Better Water for a Better World

THE PROBLEM

Kids realize the benefits of a simple engineered solution to a global challenge.

GRADE LEVEL

Middle school. For high school extensions, see *http://files.asme.org/asme-org/Events/29694.pdf*

DISCUSSION

While water treatment plants clean most of the water we drink in the United States, much simpler treatment systems can make a huge difference to people living without a reliably clean water source. For instance, in developing countries simple filtering systems and boiling can have a very positive impact on public health.

MATERIALS

For each group of 2-3 students:

- 2-liter soda bottle cut in half
- Paper towels
- Paper clips, yarn, rubber bands
- Gravel, sand, paper, cloth, coffee filters, sponge, cotton balls, other found materials (to make a filter)
- "Contaminated" Water

For the whole group: Small amounts of these Contamination Materials: food coloring, oil, detergent, raisins or dry beans, potting soil, leaves, paper torn into small pieces, small pieces of plastic; one large bucket filled with water.

ACTIVITY

1. Divide kids into groups of 2-3. Tell them they are part of a team of Engineers Without Borders and need to design a prototype water filter that uses the fewest possible materials to get rid of the most pollutants.

2. Ask one or two students to help you mix the contamination liquid that will be poured through the students' filters. Add the "contamination materials" to the water in the bucket. The food coloring represents chemicals, the raisins or beans represent animal and human waste, the potting soil represents earth, the torn paper is litter.

3. Have students put the top half of the soda bottle upside-down (like a funnel) inside the bottom half. The top half will hold the filter; the bottom half will hold the filtered water.

4. Have students select from the materials you've provided, and layer them in the top half in the way they think will be most effective to filter out the pollutants you've added. Ask students to predict which material might remove which pollutants from the dirty water and record their predictions.

5. Have each group pour the dirty water through their filter. What does the filtered water look like? Which group's water was cleanest? Why? Have students record their findings.

6. Have each group take their filter apart and look at the different layers. Can you tell which pollutant each filter material removed from the water? Which filter was most effective? Can students think of a way to improve on their filter?

7. Based on findings, have students reconfigure and retest their filters. Can they improve on their original design? Remind them that one important goal is to use the least possible materials but still make an effective filter.

FURTHER EXPLORATION

Bring a container of local pond, lake or river water with you to class. After students have determined the most efficient filter design, test it using the untreated water. Remind students that these filters do not remove bacteria or other microorganisms.

CONNECT TO ENGINEERING

This activity is based on an actual Engineers Without Borders-USA project which challenged students at the University of Massachusetts, Amherst (UMass), and the community of Namawanga Village, Kenya, to develop a self-sufficient water supply for several thousand people in the rural farming village of the Namawanga area in western Kenya.

The ultimate goal for the student engineers working on the project was to provide a permanent clean water source for the community. Sustainability is an important aspect of all EWB-USA projects. By

designing low-cost, easy-to-maintain solutions to local problems, engineers empower communities for the long haul. In the case of this project, UMass students continue to work with Kenyan stakeholders to develop the most affordable, sustainable solution to ensure potable drinking water for all.

Activity courtesy of ASME (American Society of Mechanical Engineers), Engineers Without Borders - USA, and JETS. ASME, Chair of Engineers Week 2012, promotes the art, science, and practice of multidisciplinary engineering and allied sciences around the globe.