Who Polluted the Potomac?

ELABORATION

BACKGROUND INFORMATION:

You will read aloud an interactive story dramatizing how population growth and changes in land use can cause a river to become so polluted that it is transformed from a valuable resource into a repugnant and even toxic wastewater. The emphasis in this activity is on nonpoint source pollution, which originates from sources that are not easy to identify. Nonpoint source pollution is mostly the result of runoff and includes fertilizers and other toxic chemicals washing off lawns and farmland; oil, grease, and litter from streets and parking lots; soil eroding off construction sites; and air pollutants washed to earth by rain. These pollutants are very difficult to measure and control, and they have a great impact on life in a water body.

This exercise demonstrates that we are all part of the problem. It also shows that protecting the environment is not a one-time event, but requires ongoing changes in our daily habits. After completing this activity, students should be ready to discuss the actions they can take to help prevent pollution.

Fill the 16 canisters as indicated in the following chart:

"Factor"	Substance in Canister
Construction site	3mL dry clay soil
Trees	Dry leaves, crumbled
Motorboat	1mL vegetable oil
Beach party	Assorted litter (pull tabs, Styrofoam, etc.)
Family picnic	Assorted litter (paper, plastic wrap)
People fishing	Tangle of nylon fishing line
Farmer	Potassium chloride or 2mL baking powder
Barnyard	Molasses, coffee, or food color mix
Homeowner	Yellow food color, water, toilet paper
Coal mine	1/4 canister vinegar
Electric power plant	1/4 canister vinegar

(Chart continued on next page.)

Goal:

- To become aware of the many different ways pollutants can enter a river.
- To realize that protecting the environment is not a one-time action, but that it requires ongoing changes in our daily habits.

Materials List:

- Water quality testing kits for each parameter
- 1 gallon of tap water in a clear, colorless, wide-mouthed container
- 16 labels (found on page 6)
- 16 film canisters or other small containers (one for each factor)

Suggested Adaptation

- Teachers with water-quality testing kits and labs can test the water before and after the story for apparent color, odor, pH, orthophosphates, nitrates and turbidity using the techniques from "Understanding the Water Quality Index" exploration activity.

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PROCEDURE:

1. Before class begins, make a copy of the following labels. Cut them out and tape them to film canisters. Fill the canisters with the ingredients listed on pages 3-4. Put one gallon of tap water into the container to represent the Potomac River.

"Factor"	Substance in Canister
Commuters	¼ canister of vinegar
Gardeners	2mL monosodium phosphate or baking soda
Antifreeze	Blue/green food color and water
Washing the car	½ canister of soapy water
Mysterious liquid	1mL diluted red food color and water

Note: The canisters need to be labeled and filled before the class begins.

2. Have students arrange themselves around the container of water that represents the "Potomac River."

3. Distribute a set of canisters to the students representing the factors that impact a waterway. Students should keep the identity of the factor/contents of their canister a secret. Explain that when a factor is mentioned as you read the story (below), the student with the corresponding canister should empty the contents into the "river" (the jar of water).

4. Read the following story out loud to the class.

THE STORY OF "WHO POLLUTED THE POTOMAC?"

For many thousands of years, people have lived on the banks of the Potomac River. They hunted in the great forests, harvested food from the wetlands, and fished the river.

Imagine that the jar of water was taken from this river about 500 years ago.

Would you drink this water?

Would you swim in it?

Would you go boating in it?

Is it safe for wildlife?

In 1608, Captain John Smith explored the Potomac for settlement by European colonists. He kept a journal of his discoveries, writing about the Native American villages, the forests, and the river itself. He described tributaries of "sweet waters" and the river so full of fish that he and his crew tried to scoop them up with a frying pan.

Soon colonists began to arrive. They found fertile land for farming, forests teeming with game, and a river that provided ample food and water. It was an outstanding environment for settlement, and the colonists prospered.

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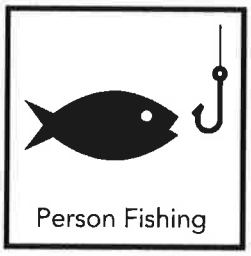
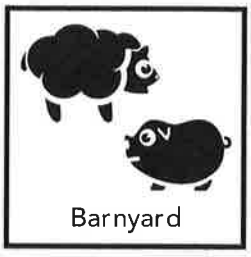
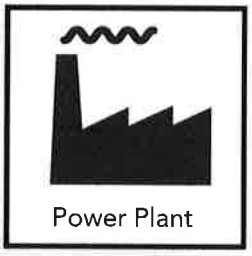
CANNISTER LABELS







The Potomac River has changed a lot in the past 400 years. This is the story of the changes.

Listen for the name of the character printed on your canister. When you hear your character named, open the canister and dump its contents into the river.

Imagine now that everything in the story is happening in the present – maybe even while we're sitting here today.

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A sudden downpour drenches the area. The pounding rain is washing loose soil from a nearby **CONSTRUCTION SITE** into the river. High winds whip through the **TREES** and blow leaves into the water.

Imagine that the jar of water was taken from this just after a downpour.

Would you drink this water?

Would you swim in it?

Would you go boating in it?

Is it safe for wildlife?

Why or why not?

In a short while, the storm passes over and the sun comes out again. People head for the river to have fun. Some zoom up and down the river in **MOTORBOATS** and don't notice that a little engine oil leaks into the water.

A group of friends have spread blankets on the shore for a **BEACH PARTY**. Lots of families are **PICNICKING** in the parks, too. Some of these people have left trash on the shore. At the next high tide, or during the next rain, that trash will wash into the river. On the dock, a **PERSON FISHING** snags the hook on a log and breaks the nylon fishing line.

Imagine that the jar of water was taken from this river now.

Would you drink this water?

Would you swim in it?

Would you go boating in it?

Is it safe for wildlife?

Why or why not?

Not everyone is out playing today. A **FARMER** has been fertilizing cornfields close to the shore. The rain washed some of the fertilizer off the land and into the nearby river. The farmer also keeps pigs and other animals in the **BARNYARD**. As the rainwater drains out of the barnyard, it carries some of the manure into a little creek behind the farm. The creek flows into the river.

Out in the country, high on a hill overlooking the river, is an old house. It is not connected to the city sewer system. Wastewater from the house goes into a septic tank underground. The **HOMEOWNER** has not maintained the septic tank, and poorly treated sewage is seeping into the river.

Imagine that the jar of water was taken from this river now.

Would you drink this water?

Would you swim in it?

Would you go boating in it?

Is it safe for wildlife?

Why or why not?

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Upstream is a **COAL MINE**. Rainwater drained down into the shaft and soaked the piles of wastes and scraps from mining. This made the water become acidic - like strong vinegar. Then the acid water trickled back out into the river.

The **ELECTRIC POWER PLANT** on the river burns coal to produce electricity. The gases coming out of the smokestacks combine with moisture in the air to form acids. The pollution falls back to Earth as acid rain or snow.

Many **COMMUTERS** drive their cars to and from work. Car exhaust fumes (just like the power plant fumes) cause more acid rain. If a car is not kept in good repair, it might also leak oil or other fluids, which will be washed off the pavement and into the river with the next rain.

Imagine that the jar of water was taken from this river now.

Would you drink this water?

Would you swim in it?

Would you go boating in it?

Is it safe for wildlife?

Why or why not?

Let's look in on some typical activities around the neighborhood. Lots of **GARDENERS** are out working in their yards today. Many of them are using weed killers and insect sprays to keep their lawns pretty. The next rainfall will wash these poisons into a little creek nearby, and then into the river.

There's a father teaching his daughter how to change the antifreeze in her truck. They pour out the used **ANTIFREEZE** on the driveway. Antifreeze is sweet-tasting and can poison an animal that licks it. It can also get into the nearby creek and poison fish.

Later, father and daughter **WASH THE CAR**. The soapy water rushes down the driveway into the storm drain; the storm drain empties into the river. Phosphates in detergents used to be a pollution problem because they acted like fertilizer, making too much algae grow in the river. Laws were passed to stop the use of phosphate soaps in order to help solve the algae problems. But the grease and grime on a car contain asphalt from the roads, asbestos from the brakes, rubber particles from the tires, heavy metals, and rust. If the man and his daughter had gone to the local car wash, the water would have been treated before it was returned to the river.

Next door a family is cleaning out their garage. They find an old rusty can with a tattered skull and crossbones label still stuck on it. What could it be? It looks dangerous, and they want to get rid of it before someone gets hurt. But how? One of the kids gets the idea: "Let's pour it down the drain out by the curb. Hurry up! " So the **MYSTERIOUS LIQUID** goes down the storm drain. The poison is out of sight, but it is headed for the river.

Imagine that the jar of water was taken from this river now.

Would you drink this water?

Would you swim in it?

Would you go boating in it?

Is it safe for wildlife?

Why or why not?

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Think about what was in the canisters:

1. **Could something be done to prevent that type of pollution from entering the river?**
2. **What could you start doing right away to help improve the health of the watershed where you live?**
3. **What do you think would have to be done to this water to make it safe to drink?**
4. **Once pollutants have entered the river, how can we get them out?**
5. **How can we clean up the river?**
6. **Do you think it is easier to prevent pollution or clean it up?**

TIGHTLY CLOSE THE CONTAINER OF POLLUTED WATER AND SAVE IT. Students will be using it after their field study to create strategies for cleaning their river. (See "Polluted Water Can We Clean It" on page 25.)

Note: Extensions to this activity provide options for isolating the nonpoint source pollution in various tributaries of the Potomac River and exploring differences in the subwatersheds' size, land use, and development patterns. Extensions are provided with your supplementary materials.