Who Polluted the Hudson River?

Topics: Pollution, non-point source, point source, watershed, Hudson River
Grade Level: 3-7

New York State Science Learning Standards
4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.
5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth’s resources and environment.
MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Key Understandings
- Pollution has various effects on people, wildlife, and plants.
- Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways.
- Human activities have effects on the land, streams, rivers, ocean and air.
- Fresh water, limited in supply, is essential for some organisms and industrial processes. Water in rivers, lakes, and underground can be depleted or polluted, making it unavailable or unsuitable for life.

Vocabulary
Acid rain, Fertilizer, Insecticide, Litter, Non-point source, Point source, Pollution, River, Tributary, Waster water

Essential Questions
- What is pollution? Identify different types.
- Explain the differences between non-point and point source pollution.
- Describe how human activities affect the environment?
- How can we prevent pollution from getting into our waterways?
- How can my actions affect the health and quality of my environment?

Background Information
There are many different types of pollution and can be put into two categories: non-point source, and point source pollution. Non-point source pollution (NPS) is when pollution originates from many different sources rather than one specific, identifiable source. NPS occurs when rainfall, snowmelt, or irrigation runs over land or through the ground, picks up pollutants, and deposits them into rivers, lakes, and coastal waters or introduces them into ground water. Not only can it contaminate water, it also causes adverse changes to the vegetation and affect the shape and flow of streams and other aquatic systems. NPS pollution remains the nation’s largest source of water quality problems. NPS pollution is widespread and can result from a variety of human activities on the land. Careless or uninformed household management contributes to NPS pollution problems. The most common household originated NPS pollutants include pesticides, salts, oil, grease, toxic chemicals, and heavy metals. Inadequate septic systems, animal waste, and large amounts of grass clippings, leaves and other natural debris cause household hazardous waste to get into our natural water supply. Other examples of NPS pollution include, soil eroded from construction sites, fertilizers from fields and lawns, metals and oil from automobiles, and road salts.

Point source pollution is when there is one specific, identifiable source of pollution. For example, waste water treatment facilities can get overloaded during rain events. The wastewater overflows, and you can directly point to the source of pollution. The Hudson River is cleaner today than it was 20 years ago, however there is still pollution getting into our waterbodies.
Materials

- For each student: One canister of premade pollution.
- Teacher: photocopy “Who Polluted the Hudson River” story.
- 15 labeled film canisters (or other small containers with lids). Make doubles if the class size is larger than 15 students.
- Pollution materials (see list).
- Large clear container with water, filled halfway.

Student Activity:

Using the dry erase board to record information:

1. Begin the lesson by discussing and listing on the board different types of pollution. Review essential questions.
2. Explain to students that you will be reading a “fictional” story about pollution in the Hudson River Watershed. When the name of the pollution is read, the student with that pollution on their canister is to come up to the front of the room, and carefully dump the contents into the large clear container.
3. At the end of the story have a class discussion about what happened to the water. Is pollution good or bad for the environment and why? How can pollution affect humans and wildlife?
4. Have students individually or in small groups answer the following questions:
   - How can we prevent pollution from getting into our waterways?
   - How can my actions affect the health and quality of my environment?
   - What can YOU do to protect the Hudson River?
5. Extension: Have students research and come up with designs to keep pollution out of the water.
6. Extension: Have students clean up the polluted water, creating their own filter systems.

Trees                      Dry leaves
Construction site         Dirt
Fertilizer                Baking Soda
Coal fired plant          Vinegar
Nuclear power plant       Vinegar
Commuters                 Soy sauce
Apple farmer              Sprinkles
Motor oil                 Soy sauce
Washing family car        Water + 1 drop dishwashing soap
Mysterious liquid         Water + 1 drop red food coloring
Motorboats                Water + 1 drop blue food coloring
Birthday party            Balloon, or strips of paper
Picnicking                Pieces of paper, liter
Person fishing            Fishing line, or dental floss
Wastewater                Coco powder + little water
Who Polluted the Hudson River?

For over 10,000 years, people have lived on and around the shores of the Hudson River. These men and women caught fish in the river, hunted the land, and grew crops from the fertile soil.

Imagine the year is 1609 and the jug of water in front of you was taken from the Hudson River by a Native American.

- What does the water look like?
- Would you drink, swim, or eat the fish from the river?

Robert Juet, one of many Hudson River explorers kept a journal of his voyage along the river. He wrote about meeting the Native American people and what the Hudson River Valley had to offer; the “woods of goodly oaks”, and the river “full of fish”.

Shortly Colonist began to settle in the area. They knew the land was fertile for farming, the river full of fish, and a place for trade and commerce.

- Do we use the Hudson River the same way(s) today? Give some examples of similarities and difference in the way we use the river. (Transportation, food, water supply, etc)

Today the river is a lot different that it was 400 years ago. This story talks of those changes. Listen for the name of the character printed on your container. When the character is named in the story, open the container, and dump the contents into the river (jug of water).

As time went by, cities and towns around the Hudson Valley grew. Land was cleared, wetlands were filled, and trees were cut down to build houses and businesses. After heavy rainfall, the water eroded the loose soil and sediment from the construction sites into the Hudson.

- Do you think the water is safe to drink? (If the response is “no”, ask if the river had leaves or soil in it when Native Americans first drank from it)
- Would you swim or fish in the river? Is it safe for wildlife?

In the valley, farmers planted crops to feed the growing population. Some of these farms were on the shores of the Hudson and the fertilizer used to help grow the crops washed off the land and into the River. Some farmers had cows and other animals that could go right up to the river and drink the water or cool off. There were no fences to keep them out. As rainwater washed over the land, it carried some of the cow manure into the nearby creek. This creek is a tributary to the river, which means it flows directly into the Hudson.

- Is the water safe to drink now? Would you swim in it?
- Is the water safe for wildlife?

As cities grew larger, people began to move into the countryside. These rural houses are not connected to the city sewer system but have their own septic tanks underground. Wastewater from the toilet, showers, and sinks, flows into the septic tank. A homeowner has not maintained their septic system and wastewater has seeped into the ground, and on its way to the Hudson.

One site on the river producing electricity is a coal fired plant. Rainwater has soaked piles of wastes and scraps from the plant this has made the water become acidic-like strong vinegar. The polluted waste drained off the land and into the river.
There is also a nuclear power plant on the river that produces electricity. Gasses released out of the smokestacks combined with moisture in the air forms acids. This form of pollution falls back to the earth as acid rain or smog.

- Would you drink the water now? Swim in it?
- Is the water safe for wildlife? How could we test the water to see if it was safe for wildlife? (Testing levels of Dissolved Oxygen (DO), testing for pH levels, looking at the invertebrates in the water, noticing if there any dead animals around)

The Hudson Valley is a popular place to live and work. Traffic can get congested and be a problem for commuters who drive their cars to and from work. Exhaust fumes from cars cause acid rain. Cars can also leak oil or other fluids if not kept in good repair. These fluids can be washed off pavements and into the Hudson.

Some of our residents are apple farmers. On one farm, a farmer uses insecticides to keep the insects off the apples. The next rain could wash these poisons into the nearby tributary, and into the river.

One car owner is changing the motor oil in his truck. He pours out the used motor oil into the road. The motor oil got washed into a nearby storm drain, and is on its way to the nearby stream.

Next door, a neighbor is washing the family car. The soapy water runs down the driveway into the nearby storm drain. The storm drain that just collected the soapy water is on its way to the river. The grime and grease on the car contained asphalt from the roads, rubber particles from the tires, and rust. If the neighbor had gone to the local car wash, the water may have been treated and cleaned before it returned to the river.

Close by, a family is cleaning out their shed. They find an old rusty container filled with an unknown liquid. They think it might be dangerous and want to get rid of it. Not knowing what the liquid is, they decide to pour it into the storm drain. The mysterious liquid is out of sight - but headed for the river.

On sunny days, many people head down to a local river park to enjoy the day. Some ride around in motorboats for fun, but one boat owner has not fixed leak and engine oil is leaking into the river. Many families are picnicking in the park and others having a birthday party. The trash that was left behind will end up in the river.

On the fishing pier a person fishing snags a hook on a tree, cuts off the nylon fishing line and drops it into the water. The fishing line can get tangled and wrap around animals.

Does this story have any parts to it that you are aware of, or seen? Think about the consequences to the animals that live in the River, and the health of the river, and yourself.