



# **EPA WATER POLLUTION PREVENTION AND CONSERVATION**

## **POLLUTION PREVENTION (P2) EDUCATION TOOLBOX**

Tools for Helping Teachers Integrate P2 Concepts in the Classroom

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### **HOW DO WE USE WATER?**

Water is a resource that has many uses, including recreational, transportation, hydroelectric power, agricultural, domestic, industrial, and commercial uses. Water also supports all forms of life and affects our health, lifestyle, and economic well being. As individuals, we use water for sanitation, drinking, and many other human needs, and we pay for the public water utilities that provide water. Examples of the amount of water used by an individual during everyday activities are shown below (compare the gallons to a gallon of milk):

To flush a toilet	5 to 7 gallons
To run a dishwasher	15 to 25 gallons
To wash dishes by hand	20 gallons
To water a small lawn	35 gallons
To take a shower	25 to 50 gallons
To take a bath	50 gallons
To wash a small load of clothes in a washing machine	35 gallons
To brush teeth (running water continuously)	2 to 5 gallons

The average American uses 140 to 160 gallons of water per day.

Although more than three quarters of the earth's surface is made up of water, only 2.8 percent of the Earth's water is available for human consumption. The other 97.2 percent is in the oceans; however, this water is too salty to use for most purposes, and the salt is very costly to remove. Most of the Earth's fresh water is frozen in polar ice caps, icebergs, and glaciers.

### **WHY IS WATER POLLUTION PREVENTION AND CONSERVATION IMPORTANT?**

Although water flows from our faucets throughout the day, we often take the amount of fresh water available on Earth for granted. As the world's population increases, water consumption increases. Preventing water pollution and conserving water are important to assure a continuing abundance of water that is safe to use for ourselves and future generations.

### **WATER POLLUTION**

Water pollution is any human-caused contamination of water that reduces its usefulness to humans and other organisms in nature. Pollutants such as herbicides, pesticides, fertilizers, and hazardous chemicals can make their way into our water supply. When our water supply is contaminated, it is a threat to human, animal, and plant health unless it goes through a costly purification procedure.

Examples of pollution and its effects on water bodies such as Lake Michigan are listed below.

- ✓ Pollutants can come from a specific source such as a pipe that discharges used water or other material from a factory into a water body. Such discharges can harm the aquatic ecosystem.
- ✓ Pollutants can also come from large areas such as agricultural fields that have been covered with fertilizer or pesticides. Fertilizer and pesticide residues can run off or wash into streams and rivers or seep into soil, contaminating underlying groundwater.

- ✓ Pollutants can also come from parking lots, gardens, driveways, sidewalks, lawns, and roads. Rain water or melted snow can transfer materials such as oil, litter, fertilizers, and salt down storm sewer inlets found on the streets. In some areas, the storm sewer transports this polluted water to a water treatment facility. In other areas, the storm sewer transports this polluted water to a nearby river, lake, stream, or wetland.
- ✓ Pollutants can contaminate our drinking water sources, reduce oxygen levels which can kill fish and other wildlife, accumulate in the tissue of fish we catch and eat from the lakes, and reduce the beauty of the water.

## **WATER CONSERVATION**

As the population increases, more water is used and wasted. In some areas of the country, especially in the western states, water shortages can occur due to limited supply. However, even in Chicago, where there is an abundant supply of fresh water from Lake Michigan, shortages can occur during summer high-use periods when the amount of treated water available cannot meet the high demand for it.

## **HOW CAN POLLUTION PREVENTION HELP YOU?**

It is hard to imagine that one person can make a difference in protecting and conserving fresh water supplies on this planet, but each individual can really help the environment. The following P2-related concepts can help you protect water from pollution, conserve water by reducing the amount of water you use, and save money:

### **Changing What You Use**

- ✓ Replace shower heads and faucet aerators with water efficient models.
- ✓ Use a water-filled milk jug or plastic bottle in your toilet tank to displace water; this allows your toilet to operate using less water.
- ✓ Choose nonphosphate or low phosphate detergents. High phosphate levels in lakes and streams can kill fish and other wildlife.
- ✓ Use a broom instead of water to clean your driveway or garage . Do not sweep debris into the street or storm sewer.
- ✓ Put a spray nozzle on the end of your hose for car washing and plant watering to prevent the hose from continually releasing water and to control the amount of water used.
- ✓ Use native plants in your garden that require less water.
- ✓ Use cat litter or sand instead of salt on icy walks. Salt pollutes water and kills plants.

### **Changing What You Do**

- ✓ Do not let the water run while brushing your teeth or washing your face (you can save up to 5 gallons).
- ✓ Do not leave the water running if you wash dishes by hand.
- ✓ Rinse all your dishes at once by using a dishrack placed in the sink.
- ✓ Only run your dishwasher and washing machine when they are full.

- ✓ Do not open fire hydrants on hot summer days because water needed to fight a fire will not be available in an emergency. Also, opening fire hydrants is illegal.
- ✓ Do not throw in the trash, pour down the drain, or dump on the ground paint, antifreeze, motor oil, and other household hazardous wastes, because they can migrate to your water source.
- ✓ Dispose of tissues, dead insects, and other waste in a trash can rather than a toilet.
- ✓ Plant native plants instead of traditional lawn grass to avoid the use of herbicides, pesticides, fertilizers.
- ✓ Do not dump used motor oil on the ground or into sewers; throwing motor oil in the trash is illegal. Recycling centers and many service stations accept used motor oil for recycling.

### **Improving Your Housekeeping**

- ✓ Fix leaks by replacing faucet washers and toilet flappers as needed. A slow drip or leak can easily waste more than 100 gallons of water a week, which leads to an unnecessarily high water bill.
- ✓ Put all litter in trash cans so it does not get washed into the storm sewers.
- ✓ Clean up waste products while walking your pets.

### **Educating Yourself and Others**

- ✓ Educate your community about the effects of dumping waste, such as pesticides, down drains and into waterways.
- ✓ Encourage your neighbors, family, and friends to install low flow water fixtures and to practice water conservation.

## LESSON PLAN

This lesson plan provides guidance and activities to help you meet the following goals:

- ✓ Describe water uses and sources
- ✓ Explain why water conservation is important
- ✓ Explain how pollution prevention concepts can be used to conserve water and prevent water pollution

The preceding pages of the fact sheet contain background information and the definitions necessary to implement this lesson plan, which meets the requirements for the following Chicago Academic Standards and Frameworks: 6th grade -state goal 11 CAS B. CFS 4,7, and 10, state goal 13 CAS B.; 7th grade - state goal 13 CAS A. CFS 1, CAS B. CFS 2; 8th grade -state goal 13 CASA. CFS1, CASB. CFS1.

### HOW DO WE USE WATER?

Begin the lesson by discussing the importance of water.

- ✓ Ask the students to identify how they used water during the past week at home and at school. Sum the amount of water used by referring to the average quantities shown on the first page of the fact sheet.
- ✓ Review the attached list of percentages on Earth's total and fresh water supply to demonstrate our limited water resources.
- ✓ After the students have discussed individual water uses, ask them to identify water uses outside of the home and school [examples include agriculture, irrigation, livestock watering, fishing, industrial uses (a good example is paper manufacturing), mining, power generation, and transportation.]

### Activity No. 1 - Earth's Water Distribution

**Objectives:** Students should understand the distribution of Earth's water and be able to name sources of fresh water on Earth.

**Time Length:** About 15 minutes

**Materials Needed:** One copy of attached pie chart of Earth's total water supply, one 1,000-milliliter (mL) graduated cylinder, five 100-mL graduated cylinders, one medicine dropper, and food coloring. Use the table below to determine the distribution of water for this demonstration:

Earth's Total Water Supply (milliliter)		Earth's Total Fresh Water Supply (milliliter)	
Ocean (saltwater)	972	Icecaps and glaciers	23
Fresh water	28	Groundwater	4
		Surface water	2 drops*
		Water in air and soil	1 drop
Total water on earth	1,000	Total fresh water on earth	28

1 liter = 1,000 milliliters

\* 3 drops = 1 milliliter

**Activity:**

- ✓ Ask the students to estimate how much fresh water is available on Earth and where the fresh water comes from. Explain that you are going to demonstrate the actual distribution of the Earth's fresh water.
- ✓ Fill one 1,000-mL graduated cylinder with colored water to the 1,000-mL line. This represents the Earth's entire water supply.
- ✓ Pour 28 mL of the water into a 100-mL graduated cylinder. This represents the Earth's total fresh water supply. The water remaining in the first cylinder (972 mL) represents salt water.
- ✓ Divide the 28 mL of fresh water into smaller containers. Use the amounts shown in the table.
- ✓ Explain to the students that the cylinder containing 972 mL of water represents the salt water that we cannot drink without a costly procedure to remove the salt.
- ✓ Ask the students which fresh water graduated cylinder represents the most fresh water on Earth (answer is the 23 mL cylinder representing icecaps and glaciers). Ask if this source of fresh water is commonly used by humans.
- ✓ Explain to the students that Chicago gets most of its drinking water from surface water (Lake Michigan) and some from groundwater (aquifers), which together comprise only 16.7 percent of the Earth's fresh water.

**WHY IS WATER POLLUTION PREVENTION AND CONSERVATION IMPORTANT?**

Now that the students have an idea of where water comes from and how much of this valuable resource is used in our daily lives, discuss why water conservation is important.

- ✓ Explain to the students that in order to assure water is safe to use for ourselves and future generations we must prevent water pollution and conserve the fresh water that is available on Earth.
- ✓ Based on the information provided on water pollution, explain sources of pollutants and possible ways that pollution can enter our fresh water supply.

**Activity No. 2 - Pollution Flow Chart**

**Objectives:** Students should understand the sources of pollution and how pollution can be a threat to our water supply.

**Time Length:** About 20 minutes

**Materials Needed:** Paper and pencil for each student

**Activity:**

- ✓ Divide the class into groups and have each group identify at least five types of pollutants and their sources (examples include salt from roads, herbicides, pesticides, and fertilizers from lawns, oil from cars, and phosphate from detergents).

- ✓ On a sheet of paper, have each group write the sources (for example, a road) in boxes. Then have them draw arrows that show the pollutant (for example, salt) moving toward a potential pathway (for example, a storm sewer). More than one line may apply to each pollutant because the pollutants may end up in several places (for example, pesticides can be washed down sewers and also seep into the ground and contaminate aquifers).
- ✓ Have each group also create boxes for the potential pollution receptors (for example, fish and people) and connect them with arrows to the original sources and potential contaminants. The pictures should all connect to form a pollution flow chart.
- ✓ After each group has shared their ideas with the class, have the students discuss ways of eliminating pollution from potential sources. Examples include picking up pet waste; disposing of hazardous waste properly; not pouring antifreeze, oil, or paint down sewers; and eliminating the use of herbicides, pesticides, and fertilizers on your lawn.

Humans >>> Lawn >>> Storm Sewer >>> Lake >>> Fish

## HOW CAN POLLUTION PREVENTION HELP YOU?

Based on the information provided, discuss how the four P2 concepts described earlier can be used to help conserve water and prevent water pollution.

- ✓ Keep this discussion interactive. Ask students for ideas to conserve water in the home and at school and how to prevent water pollution.
- ✓ Emphasize that small or individual actions to conserve water add up and can result in many gallons of water and money saved.

### Activity No.3 - Water Watchers

**Objectives:** Students should be able to develop water conservation tips on their own and pass on the information to family, friends, and neighbors.

**Time Length:** A 5-minute brief explanation of homework assignment to students; about 25 minutes in class the following day or week

**Materials Needed:** Student journal, poster board or cardboard, and markers or colored pencils

#### Activity:

- ✓ Assign the students to observe water uses of family, friends, and neighbors. Students will record observations in their journals of all the water uses and how long their family, friends, or neighbors used the water. For example, if a student's neighbor is watering a lawn, have the student record who used the water, how the water is used, and for how long. Other actions to observe include a family member using the washing machine or brushing his or her teeth.
- ✓ After students have recorded the water uses they observed in class, divide the students into groups and have each group discuss their observations. Ask each group to come up with alternatives or conservation tips for each water use.
- ✓ Have each group create a poster that represents all of their ideas.

- ✓ Pin up the posters created so that the entire class can discuss new ideas. Hang the posters in the classroom so that the alternatives become familiar to the students.
- ✓ Have students report back to the people they observed with alternatives and conservation tips.

#### **METHOD OF EVALUATION/ASSIGNMENT**

In addition to Activity No. 3, have students write the following questions in their journals:

- ✓ What water conservation tips were developed in class?
- ✓ Are you practicing the water conservation tips developed in class?
- ✓ Are you dumping or throwing anything away that could potentially pollute our water?
- ✓ If you are, what safer disposal methods could you use?
- ✓ What water conservation tips can be used at school?

Students should answer these questions with the help of family and friends and write the answers in their journals.

## ATTACHMENT

### EARTH'S TOTAL WATER SUPPLY

Oceans (saltwater)	=	97.2%
Fresh water	=	2.8%

### EARTH'S FRESH WATER SUPPLY

Ice caps and glaciers	=	82.1%
Groundwater (aquifers*)	=	14.3%
Surface water (lakes, rivers, and streams)	=	2.4%
Air and soil	=	1.2%

- \* An aquifer is any geological formation containing water, especially one that supplies water for wells and springs. It is like an underground river.