SAMARITAN'S PURSE WATER PROJECTS

Turning on the tap to safe water for communities.

Every 24 seconds, a person in the developing world – usually a child – dies from diseases caused by polluted drinking water. But this heart-breaking issue extends even to developed countries like Canada, where water contaminated by animal waste has been a problem.

Through basic information and challenging activities, these junior high (grade 7-9) science resources are intended to teach students principles around water stewardship and water treatment, while adhering to government education guidelines. Learn about Samaritan's Purse's work helping families get safe water and involve your students in thinking about world water issues and how to solve them.

TREATMENT OPTIONS:

1. BIOSAND FILTERS

The BioSand Filter is an award-winning adaptation of slow-sand filtration developed by Dr. David Manz, a former University of Calgary professor.

The filters are a proven, effective, and inexpensive technology. From start to finish, the filters can be constructed and ready to install in roughly 10 days. The average cost of the filters is $150, which covers the raw materials, construction, transportation, supervision, training for recipients in filter maintenance and personal hygiene, as well as monitoring and evaluation. Each filter serves up to 10 people.

The filter removes organisms responsible for diseases spread by water, such as cholera, typhoid fever, and amoebic dysentery. The filter also strains out particles causing cloudiness and much of the organic matter responsible for taste, color, and odor.

By late 2012, about 190,000 BioSand Filters had been installed by Samaritan's Purse and its partners, bringing safe water to more than 1.1 million individuals worldwide. More than 20,000 new filters are constructed and installed each year.

The filtration process

The filter is very durable, constructed from concrete, sand, gravel, and plastic piping. These materials can be found in almost every country and enable beneficiaries to help construct the filters on location.

Water is poured into the top and flows through layers of sand. Water requiring filtration usually contains organic matter, sediment, and living organisms. The water first passes through the diffuser plate, which reduces the disruptive force of the water and large debris and protects the "biological layer."

The sand functions as a barrier that traps particles and larger organisms, causing them to accumulate in the uppermost layers of the filter. Organic material and organisms caught in the sand eventually develop into a dense population referred to as the biological layer.

As the water passes through the biological layer, contaminants such as bacteria, viruses, and organic contaminants are consumed by the organisms. The filter is designed to hold water above the top of the sand to sustain the biological layer while the filter is not in use.

The fine sand acts as a sedimentation bed as the water passes through the filter, helping remove cloudiness, odor, bad taste, and harmful micro-organisms from the water. The size and shape of the sand grains are critical to the filtration process and, therefore, the effectiveness of the filter. Sand is carefully selected and prepared to achieve proper filtration. By the time the water reaches the coarse sand and gravel at the bottom, 95 to 99 per cent of microbial contaminants have been eliminated.[1]

The filtered water flows out of the spout and is collected in a safe storage container to prevent post-treatment contamination. The average flow rate of the filter is 630 ml per minute, which enables 38 liters to be filtered per hour, enough to provide a family of eight with sufficient water for their daily drinking, cooking, cleaning, and hygiene needs. An individual requires between 7.5 and 15 liters of water per day for basic needs[2], which is well within the capabilities of the BioSand Filter.

Maintenance

Operating and maintaining the filter is simple. There are no moving parts that can break or any special skills to operate it. Over time, continued use of the filter causes the pore opening between grains in the sand layer to become clogged with debris. As a result, the water flow rate through the filter decreases. Filter recipients are trained in the simple maintenance procedures to restore the flow rate.

To clean the filter, the surface of the sand must be agitated, thereby suspending captured material in the standing water on top of the sand. This dirty water can then be removed using a small container. The process can be repeated as many times as necessary to regain the desired flow rate. After cleaning, the biological layer re-establishes itself quickly.

Benefits, drawbacks and appropriateness

The benefits of BioSand Filters are:

- Because the water is treated at the point of use, there is less risk of contamination during transport.
- Easy to use. Simply pour water in the top and it pushes out water that has passed through the sand layers. There's almost no waiting, no moving parts, no energy required, and nothing for the user to do but make sure a clean container is available for the improved water.
- There are no additional operating costs, so people are able to use it every time they need water.
- After filtering, the water tastes better, has less sedimentation, and cools as it passes through the sand. No other technology has these three quality improvements, and this is often stated by users as one of the finest attributes of the filter.
- Reduces incidents of diarrhea by up to 40 per cent.

The drawbacks of BioSand Filters are:

- Very heavy, so putting them in place to operate takes a lot of effort.
- Not designed to be moved, so inappropriate for nomadic people.
- Do not filter out every pathogen.

Suggested Activities:

- Watch the filter construction video plus videos about Samaritan's Purse water projects and the difference they are making: www.SamaritansPurse.ca.
- Design a comparison study to discover the similarities between how wetlands and BioSand Filters improve contaminated water.
- Are there places and situations where BioSand Filters could be used in Canada? Have students research the question and present their answers and explanations.

Sources: Samaritan's Purse Canada, www.SamaritansPurse.ca.
Dan Kaskubar, an intern with a Ugandan non-governmental organization

---

[1] "Technical notes on drinking water, sanitation, and hygiene in emergencies," World Health Organization, http://www.who.int/water_sanitation_health/publications/2011/tn9_how_much_water_en.pdf.

[2] The Sphere Project, 2004, Humanitarian Charter and Minimum Standards in Disaster Response.