

### **Landfills: A Solid Waste Management Plan**

*Teachers: This lesson contains three classroom activities with discussion questions related to the AFG video clips about landfills, nutrient cycles, and solid waste management. These parts may be used individually or together, depending on the needs of your class.*

*Note: You can access and view the video clips used in this lesson in the Teacher Resources section of the AFG Web site ([www.pbs.org/americanfieldguide/teachers](http://www.pbs.org/americanfieldguide/teachers)).*

**Grade Level: 6-8**

#### **Background Information**

The average American produces about five pounds of garbage every day. Most of this waste ends up in landfills. Other waste from the American home gets recycled through community recycling programs or through natural cycles (for instance, water used on our lawns). This activity is designed to help middle school students identify some of the solid waste that is generated by them and produced by industry for products they may use. They will then design a solid waste management plan that applies their knowledge of natural cycles to minimize the waste and the dangers of landfills.

Note: In order to complete the second part of the activity, students should have a basic understanding of the concept of cycles (for instance, the water cycle, rock cycle, carbon cycle, nitrogen and other nutrient cycles or recycling – not all of these are necessary). These lessons can also be used in conjunction with units on Environmental Issues/Science, Human Populations or Cycles.

#### **Related National Standards**

This lesson addresses the following National Content Standards found at:  
<http://books.nap.edu/html/nses>

Content Standard D: As a result of their activities in grades 5-8, all students should develop an understanding of

- Structure of the Earth System:
  - Water, which covers the majority of the earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the 'water cycle'.
  - Water is a solvent. As it passes through the water cycle, it dissolves minerals and gases and carries them to the oceans.

Content Standard F: As a result of their activities in grades 5-8, all students should develop an understanding of

- Populations, resources and environments
  - When an area becomes overpopulated, the environment will become degraded due to the increased use of resources
- Natural Hazards
  - Human activities also can induce hazards through resource acquisition, urban growth, land-use decisions, and waste disposal. Such activities can accelerate many natural changes.

#### **Extension Web sites from PBS**

- **Newtons Apple – Glass Recycling**

<http://www.pbs.org/ktca/newtons/10/recycle.html>

This website includes background information on bottle recycling and several activities that involve calculating the amount of materials we put into a landfill.

- **Escape from Affluenza Teacher's Guide**

<http://www.pbs.org/kcts/affluenza/escape/guides/teach/print.html>

Have students collect and measure all the garbage they produce in one day

The following three sites contain tips and problems that integrate math and the subject of solid waste:

- **PBS Mathline - Real Data**

<http://www.pbs.org/teachersource/mathline/tips/tips498.shtm>

- **PBS Mathline - What We Do Adds Up**

<http://www.pbs.org/teachersource/mathline/concepts/earthday/activity1.shtm>

- **PBS Mathline - A Little Recycling Goes a Long Way**

<http://www.pbs.org/teachersource/mathline/concepts/earthday/activity2.shtm>

**Activity 1: What Kind of Garbage Do You Produce?****Time Allotted:**

30 minutes including discussion

**Materials:**

- Butcher Paper, Poster Paper or Chalkboards for Brainstorm Activity

**Objectives:**

- Students will be able to list the types of household waste that they produce daily.
- Students will be able to describe some other types of waste that are produced by industry or agriculture to help maintain their lifestyles.
- Students will be able to explain the fate of some of their household waste.

**Watch the AVG Video Segment: "Landfills-Health Concerns"**

Watch the video clip from the beginning of the video and stop after hearing 'out of site and out of mind, no complaints.'

*Note: You can access and view the video clips used in this lesson in the Teacher Resources section of the AFG Web site ([www.pbs.org/americanfieldguide/teachers](http://www.pbs.org/americanfieldguide/teachers)).*

**Discussion Questions for Video Segment**

- Break students into small groups (three to five students). Give them paper or part of the chalkboard and markers or chalk. Have them brainstorm answers to the following question for five minutes: What things do you dispose of each day? Be specific.
- Have a spokesperson for each group explain their ideas. Compile a class list on the chalkboard or overhead.
- Watch the video clip for more ideas and then add them to the class list.

**Watch these two AVG Video Segments  
"Landfills Hazardous Waste"**

Start the video clip at 'Residents who live near landfills have one other big concern' and stop it after 'so they can be sent to hazardous waste facilities.'

**"Brazos River Cleanup"**

For more ideas, watch this video clip starting at the beginning and stop after hearing 'scenes like this could easily be the rule rather than the exception.'

*You can access and view the video clips used in this lesson in the Teacher Resources section of the AFG Web site ([www.pbs.org/americanfieldguide/teachers](http://www.pbs.org/americanfieldguide/teachers)).*

### **Discussion Questions for Video Segments**

- Drawing from the class list the students created earlier, discuss the following questions:
  - What do you produce at home/school/play?
  - What solid waste is produced by industry or agriculture in order for you to maintain your lifestyle?
  - Do different types of industry produce different types of garbage?
- What type of waste is most prevalent in your area?
- Where do these things go? How can we reduce the amount that finds its way to landfills?
- If you are planning to have students design their own landfill (Activity 3) you may want to have them copy down the class list of solid waste into their notebooks.

### **Related Web Sites**

- **The Environment Agency**  
<http://www.environment-agency.gov.uk/kids/?lang=e>  
A site from the United Kingdom with great activities for kids to young adults.
- **Environmental Literacy Council**  
<http://www.enviroliteracy.org/>  
A site for educators and students with essays, activities, lesson plans, and reviews of environmental education resources.
- **EPA Student Center**  
<http://www.epa.gov/students/>  
A site from the Environmental Protection Agency geared towards students in middle and high school.
- **Earthforce-GREEN**  
<http://www.earthforce.org/green/>  
A site from the Global Rivers Environmental Education Network for watershed monitoring by groups.
- **Environmental Defense – Scorecard**  
<http://www.scorecard.org/>  
A site devoted to information about environmental issues and pollutants in the United States.

**Activity 2: Recycling Solid Waste****Time Allotted:**

25 minutes

**Materials:**

None

**Objectives:**

- Students will learn how household waste can be reduced, reused or recycled.
- Students will be able to demonstrate how certain types of waste can be reused by returning to natural cycles such as the carbon cycle, nitrogen cycle or in recycling.

**Watch the AVG Video Segment: "Healthy Rivers Part 4"**

Note: Start the video at 'shows examples of practices he wants farmers to change' and stop after hearing 'cut the dairy farmers fertilizer expense.'

*Note: You can access and view the video clips used in this lesson in the Teacher Resources section of the AFG Web site ([www.pbs.org/americanfieldguide/teachers](http://www.pbs.org/americanfieldguide/teachers)).*

**Classroom Activity**

Ask students to show how these farmers are recycling the nitrogen. Give students a diagram showing a cycle (e.g. a circle with arrows). Ask them to work with a partner or in a group of three to illustrate the steps that the nitrogen passes through during its cycle.

(Answer: Nitrogen is in grass, horse eats grass, horse eliminates, manure is stored in pond, pond water is used as fertilizer, nitrogen fertilizer helps grass grow, horse eats grass)

**Discussion Questions**

After they have completed their diagrams, ask students the following questions:

- How did these farmers put solid waste to good use?
- What are some ways that this technique helped the environment?
- Does this technique have any implications for what we do with our household waste?

**Activity 3: Designing a Solid Waste Management Plan**

**Time Allotted:**

2-3 45-minute class periods plus some time as homework

**Materials:**

- Student Instruction Handouts
- Poster Board

**Objectives:**

- Students will design a waste disposal system to integrate the concept of cycles that will help to reduce the amount of solid waste that ends up in landfills.

**Classroom Activity**

Students will research problems associated with garbage disposal. They will then apply what they know about garbage to make a plan that will effectively reduce or reuse solid waste produced in American society. Have students work with a partner. They should follow the directions included on the Student Instruction Handout.

**Assessment**

A sample of a scoring guide that can be used to assess the poster and presentation follows:

Points	Problems and Solutions	Concept of Cycles	Poster	Knowledge or understanding of solid waste disposal
	3-5 problems are clearly explained and workable solutions are presented	Two cycles are clearly integrated into the new disposal system	Clearly helps to explain the new solid waste facility	Clear main ideas, carefully selected details, complex connections and insights
	Fewer than 3 problems and solutions are addressed, OR problems are presented but are unclear or solutions aren't reasonable	Cycles are presented but are not well integrated	Visual aid is present but doesn't address all the problems and solutions	Main idea is present; limited supported details; limited understanding
	Includes only part of necessary components; presentation is unclear and unorganized	One cycle is discussed, but isn't well integrated	Visual aid is present, but only covers a small part of the presentation or doesn't illustrate the solutions.	Unclear main idea; few or no details; presentation is a list of facts with no understanding of topic.

## **Student Instructions**

### **Designing a Solid Waste Management Plan**

#### **Project Description**

The average American consumes 120 pounds of resources every day. About five pounds of this ends up in a landfill. A good portion of the rest goes to sewage treatment facilities. Other parts are recycled or end up back in natural cycles (for instance, water used on our lawns). What to do with waste is an ongoing problem in society. Landfills are filling up, producing pollutants that get into our air and water. In addition, materials put into landfills are not reused, thus using up natural resources. People who design landfills and solid waste treatment facilities are using a number of techniques to try to solve some of these problems.

You will work with a partner to research solid waste and to design a solid waste facility that uses better methods of garbage disposal. You will identify several problems that are associated with landfills and then you will design a new landfill that effectively addresses the problems that you identified. You should be sure to include at least two cycles in your landfill (for instance, the water cycle, rock cycle, carbon cycle, nitrogen and other nutrient cycles or recycling).

#### **The General Process**

After discussing types of garbage and what happens to it and after watching the video clips, you will conduct research about solid waste disposal. You may use the library, personal interviews, on-site visits or the Internet to get your information. Some keywords to try include: landfills, solid waste, garbage or garbage dumps. Find at least four resources.

Then you will want to identify three to five problems associated with solid waste disposal and determine solutions to these problems. Your solutions should include the concept of cycling of materials (at least two cycles). Finally, design a landfill incorporating your solutions. Make a poster and prepare a presentation that explains your design.

Thus you will:

#### **Research:**

- 3-5 problems associated with solid waste disposal/landfills
- at least one solution to each problem
- how cycles and cycling of materials are incorporated into your solutions

#### **Turn In:**

- A poster
- A presentation
- A bibliography (see your teacher for format)