

# You Say Waste, We Say Resource



## Science Enhanced Lesson — Grade 6

### TOPIC

## Renewable Resources

### OUR WORLD, OUR RESPONSIBILITY

- 6.1** The student will demonstrate an understanding of scientific and engineering practices by (e) developing and using models.
- Use, develop, and revise models to predict and explain phenomena

- 6.1** The student will demonstrate an understanding of scientific and engineering practices by (f) obtaining, evaluating, and communicating information.
- Read scientific texts, including those adapted for classroom use, to obtain scientific and/or technical information
  - Construct, use, and/or present an argument supported by empirical evidence and scientific reasoning

- 6.6** The student will investigate and understand that water has unique physical properties and has a role in the natural and human-made environment. Key ideas include (f) water is important for agriculture, power generation, and public health.

- 6.9** The student will investigate and understand that humans impact the environment and individuals can influence public policy decisions related to energy and the environment. Key ideas include (a) natural resources are important to protect and maintain; (b) renewable and nonrenewable resources can be managed; (c) major health and safety issues are associated with air and water quality; and (e) preventative measures can protect land-use and reduce environmental hazards.

### EARTH SCIENCE

- ES.6** The student will investigate and understand that resource use is complex. Key ideas include (a) global resource use has environmental liabilities and benefits; (b) availability, renewal rates, and economic effects are considerations when using resources; (c) use of Virginia's resources has an effect on the environment and the economy; and (d) all energy sources have environmental and economic effects.

### BACKGROUND INFORMATION

AlexRenew completes the water cycle by transforming wastewater into clean water and renewable resources. The full process is described in AlexRenew's infographic titled, "From Wastewater to Clean Water." Please reference the handout for additional background information.

In this lesson, students will learn the process water goes through at the wastewater treatment plant, and how the organization turns waste into a resource. Students will be encouraged to be innovative and to see everyday objects in a new light.

## **MATERIALS FOR TEACHER**

- Handout: “From Wastewater to Clean Water”
- 5 clear plastic cups
- 1 tablespoon of the following household products: shampoo, hand soap, dish detergent, laundry detergent, cooking oil
- 1 square of toilet paper
- 1 baby wipe or small toy
- 1 piece of food or chocolate sprinkles to represent food scraps
- 1/4 cup of dirt or potting soil
- 1 cup of tap water
- 1 food strainer
- 2 paper towels
- 3-4 raisins

- Flashlight
- Tape
- 1 permanent marker
- 3 small plastic or glass plates

## **MATERIALS FOR STUDENTS**

- Handout: “From Wastewater to Clean Water”
- Access to items in the classroom
- Paper
- Pen/pencil
- Phone with camera (optional)

## **VOCABULARY**

Renewable resource, wastewater

## **AVAILABLE HANDOUTS**

- From Wastewater to Clean Water

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## **STUDENT/TEACHER ACTIONS**

### **LESSON INTRODUCTION SET-UP:**

- Line up five clear plastic cups in front of the class. Label each cup with a number from 1-5 with a permanent marker.
- Fill cup 1 halfway with water from the faucet.
- Cover the top of cup 3 with one folded piece of paper towel. Tape the paper towel to the cup to secure.
- Place a few raisins in cup 4.
- Have household products, food, dirt and strainer readily available.
- Distribute a copy of the “From Wastewater to Clean Water” handout to each student.

### **TEACHER LESSON INTRODUCTION:**

- Share with students that AlexRenew is the wastewater treatment plant that transforms wastewater into clean water and renewable resources.
- Share that you are going to demonstrate the multiple steps that wastewater goes through to get clean and produce renewable resources.
- Share that the students can follow the steps highlighted on the “From Wastewater to Clean Water” handout as you go through the demonstration.

### **Step 1: Where your water goes**

- Point to cup 1, filled halfway with clean water. Share with the students that Virginia American Water distributes clean water to homes, schools and businesses in the community every day. In fact, Virginia American Water delivered the water used to fill the cup.
- Ask students to think about the many ways they use water at home. As students share ways water is used, pour the household product into cup 1.
  - Bathing/showering – pour shampoo into the cup
  - Washing hands – pour hand soap into the cup
  - Washing dishes – pour dish detergent into the cup
  - Washing laundry – pour laundry detergent into the cup
  - Cooking – pour cooking oil into the cup
  - Running garbage disposal – pour pieces of food in the cup
  - Flushing the toilet – place toilet paper and baby wipe (or small toy) in the cup

- After pouring all these items into the cup, add dirt to represent general dirt that ends up in the water.
- Hold up cup 1, now dirty water. Share that all the dirty water we create travels down the drain and through the sewer to AlexRenew.
- Share that this step in the process is described in step 1 on their handout.

### Step 2: Take out the trash

- Share with the students that when the dirty water arrives at the plant, it is sent through a screening process to remove all the trash. Trash includes larger items that go down the drain (like toys, food scraps and wipes) that cannot be reused.
- Place the food strainer over the empty cup 2. You may also want to place a bowl or plate under the cup to catch any spilled water.
- Pour the dirty water from cup 1 over the strainer into cup 2. Dirty water will pass through the strainer into cup 2. However, large items like a baby wipe and food scraps will remain in the strainer.
- Show the class the items in the strainer. Share that these items represent the trash that AlexRenew removes from wastewater. The trash is sent to a landfill. This phase is described in step 2 on their handout.
- Take the items in the strainer and throw them in a trash can. This will physically represent the trash being sent to a landfill. Set the strainer aside.

### Step 3: Separate the solids

- Hold up the dirty water in cup 2, now with solids removed. Students should see the dirt settling to the bottom of the cup. They may see some oil floating on the top of the cup.
- Share with students that after wastewater goes through the screening process, it is sent to settling tanks. Share that in the settling tanks, the plant separates water from grease and solids. Grease floats, so it is skimmed off the top and sent away. Solids settle to the bottom. Water is separated from the solids and moves onto the next treatment phase.
- Pour the dirty water in cup 2 over the empty cup 3. Cup 3 should be covered with paper towels. Pour slowly. Water will work its way through the paper towel. You may want to have a bowl or plate under cup 3 to capture any spills.
- After water makes it through the paper towels on cup 3, the dirt should be on the paper towel. The water that made it through the paper towel should start to look cleaner.
- Share that the separation of water and solids is

highlighted in step 3 on their handout.

- Remove the paper towel with dirt from cup 3 and set aside on a plate for later.

### Step 4: Put bugs to work

- Hold up the water in the cup 3. Share that while the water looks cleaner, it still needs to be improved.
- Share that after water is separated from grease and solids, it is sent to another tank where small bugs eat the remaining waste in the water.
- Point out the raisins in cup 4. Share that the raisins represent small bugs that play a big role in wastewater treatment.
- Share that while the class can see the raisins, the bugs that eat the waste are too small to see without a microscope.
- Pour the water from cup 3 into cup 4.
- Share that this process is highlighted in step 4 on their handout.

### Step 5: Separate the bugs

- Share with students that the bugs sink to the bottom of a tank when they get full. When they get full and sink, they are separated from the water and join the other solids.
- Pour the water in cup 4 into cup 5. When you pour, make sure the raisins remain in cup 4.
- The raisins in cup 4 can be added to solids in the paper towel.
- Hold up the final cup of water, cup 5. Share that active bugs, ones that still have room for food, continue to eat any remaining waste in the water.
- Share that this process is highlighted in phase 5 on their handout.

### Step 6: Purify the water

- Share that once all waste has been removed from the water, the water is purified. Using ultraviolet light, bad bacteria in the water is killed. This process protects your health.
- Holding up cup 5, shine a flashlight through the back of the cup to represent the ultraviolet light process. Share that this process is highlighted in step 6 on their handout.
- Share that once water is purified it is released into a local waterway. AlexRenew sends treated water to the Hunting Creek, which eventually connects to the Potomac River. The local waterways serve as holding tanks for all the water the community needs to survive.

### Step 7: Digest the solids

- Hold up the paper towel that has dirt and raisins in it.

- Remind students that this represents the solids removed from water that did not go to a landfill. It also includes some of the bugs that ate a lot of the waste.
- Point out that some treatment plants around the country view this as waste. However, AlexRenew views it as a resource.
- Share that AlexRenew breaks down the pollution eating bugs in the waste. This process releases methane gas, which the utility uses for energy.
- You can flip the lights in the room on and off to represent the use of energy.
- Share that this process is highlighted in step 7 on their handout.
- After giving students a minute to think, have the students share their ideas out loud. Some shoe use ideas may include: a planter, a hammer/tool, a bug swatter, a bucket, etc.
- Now, give students a few minutes to select an item in the classroom. After they select the item in the classroom, have the students brainstorm innovative ways the item can be used (other than for its actual intent). Have students brainstorm at least 5 possible new uses for the item.
- Optional: You can have students only select an item that may find its way into the trash/recycling bin to add an additional layer of difficulty and to reiterate the concept of waste becoming a resource.

### Step 8: Remove the water

- Once again, hold up the paper towel that has dirt and raisins in it.
- Share with the students that in addition to using the solids to produce energy, AlexRenew uses the waste to create one more resource.
- Point out the water seeping through the paper towel.
- Share with the class that the remaining solids still have a lot of water in them. However, once the water is removed from the solids, the waste becomes thick as dirt.
- The thick, solid waste is taken to farm fields because it can help return vital nutrients to soil that help plants grow.
- The removed water is sent back through the treatment process.
- Share that this process is highlighted in step 8 on their handout.
- Once students document 5 possible new uses for their item, have students select their one favorite new use. Have students develop a Twitter headline to describe the new use for their item.
- Go around the room and have students share their selected items and new innovative uses.

### TEACHER ACTIVITY CONCLUSION:

- Remind students that water travels through many steps to get clean.
- Organizations like AlexRenew and Virginia American Water play a vital role in protecting water and providing it to the community.
- In addition to providing clean water, AlexRenew transforms wastewater into renewable resources.
- Remind students that it is important to be open-minded. What one sees as waste, another can see as a resource.
- Ask the students to be open-minded by thinking of news uses for everyday products. If they do this, they might just discover the next great invention.
- Share with the students that AlexRenew was able to see waste as a resource. Share that this often happens by looking at everyday products or processes in a new light.
- Share that today the students are going to be creative and look at everyday classroom items in a new light.
- Share that they are going to participate in an activity that will encourage creative thinking. As the future leaders of the community, they will be responsible for being innovative and creative. One day they will improve the community by revisiting everyday products or processes and coming up with new ideas.
- Before explaining the activity, get the students to start thinking in this way by asking them to think for a minute about all the possible ways a shoe could be used other than wearing it on their foot. Encourage the students to think outside the box.

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## ASSESSMENT

### QUESTIONS

- What does AlexRenew do for the community?
- What does American Virginia Water do for the community?
- What resources does AlexRenew generate from solid waste?

### JOURNAL/WRITING PROMPT

- In your own words, describe the process wastewater must go through to get clean.
- Identify a new use for an everyday item. Introduce this item to the world by describing it and the benefits it can provide to the user.

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## EXTENSIONS AND CONNECTIONS

- Invite a guest speaker from AlexRenew to describe the wastewater treatment process.
- Schedule a tour of the AlexRenew treatment plant.
- Share the innovative ideas students identified with others in the school. Host a creative thinking contest with students across the school to encourage innovation.

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## STRATEGIES FOR DIFFERENTIATION

- Reach out to AlexRenew to see if they have a video that shows the phases of the wastewater treatment process.
- Instead of using classroom items, have students bring in an item from home that the household would consider waste. Have the students transform the wasteful item into a resource. Or have the student describe how the waste could be used as a resource.