



EarthCircles

Water at Work

LESSON 6: THE GREAT WATER CLEANUP

OVERVIEW:

Concept: Human activities contribute more to water pollution than the water cycle can manage.

Lesson At A glance

Materials

Preparation

Background for Teachers

LESSON PLAN:

Opening Circle

Activity: Kids explore methods used to clean dirty water.

Discussion

Principles in Practice

Story

Closing Circle



Materials:

For opening circle:

- Half gallon of dirty water in clear container

For water cleaning activity for each team of Kids:

- Gallon or so of dirty water in a bucket
- Sieve, such as small kitchen strainer
- 2 clear 10 oz plastic cups
- 5 paper cups with very small holes in the bottoms
- Eye dropper
- Coffee Stirrers
- Tbsp powdered alum
- ½ cup clean sand, rinsed well
- ¼ cup gravel, rinsed well
- ¼ cup plant-type charcoal
- 2 drops yellow food coloring
- Strainer or funnel
- Filter paper
- Sand
- Dirt
- Dry clay if available
- Dirty water
- 2 pint-size clear containers

Book: *Earth, Fire, Water, and Air* by Mary Hoffman and Jane Ray

Preparation:

- Put a gallon or two of water into the bucket and mix in assorted dirt, leaves, and other pollutants.
- Pour some of it into a clear container. Save the rest for later.
- Poke very small holes into the bottoms of five paper cups, using a pointed tool such as an auger or a large needle. Larger holes allow water to filter through the system too quickly, letting dirt go through the holes as well.
- Mix a few drops of yellow food coloring in a small amount of water.
- <http://www.youtube.com/watch?v=7sZc1d74Zml> to access video clip.

Gather supplies. Powdered alum is available in pharmacies or where canning supplies are sold. Garden supply stores have “clean” sand and gravel but they will need rinsing. You may also find plant-type charcoal there or at greenhouses. Remaining supplies are readily available.

You may want to assemble a set of materials for each team, or place supplies on a table and list materials needed on the chalkboard for teams to gather themselves.

Background for Teachers:

Drinking water is necessary for people to survive. But water is often dirtied with matter such as sewage, runoff carrying street trash and chemical and agricultural wastes, and trash from human activities. There are two problems that can overwhelm the natural water recycling processes. One is the amount of sewage, runoff, and other nasty stuff that gets into the water where populations are dense. Too many farms and factories let their wastes go into the nearest river. The second problem comes from the chemicals that natural processes cannot handle.

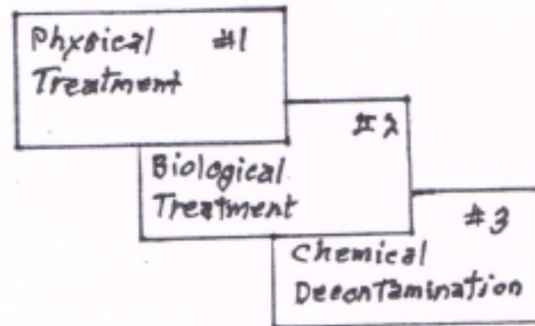
During the late nineteenth century sewage systems were devised and the first flush toilets came into being. In cities and larger towns an elaborate system of pipes collects sewage from houses, businesses, and industries and from street runoff and brings it to a treatment plant.



Several steps are involved in cleaning water whether for a water supply or to return it to nature.

- **Screen filtering** removes bulky material.
- **Aeration** releases trapped gases and absorbs oxygen.
- **Coagulation:** Alum or a similar substance is dissolved in the water and attaches to small dirt particles and dissolved organic materials, causing them to sink.
- **Sedimentation:** Heavy particles sink to the bottom. Clear water is piped off from the top.
- **Filtration:** Water then goes through layers of gravel, sand, and charcoal to clean it.
- **Chlorination:** A small amount of liquid chlorine or chlorine gas is added to filtered water to kill bacteria and other disease organisms.
- **Storage:** Treated water is kept in a closed tank for several days to allow chlorine to do its work. Some of the chlorine will dissipate, but some chlorine needs to stay in the water to kill bacteria in the pipes (distribution system).

Many water supplies across the country are treated in the above primary way by law. A secondary level of treatment disposes of biological contamination with bacteria that digest remaining solid matter. The third level deals with chemical contamination such as heavy metals, which usually require individual treatment. In such cases the factory or business responsible may be required to manage such waste waters themselves.



LESSONPLAN

Opening Circle: With everyone seated in a circle, exchange greetings and note who is present. Ask what do Kids think happens to all the dirty water coming from homes and businesses where we live?

Discussion:

- When water goes down the drain, where does it go from there?
- What happens to it?
- In cities and large towns it may go to a treatment plant to be cleansed.
- Is there such a plant near you? What happens there?

Activity: Dirty Water Cleanup

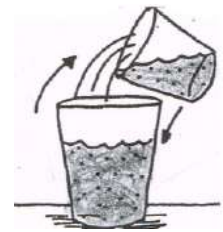
Tell the Kids that we can investigate some ways that we clean up dirty water. Have them form working pairs. Teams gather supplies. Then you read each step aloud for teams to follow. Use background information to inform the Kids about what each procedure does as they work. You may need to add a little more dirt and stir the water thoroughly before beginning.

Sewage Treatment:

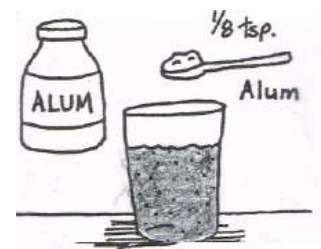
1. Intake and Screening: Teams use a clear plastic cup to scoop up some dirty water. Do Kids think it is possible to clean it? They pour it through the sieve into a clear plastic cup. Does this process change the water? If so, how? Would you drink it now?



2. Aeration: Teams half-fill one clear plastic cup with dirty water from the bucket and pour it back and forth between the two clear cups. What do they think is the purpose of this step?



3. Coagulation: Teams mix about $\frac{1}{8}$ tsp. of alum into the water in a clear cup. What happens? They let it set for a few minutes. Does anything change? It may take a little time.



4. Sedimentation: Kids may have to let their cups sit overnight (or all week) for sedimentation to completely occur. What do Kids expect will happen? (This step does take time for fine bits of dirt to settle. It may be necessary to let the cups sit until the next class.)



5. Filtration: Teams put a small piece of paper towel in the bottom of each of the five paper cups with holes in the bottom. In one cup they place a layer of clean sand, in a second cup a

layer of gravel, and in a third cup a layer of charcoal. Then they stack the cups with an empty cup between each layered cup. Kids pour the water in the clear cup into this filter, with the second clear cup in position to catch the water as it comes through the filter. (This process takes a few minutes for water to come through.) What does the water look like now? Is it clean enough to drink? What might still be in it?

6. Chlorination: Kids add two drops of yellow water to their filtered water to simulate adding chlorine. What does the chlorine do?



Kids can clean up at this point.

Discussion:

- How does the treated water compare with the dirty water?
- Do Kids think that this process makes the water clean enough to drink?
- How would they change the process to improve it?

Explain to the Kids that these activities are small scale models of what happens in a sewage treatment plant doing primary treatment. Use background information to introduce secondary and tertiary treatment if Kids are interested.

- What pollutants do Kids think would come from their homes?
- From businesses around town?
- From traffic?
- From Industry?

Encourage them to brainstorm and see how long a list they can make.

- If they live in an urban area, do they know where their sewage gets treated?
- How about areas that don't have sewer systems and treatment plants?
- What do Kids think happens to sewage in undeveloped countries and remote parts of this country?

Story: *Earth, Fire, Water, and Air* by Mary Hoffman

You may select one or two single-page essays about water for reading aloud from this intriguing book. It includes information about cultural and religious uses of water over the ages as well as basic information.

Principles in Practice:

Ask Kids if they would like to pledge to be good Water Watchers as a way to honor UU Principles in their everyday lives. Go over the pledge with them and discuss what it would mean in what they do every day. Have those who agree recite the pledge together, repeating after you as you read it aloud. Or you can use the pledge for closing words.

Water Watchers Pledge:

I pledge to honor my place in the Web of Life by caring for and conserving Earth's waters. I will not waste water when I can help it. I will be careful of where I dispose of wastes, remembering that what happens upstream affects people and all of life downstream. I will try to help more people around the world get the clean water they need.

Closing Circle:

Ask Kids to repeat these words together.

Water flows over these hands.
May I use them skillfully to preserve our precious planet.

Gerard Manley Hopkins,
Earth Prayers

