the sustainability corps

the sustainability corps and the chemistry of healthy water

safety note

Safety Note:

Although the demonstrations presented in this activity can produce perfectly potable water, it is never allowable to let students drink any substance in a science laboratory. There is always a chance of contamination or an allergic reaction which could be very dangerous to some students. This safety rule should be followed throughout the experiments presented in the module.

goal

Goal:

Examine potential action taking strategies that could be implemented to improve your community's water supply.

Standards Met: S2, S5, S6, LA1, LA3, LA7, LA8

objectives

Objectives:

Students will…

- Observe and listen to simulated action taking specialists presentations
- Compare action taking strategies and summarize important factors in chart form
- List claims of each action taking strategy that they would like to test through experimentation

Time Required: One – 45 to 60 minute class period

materials

Materials (for a class of 30):

- 30 copies of The Sustainability Corps – Action Taking Strategies Student Sheet
- Transparency of The Sustainability Corps – Action Taking Strategies Teacher Key
- Photocopy of The Sustainability Corps – Action Taking Strategies Teacher Key (for each actor)
- 30 class sets of Action Taking brochures
- Costumes for each team of action taking specialists, "actors" (see PREP section for costume descriptions)
- One copy of each of The Sustainability Corps – Potential Action Taking Strategies Expert Role Cards

Prep

- Organize six volunteers to serve as "actors" to come and help present through role-play. If you cannot find enough volunteers, people can play two or more roles.
- Actors will role-play action taking experts.
- Prepare the costumes found on The Sustainability Corps – Potential Action Taking Expert Role Cards and get props ready for the actors. Bear in mind that the goal is to make this fun as well as informative!

In Class

- Explain to students that they will be playing the roles that were assigned to them earlier and that eventually they will have to select an action taking strategy to clean up their community's water supply.
- Pass out The Sustainability Corps – Action Taking Strategies Student Sheet and the Action Taking brochures to each student.
- Tell students that experts in six different action taking techniques are going to make a presentation.
- Put The Sustainability Corps – Action Taking Strategies Teacher Key transparency on the overhead and hide the answers.
- Review the items in the 'factors' column and discuss as a class. What does each factor mean to you? The last row listed under Factors, "What you would like to test," allows students to list one or two ideas that were presented to them that they would like to validate through experimentation.
- ***The actors are backstage waiting for you to introduce them.***

Proce

- Prepare students to listen carefully to what each action taking expert says.
- Have the first "expert" enter and continue until all six experts have presented to the students.

Debrief the Activity

- Talk with students about the various action taking options. Ask questions of the students. Encourage the students to ask questions. Have students determine what their favorite option would be. Discuss why.
- Explain to the students that they will be able to test each of these action taking strategies over the next several lab days.

Homework

- Using print or electronic media, have students gather more information about the techniques that were presented and write a paragraph on each. You may want to hand out the list of websites included in this module for some guidance as to where to start their research.
- OR, using the five groups already assigned, have each group select an action taking option to further investigate. Students write a page on their solution and orally present it to the class.

Assessment

- Participation in activity
- Successful completion of The Sustainability Corps – Action Taking Strategies Student Sheet

Potential Action Taking Strategies Expert Role Cards

Clay (Ceramic) Pots

Character Name: Clay Potter from Clay's Potable Pottery

Costume: Tie-dyed shirt, clay flower pot with a small hole in the bottom, the inside of the pot should be painted silver to represent colloidal silver, cup of water, container to collect water.

Presentation: Introduce yourself and what you do. Ask for a volunteer from the audience to pour water into the pot (the flower pot needs a hole in the bottom so the water will flow through). You hold the flower pot and place the container to collect the water on the table. When all water from the volunteer has poured through the flower pot, take a drink to show that it is potable! Be sure to include the information below in your presentation.

Safety: Extremely safe! The pots are man-made from natural ingredients with no technology required.

Volume Produced: 1-4 L/hour depending on type and size of clay pot.

Cost: Inexpensive! Commercially they sell from $4 to $30 but much less if you make it yourself. This is a great business opportunity for local potters.

Environmental Impact: All natural, organic materials except for colloidal silver

Effectiveness: Eliminates 98% of bacteria and parasites.

Clay's Potable Pottery

Eliminates 98% of Bacteria and Parasites!

Do you need a simple, inexpensive, and cost effective way to take your dirty water and make it fresh? Try Clay's Potable Pottery!

At Clay's Potable Pottery, we use all natural materials. Our man-made process is simple. First we take organic materials, such as crushed, dried clay, and add to it an organic material, such as rice husks, used coffee grounds, used tea leaves, or sawdust. We mix it with water to form a biscuit-like consistency and then form it into the shape of a pot with one end closed. Our pots are dried in the sun approximately four days and then fired in a kiln, if available in the area they are produced. The inside of the pot is then coated with colloidal silver, which helps to stop bacteria.

How does it work you ask? The pores in the filter are wide enough for water droplets to pass through but too narrow for pathogens, eliminating 98 percent of bacteria and parasites.

Don't try just any other filtering process because ours is the fastest! Our pots filter approximately 1-4 liters per hour (depending on design, size and materials, of course).

Our pots are effective for approximately one year but be careful… they can break! A monthly cleaning is recommended.

Are you a local potter in your village? Franchises available! We will come and train you to start your own potable potting business.

For only the cost $4 to $30 U.S. dollars, you too can own one of Clay's Potable Pottery pots.

It will change your life forever!

Contact us today at: 555-CLA-YPOT

Potential Action Taking Strategies Expert Role Cards

PUR Packets

Character Name: Sed Ment the Infomercial Salesman

Costume: Suit, briefcase, PUR packet, bucket of "dirty water," cloth to filter water.

Presentation: Introduce yourself and what you do. Wow your audience with your demonstration of the miracle cleaning action of your PUR packets. "It's a mini-water treatment plant in each packet! Buy it today before it's too late!" Be sure to include information below in your presentation.

Safety: Chemicals are present in the packets, so do not ingest before it goes into the water. After the packet has dissolved in the water, it is totally safe.

Volume Produced: 1 packet will sanitize 2½ gallons of dirty water.

Cost: Only a few cents, for only 10 cents you can treat the drinking water for a family of five for one day

Environmental Impact: Once the packet has been added to the water, there is no waste left except the paper packet that is biodegradable.

Effectiveness: Kills 99 percent of bacteria, viruses, and parasites. It also kills waterborne pathogens that cause cholera, typhoid, and dysentery, and removes toxic metals.

PUR® Packets

2006 Invention of the Year! More Than 40 Million Distributed!

Reliable fresh water! PUR-treated water meets World Health Organization standards for potable water. It's a mini-water treatment plant in each packet.

Our packets consist of a grayish powder composed of a variety of chemicals that collectively are capable of removing contaminates within minutes of being added to water. The main active ingredient of the powder is calcium hypochlorite (bleach), which kills 99 percent of bacteria, viruses and parasites. It also contains ferric sulfate, a particle binder that can remove impurities, such as dirt, and also disease-causing pathogens that aren't killed by the bleach. The packets can kill water-borne pathogens that cause cholera, typhoid and dysentery AND they remove a variety of toxic metals, including lead, arsenic and mercury.

Our packets are very efficient and portable. A single packet can decontaminate 2½ gallons of drinking water.

The process is simple. The packet is added to a large container of impure water, stirred, filtered through a cloth to remove impurities and then allowed to sit for 20 minutes. The result is clear, safe drinking water!

The price of safety comes relatively **cheap**…ONLY a few cents per packet. For approximately 10 cents you can treat the drinking water for a family of five for one day!

Don't wait another day!
Call us today! 555-PUR-PKTS

Potential Action Taking Strategies Expert Role Cards

Solar Distillation

Character Name: Sunny Bright from Sunny's Solar Still

Costume: All yellow/gold outfit, gold heels, blonde wig, solar still model, southern-Texas accent, chewing gum, water.

Presentation: Introduce yourself and what you do. Remind them your product is extremely easy to understand. Describe how the process evaporation/condensation works. Be sure to include the information below in your presentation.

Safety: Completely safe process! So easy a kid can use it.

Volume Produced: In the Southwest U.S. can average 2 liters per day in the winter and 6 liters per day during the summer, per square meter.

Cost: $200 to $300 or even more, but don't let that scare you because the payback from our solar stills are typically less than two years.

Environmental Impact: Long lasting!

Effectiveness: Eliminates all waterborne pathogens, salts, heavy metals as well as bacteria and parasites.

Sunny Bright

Sunny's Solar Still

We are the #1 provider of solar stills in the area! We are a name you can trust.

The basic principles of solar water distillation are simple yet effective, as distillation replicates the way nature makes rain. The sun's energy heats water to the point of evaporation. As the water evaporates, water vapor rises condensing on the glass surface for collection leaving the impurities and contaminants behind. The gentle slope of the glass directs condensation to a collection container. This process removes impurities, such as salts and heavy metals, as well as eliminates microbiological organisms. The end result is water cleaner than the purest rainwater. There are no moving parts to wear out or pressurized water needed.

All you need is sunshine!

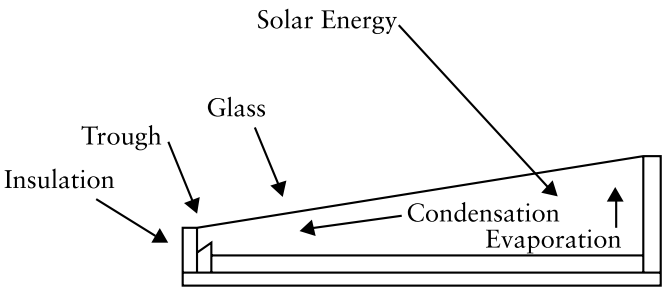
Size can be for one person or can be sized-up for a community.

Production rates in the Southwest U.S. can average about 2 liters per day in the winter to over 6 liters per day during the summer, per square meter.

Cost can range from $200 to $300 or even more, but don't let that scare you because the payback from the solar still is typically less than two years.

Long lasting! The solar panels can last up to 20 years. It does require regular maintenance to prevent build-up of salt and sediments.

Superior taste! Natural process! Superior quality!
You can only find this at Sunny's Solar Still!
555-SUN-SHNE



Potential Action Taking Strategies Expert Role Cards

LifeStraw®

Character Name: Larry Lips from LifeStraw®

Costume: LifeStraw® (or simulated model) around neck, container of water for demonstration.

Presentation: Introduce who you are and what you do. Ask someone in audience to come up and demonstrate how easy your product is to use. Don't forget to mention the great taste! Be sure to include the information below in your presentation.

Safety: Not damaging to human health but be careful to consult your doctor first if you are sensitive to iodine (people with thyroid or allergies to iodine).

Volume Produced: One straw filters 700 liters of water

Cost: $3 per straw

Environmental Impact: It has a two-stage filter-filtering from 25 microns to 6 microns. There will be waste to deal with when straw is completely used.

Effectiveness: It removes most of the microorganisms responsible for causing waterborne diseases. It kills bacteria on contact.

LifeStraw® Personal Water Purification Tool

Who imagined that something only 25 cm long and 29 mm in diameter hung around your neck could save your life for only approximately $3 a year?

No electrical or spare parts needed!

LifeStraw® filters up to 700 liters (unless used for saline water which reduces the effective amount to 350 liters) of water and effectively removes most of the microorganisms responsible for causing waterborne diseases. Each straw lasts approximately one year for an adult.

Proven Results!

LifeStraw® kills disease causing microorganisms, which spread diarrhea, dysentery, typhoid and cholera. It kills bacteria such as shigella, salmonella, enterrococus, staphylococcus aureus and E. Coli on contact!

Our product contains a specially-developed halogen-based resin, an extraordinarily effective material that kills bacteria on contact. Textile pre-filters are used to remove particles up to 15 microns. Active carbon withholds particles such as parasites. It does not filter arsenic, heavy metals, or fluoride.

The released amount of iodine in water treated from LifeStraw® is not normally damaging to human health. (People having thyroid problems and allergic reaction to iodine must seek medical advice before using this tool.)

Don't Wait! Call today and order yours!
555-LFS-TRAW

LifeStraw®

Photo by: Donald G. McNeil, Jr.
Published: October 10, 2006

Potential Action Taking Strategies Expert Role Cards

Biosand Filters

Character Name: Bobby Grain from Bob's Biosand Filters

Costume: Overalls, farm shirt, bag of sand or model of biosand unit, water.

Presentation: Introduce yourself and what you do. Explain that what makes your biosand filters different than the regular sand filters is the "schmutzdecke." What is the schmutzdecke they ask? It is the biofilm layer on the top of your filters that removes pathogens making your filters faster and cleaner than the traditional filters. Be sure to include the information below in your presentation.

Safety: So easy and safe a child can use it!

Volume Produced: 20-40 L per hour

Cost: Around $12 to $50 or more but the maintenance costs are FREE!

Environmental Impact: No chemicals or electric power needed, no wastewater.

Effectiveness: Removes 98.9% of bacteria as well as all worms, protozoa, and most viruses.

Bob's Biosand Water Filters

Bob's Biosand

We give you the sand and you filter the water!

Bob's Biosand Water Filters are world famous! We use a simple design and basic materials. With no moving parts and no electricity needed, this is the water filter for your family!

So easy and safe a child can use it!

Don't trust your family's water to anyone else. Our filters remove 98.9% of all bacteria present in the water, all worms and protozoa, and most viruses.

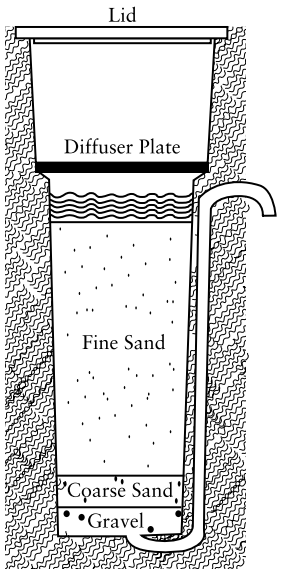
What makes our filters different? Our biological biofilm top layer "schmutzdecke" removes the majority of the pathogens, making our filter faster and cleaner than regular traditional slow sand filters.

Regular maintenance and cleaning approximately every one to three months, depending on turbidity, of the schmutzdecke is required but at no cost! However, during times of monsoon or a very wet season, the sand could possibly need daily cleaning so it doesn't clog. Clogging is caused when the particle deposition increases and the pore size decreases, reducing flow rate. Filters approximately an amazing 20-40 L per hour!

Don't let the one-time high cost ($30 to $100) deter you… our filters are maintenance free and last forever!

Lifetime guarantee!

Give Bob a call:
555-BIO-SAND



Potential Action Taking Strategies Expert Role Cards

Rainwater Harvesting

Character Name: Raine Fall from the National Association of Rainwater Harvesters

Costume: Flowy dress, rain stick.

Presentation: Introduce yourself and what you do. In a dream-like, relaxed state, describe the process of rainwater harvesting. Ask participants to sit on the floor, close their eyes and imagine the sound of rain dripping off of the roof of their house, slowly dripping down the gutter, and gently running into a collection container. Describe the rest of the information below and then have them slowly open their eyes and return to their seats. Be sure to include the information below in your presentation.

Safety: Completely safe but be sure to do your regular maintenance to eliminate dust, leaves, debris and bird droppings from the roof.

Volume Produced: Depends on rainfall in area, needs to be in area of moderate to heavy rainfall

Cost: The main cost is the storage tank. U.S. costs are around $107 to $241.

Environmental Impact: All natural process

Effectiveness: Rain is perfectly natural and healthy! However, the longer the water sits in the storage container, the more likely pathogens and bacteria will contaminate it.

Rainwater Harvesting

"When It Rains, You Will Be Able to Pour"

Brought to you by the National Association of Rainwater Harvesters

Rainwater can be collected from roofs constructed from galvanized iron, aluminum, tiles, slates, or bamboo/thatched roofs. The water runs off of the roof into a gutter or tubing which is collected in a storage tank.

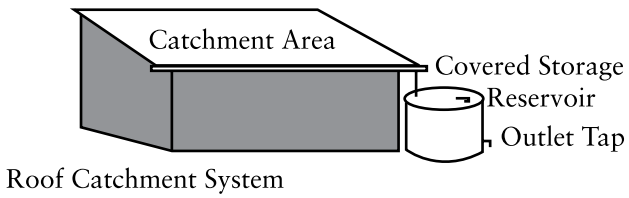
It is necessary to have moderate to heavy amounts of rainfall.

Maintenance-storage tanks need to be cleaned annually and roofs need to be cleaned regularly to remove dust, leaves, debris and bird droppings.

Analyses conducted by the Pan American Health Organization/Pan American Center for Sanitary Engineering and Environmental Sciences (CEPIS) estimated that the cost of harvesting systems using the roofs of dwellings was U.S. $107 for a 5 m^3 tank, which would amount in the case at hand to approximately U.S. $241 for a 9 m^3 tank.

Harvesting water from rainwater collection systems for human use is considered the most appropriate technology in areas that do not have aqueducts to supply the community with continuous and reliable service. Properly treated and maintained roofs are the best choice as a collection surface because their location protects the water from pollution, which is typical in ground-level collection surfaces. With this technology, pollutants can be reduced by 80 to 90 percent.

See our website for more information.



Roof Catchment System

Action Taking Strategies

Factors	Clay Pots	PUR Packets	Solar Distillation	LifeStraw®	Biosand Filters	Rainwater Harvesting
Safety						
Volume Produced						
Cost						
Environmental Impact						
Effectiveness						
What would you like to test?						

Action Taking Strategies

Factors	Clay Pots	PUR Packets	Solar Distillation	LifeStraw®	Biosand Filters	Rainwater Harvesting
Safety	*Extremely safe, man-made from natural ingredients, no technology required*	*Chemicals are in packet so be careful while storing, but safe once in water*	*Completely safe process!*	*Not damaging unless you are sensitive to iodine*	*So easy and safe a child can use it!*	*Totally safe but regular maintenance is needed to keep out debris and bird droppings*
Volume Produced	*1-4 L per hour depending on the type of clay pot*	*One packet for 2 ½ gallons*	*Depends on time of year (winter vs. summer) and your location*	*One straw filters 700 liters of water*	*20-40 L per hour*	*Depends on amount of rainfall*
Cost	*Commercially $4-$30 but less if you make it yourself*	*A few cents per packet*	*$200-$300 or more, but will pay for itself quickly*	*Around $3 per straw*	*$30-$100 or more but maintenance costs are free!*	*Main cost is storage tank-around $107-$241*
Environmental Impact	*All natural, organic materials except colloidal silver*	*No waste left once packet is in water except for the biodegradable paper packet*	*Long lasting product*	*Straw material waste left over after straw is completely used*	*No chemicals or electric power needed, no wastewater left*	*All natural process*
Effectiveness	*Eliminates 98 percent of all bacteria and parasites*	*Kills 99 percent of bacteria, viruses and parasites. It also removes toxic metals*	*Eliminates all waterborne pathogens, salts, heavy metals as well as bacteria and parasites*	*Kills bacteria on contact and removes most waterborne disease causing microorganisms*	*Removes 98.9 percent of bacteria as well as all worms, protozoa, and most viruses*	*Natural and healthy! Bacteria can come from bird droppings on roof if not maintained*
What would you like to test?						