses can use to begin working toward zero waste.



## Suggestions for Using the Worksheets

Distribute the Discussion: Zero Waste in Your Community and What Is a Discussion? handouts. Ask students for their ideas of what zero waste is. Write a definition they develop on the board or chart paper. Come to a class consensus on the types of waste the school produces. Ask students what having a zero-waste school would mean. Extend this to suggest what having a zero-waste town would mean.

Assign students to find and read a news article on zero waste in an industry. Have them write a summary report on zero waste that includes the following:

- a description of the concept of zero waste
- a summary of the zero-waste strategy used in the article
- a description of the processes of chemistry involved in completing this transformation of “waste” into a resource
- an opinion of whether the practice they have researched could be applicable in any part of their town or city, including any specific suggestions and reasoning
- an analysis of the waste produced by the school
- a proposal for two strategies that would reduce the waste
- a description of an application of chemistry to the waste at school to reduce it (for extra credit)

Organize students in groups of three. Within groups, have students share their article summaries, including their recommendations for the school. Each group is to agree on two recommendations for the school, and identify specific steps the school would need to take.

Assign groups to create a poster about zero waste that includes the following:

- a list of the zero-waste applications they researched in their news articles, noting any that could be used in their town or city
- any chemistry applications
- two agreed-upon recommendations to make their school a zero-waste site (5 minutes)

Once the posters are made, each group will select one member to review the poster for the rest of the class in a short 2-minute presentation. Note each recommendation for the school on a master list. Members of other groups can ask questions for clarification on any of the recommendations expressed. These should not be countering any of the ideas, just trying to gain a better understanding of the zero-waste strategy and its applications. Any member of a group may respond to the questions.

As a class, discuss strategies students think would be most effective for their school and their town. Some possible prompts that could increase the cognitive level of the discussion include the following:

- Are there any strategies that could be applied in both the school and the town?
- What principles of chemistry are used in the recommended strategies?
- Which are the two best recommendations for the school?
- How possible would it be to get the school to implement the two top suggestions?
- What strategies might students use personally to create a zero-waste home?

## Assessment Criteria

Students should include the following in their article summaries and discussion:

- an accurate description of the concept of zero waste
- the main zero-waste strategy described in their selected article, including any principles of chemistry used
- an accurate analysis, with supportive reasoning, of whether an application is appropriate for use in the town
- an appropriate recommendation for addressing waste at school
- contributions and questions that connect the ideas of many students and further understanding

# Discussion: Zero Waste in Your Community

## Is It Easy Being Green? What Does Zero Waste Mean?

*Environmental awareness! Go green! Sustainability! Global warming! Recycling! Eco-friendly!* These are all expressions that have infiltrated everyone's lives not only in news reports but also in popular culture. Through films (*An Inconvenient Truth*) and celebrity events (the Live Earth Concerts), awareness is increasing about the importance of reducing waste and toxins from the environment. So, what does this mean to you, and how will it impact your life?

In most industries, and in homes, people term items they cannot use as waste. However, what one person might consider waste, another may see as a resource. In zero-waste systems, all items that might be considered waste are recycled into a useful resource. Some countries are now importing waste products from the United States, converting them into useful products, and reselling the items back to this country. One example is metals. China is importing wrecked cars from the United States, converting them into useful metals, and selling metal-based products back to the United States.

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### Investigation Question

What is zero waste? How could your community work toward zero waste?

# What Is a Discussion?

## Vocabulary

**discussion** (from the Latin *discussus*, “to shake apart”)—to take up in conversation

**assumption** (from the Latin *assumere*, “to take up”)—anything taken for granted

**fallacy** (from the Latin *fallere*, “to deceive”)—a flaw in reasoning

**conclusion** (from the Latin *concludere*, “to shut up tightly”)—decision or opinion formed after investigation or thought

## Rules for Discussion

- Comments made during discussions remain in the room. They are not to be shared with others outside the classroom.
- Keep questions positive and focused on informing you and the group.
- Comments you make during the discussion should connect to the comments of those made before you.
- Let everyone have a chance to speak.
- Listen attentively, and avoid interrupting.

Add some of your own rules:

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## Research Assignment

What is zero-waste? What are some zero-waste strategies?

1. Find an article on an application of zero waste in a current newspaper, in a magazine, or on the Internet.
2. Analyze web sites to confirm that the information is reliable. (See the web sites on evaluating web pages, located on the Resources Handout.)
3. Identify any use of chemistry in the zero-waste strategy.
4. Analyze whether there would be any application of this strategy for zero waste in your town.
5. Identify two strategies for zero waste in your school.

## Writing Assignment

**Report what you've learned about zero waste. What opinions and ideas do you have about zero-waste strategies?**

Write a summary report on zero waste that includes the following:

- a description of the concept of zero waste
- a summary of the zero-waste strategy used in the article selected
- a description of the processes of chemistry involved transforming “waste” into a usable resource
- an opinion on whether the zero-waste practice researched could be used in any part of your town, including any specific suggestions and reasoning
- an analysis of the waste produced by the school and a proposal for two strategies that would reduce the waste
- a description of the way chemistry could be used to reduce the waste at your school (for extra credit)

Bring your article and summary to class. Be prepared to share your summary with classmates.

# Student Resources Handout

## **Cornell University Library—Evaluating Web Sites: Criteria and Tools**

[www.library.cornell.edu/olinuris/ref/research/webeval.html](http://www.library.cornell.edu/olinuris/ref/research/webeval.html)

This is a compilation of many resources and lists of criteria for examining web sites for reliability.

## **Kids Recycle! Waste Reduction**

[www.kidsrecycle.org/reduction.php](http://www.kidsrecycle.org/reduction.php)

This is a site providing resources that help teachers and students examine ways they can reduce their own waste, as well as that of their school.

## **ScienceDaily: Search results for “zero waste”**

[www.sciencedaily.com/search/?keyword=Zero+Waste](http://www.sciencedaily.com/search/?keyword=Zero+Waste)

ScienceDaily compiles news releases from various sources and lists the stories by headlines. It is a commercial site, so there is substantial advertising.

## **UC Berkeley—Teaching Library Internet Workshops**

Evaluating Web Pages: Techniques to Apply & Questions to Ask

[www.lib.berkeley.edu/TeachingLib/Guides/Internet/Evaluate.html](http://www.lib.berkeley.edu/TeachingLib/Guides/Internet/Evaluate.html)

This provides a good summary of methods for examining the reliability of web sites, from checking URLs to examining notations, references, and organizations linked to the web site.

## **Zero Waste Alliance**

[www.zerowaste.org](http://www.zerowaste.org)

This is a nonprofit partnership of universities, government, businesses, and other organizations working to develop, promote, and apply zero-waste strategies.

## **Zero Waste, Grassroots Recycling Network**

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