CAMPING SKILLS – DAY 7

Planning Information	
Subject (Presenter):	Camping Skills – Day 7
Objectives:	• Water Purification • Knot tying clinic
Materials:	• Rope and two staves for each pair of participants (for lashing) • Handouts for Each Participant
Preparation:	
Presentation	
Learning Objectives: At the end of this presentation, each participant should be able to:	1. Understand the importance of purifying water 2. Go over all knots and lashings from the past Camping Skills Classed
Discovery:	1. Before showing how to lash; have anyone who knows demonstrate it to the others
Teaching-Learning:	**Requirement #** **Reference Page(s)** **Title of Section**
Application:	1. Practice lashing the staves – check that the knots and lashes are tied correctly and tight
Evaluation:	1.
Summary:	
Notes:	Handouts: • *Heat Relief* (Backpacker magazine) • *Safe Water* (Backpacker magazine) • *Water* (Backpacker magazine) • *WhyPurify?* (Cartoons) • *The Perfect Bug Repellent* (Backpacker magazine)

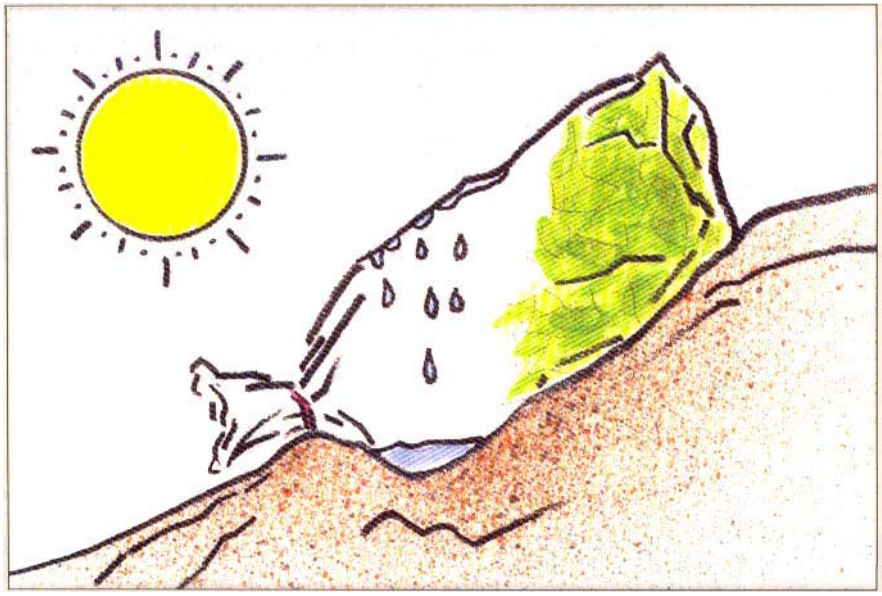
Safe Water

By Cindy Ross, Backpacker Magazine, April 1991

- Drink a minimum of three to four quarts of water a day, especially in winter when you don't feel as thirsty as you do in summer.
- Drink cool, not icy, water. In cold weather you can get chilled gulping large quantities of cold water too fast.
- If your urine is darker than normal, you're not drinking enough. If you're not urinating often, you're not drinking enough and you run the risk of becoming dehydrated. That's why it's important to drink often!
- Use widemouthed water bottles. The bottoms, where bacteria can grow, are easy to clean. They are fairly simple to fill in a stream. A spoon fits readily in the wide opening. The wide opening lets you easily remove ice. Get a clear bottle so you can see how much water is left.
- Nylon water bags are great for avoiding repeated trips to the spring. You can lay them in the sun to warm the water, then take a nice warm shower. A full bladder bag makes a great pillow too.
- In subzero weather carry water bottles in a pocket near you or buried deep in your pack so the water won't freeze. A wool sock pulled over the bottle also offers some protection. At night screw the lids on tight and set your bottles upside down, so that if ice does form, it can't plug the pouring end.
- Keep your bottle full. If water is in short supply on a winter trip, top off your bottle with a bit of snow after each drink.
- When melting snow over your camp stove, have an inch or so of starter water in the pan, then slowly add snow. Use icy, crusty snow or the wettest snow available.
- Be wary of pink or yellow snow. Watermelon snow gets its name from the color, taste, and scent caused by micro organisms that can bring on diarrhea.
- Melt and warm clean snow in your mouth before swallowing it.
- A spring where you can actually see the water bubbling out of the ground is the safest place to get drinking water. To filter out particles of soil, use a bandanna stretched over your water bottle. Push the fabric down to form a funnel.
- Besides removing particles from the water, you'll need to eliminate Giardia lamblia, which contaminates water sources and is carried by humans and animals. Ingest as few as 10 or 20 of the protozoa and you may become sick, be cause they multiply in your intestines. Symptoms usually show within a week or two and include stomach cramps, diarrhea, bloating, loss of appetite, and vomiting. Some people show no symptoms, but remain carriers for months or years. If you think you have giardiasis, get treatment with antibiotics.

  Eliminate giardiasis by boiling, filtering, and treating with chemicals. **Boiling**: Boil water for 10 minutes, which uses fuel and takes a long time, since the water must cool before drinking. **Filtering**: Water-purifying filters usually consist of a pump that forces water through a ceramic filter for instant purification. There's no aftertaste, but filters can be bulky and expensive. Filters clog over time and need replacing. **Chemical treatment**: The most popular and effective treatment is iodine, either in crystals or tablets. Both forms are extremely potent and can be harmful if directions aren't followed carefully. There's a waiting time of five to 20 minutes, depending on water temperature. Iodine also leaves a foul taste in your mouth, so some people add powdered drink mixes like Tang. Tablets or crystals are avail able at outfitters.
- If you know water will be scarce the next few miles of your hike, drink as much as you can before you start out.

- Bury water. Because snow is a good insulator, a lidded pot of water buried a foot or so under the snow will remain unfrozen overnight. Mark the spot care fully. If you are staying in one camp for several nights, bury the pot in different locations each night, because snowmelt around the pot produces ice.
- If you have to melt snow for water, you'll need to carry considerably more fuel, which, like water, weighs about t pounds per quart. You also must allow more time for meal preparations. In a brisk, cold wind, it can take an hour and a stoveful of fuel to melt and boil just one quart of water.
- Camp near water if possible. Make camp at least 200 feet from lakes and streams. Wash at least 100 feet from water sources. Use biodegradable soaps.
- If your itinerary rules out the possibility of camping near water, be sure to tank up while you're traveling. Fill up all bottles at the last running water source as you near a dry camp.
- Clean your water bottle regularly. The threads are prime breeding ground for mold and bacteria that can cause dysentery, especially if you use powdered drink mixes.
- In dire situations when your water is depleted, use air and plants to create an evaporation still. Take a plastic bag—you probably have several in your pack that you're using to organize loose items, like cooking needs or first-aid supplies—and put in a mass of crushed or cut up vegetation. Blow air into the bag like a balloon, tie the end, place on an incline, then wait for the sun to do its job. You won't be able to quench a raging thirst, but you'll have enough moisture to stay alive.



Water

Water. It's the fundamental ingredient of life. Nothing else on the planet compares. Sex, love, music, movies, books—mere luxuries. Believe it or not, people can survive years without any or all of them. Even food is relatively inconsequential. You can live for weeks without it. But water... Go waterless for a mere 72 hours and you're dead. Water is the *sine qua non* of human existence. Water is life.

All of which makes the most recent Environmental Protection Agency (EPA) National Water Quality Inventory Report particularly disturbing: As of 1994, about 40 percent of the nation's surveyed rivers, lakes, and estuaries are too polluted for basic uses, such as fishing and swimming," let alone drinking!

The leading cause of water pollution is agriculture. The business of food production contaminates more than a third of the surveyed rivers and lakes, The primary pollutant is bacteria, Other worrisome facts: Of the 94 percent of Great Lakes shore lines surveyed. 97 percent show unfavorable conditions for supporting aquatic life. Almost half of the Chesapeake Bay is seriously damaged. All but a handful of states reported fish kills caused by pollution, and every single state besides Wyoming and South Dakota was forced to release advisories limiting or banning fish consumption.

In short almost all large bodies of water in America are unsafe to drink.

But what about backcountry water The mountain streams alpine lakes and forest ponds Surely they're still pristine right? Barry Bergan director of the EPA's recent water report says that due to lack of sufficient data, there is no way of even assessing the overall quality of backcountry water in America." Statistically, this may he true, but there's plenty of anecdotal, as well as microbiological, evidence.

"In one of our studies we had over 10,000 samples from streams all across America, Alaska to Arizona, and we didn't find one without giardia," said Chuck Hibler, professor emeritus at Colorado State University, and a parasitologist who has spent a lifetime analyzing backcountry water In another study that focused lust on Colorado we didn't find a single stream, not one, without giardia. His advice: "Never drink untreated water below a camp and never drink below a beaver pond no matter how small."

Charles Gerba, a professor at the University of Arizona in Tucson and perhaps the top water microbiologist in the United States, is even more emphatic. "Lakes and ponds are the beavers' toilet," and even without them "you never know what's happened upstream. It only takes one sick person going for a swim to contaminate the water Even if there aren't people above you, any rodent can carry giaidia." Which means even glaciers and alpine snowfields can he suspect.

For backpackers, the bottom line is that almost all water, other than that bubbling directly up from within the earth, should be presumed contaminated.

But giardia, although notorious, is not the only thing that could be living in your backcountry water. In fact, there are three categories of creatures that can make you sick if you ingest them: protozoans, bacteria, and viruses.

Protozoans

Protozoans are the largest of the waterborne pathogens (disease-causing organisms). Hard-shelled, single-celled parasitic cysts, they range in size from 2 to 15 microns. One micron, one-millionth of a meter, equals 0.00004 inches. The period at the end of this sentence measures 500 microns in diameter. A human hair is 50 to 150 microns in diameter. Anything smaller than about 100 to 200 microns is invisible to the naked eye. Three of the most common protozoans are Giardia lamblia, Ciyptosporidium, and Entamoeba histolytica.

Giardia lambia is the most ubiquitous parasite in America and probably has been around for centuries. Ziegfried Vitusis, chief microbiologist at the EPA, says "Giardia was once part of the natural flora in drinking water." Back in the '30s and '40s, before regulated municipal water treatment plants, "everybody was drinking giardia all the time."

Herbert DuPont, chief of internal medicine at St. Luke's Episcopal Hospital in Houston, Texas, another man who has spent his career studying waterborne pathogens, concurs. "You usually get sick with your first exposure to giardia. Thereafter you have a certain immunity." But no one knows how long this immunity lasts. One week? One year? Gerba, who has gotten giardiasis, says the "immunity can only be temporary at best."

Giardiasis is contracted through fecal/oral transmission; in other words, you get it by drinking water that an infected animal has defecated in. Almost any mammal can carry giardia, but the primary culprits for transmission are beavers and muskrats because they live, and defecate, exclusively in the water. “In Colorado,” says HibIer “most beavers and muskrats we tested had giardia.”

Giardia cysts range in size from 8 to 12 microns but are flexible and can squeeze through a hole 5 to 6 microns in diameter. In a dry environment, outside of a stream, they can survive for only a couple days. Bobbing around in cold water they survive for two to three months. Drinking as few as one to 10 cysts can make you sick. Once ingested, it takes five to seven days to get sick. (Giardia, like most of the organisms in this story, uses your body as a host to rapidly reproduce itself. You may consume only a few, but after you get sick, you will defecate millions. This is how giardia and other nasty critters spread so quickly.)

According to Dr. Dennis Juranek of the national Centers for Disease Control (CDC) in Atlanta, Georgia, “The disease is characterized by diarrhea that usually lasts one week or more and may be accompanied by one or more of the fol lowing: abdominal cramps, bloating, flatulence, fatigue, and weight loss.” There are two drugs for treating giardiasis, metronidazole (Flagyl) and furazolidone (Furoxone). Both are prescription drugs that can relieve symptoms in one to three days. Left untreated, it takes one to three weeks to recover from giardiasis.

Giardia is killed when boiled, treated with iodine or chlorine for the recommended length of time, or strained out by filters with an absolute pore size of less than 4 microns. Pore sizes are described as either nominal, average, or absolute. A nominal pore size rating indicates that the filter will remove only 70 to 80 percent of organisms that size or larger. An average pore size averages all the pores, meaning some could be considerably larger, others considerably smaller. An absolute pore size means no pore, or hole, in the device is larger than that number. Given that with certain diseases you can get sick from consuming just one critter, the only rating that makes sense for backcountry filters is absolute pore size.

Compared to giardia, Cryptosporidium is the new super- cyst on the block, although Vitusis suspects that it, too, has been around for decades. Slightly smaller than giardia, the cryptocyst measures 4 to 6 microns, but is also flexible and can squeeze through a 3-micron hole. After ingestion, crypto cysts take two to four days to make you sick. According to DuPont, the symptoms of cryptosporidiosis and giardiasis “are almost identical.” Juranek reports that people with cryptosporidiosis usually have less gas than people with giardiasis, but also have a low-grade fever. Unlike giardiasis, however, there is no cure for cryptosporidiosis. The disease usually runs its course in seven to 10 days.

Outbreaks of cryptosporidiosis in municipal water systems have occurred across the nation. In April 1993, 400,000 peo ple in Milwaukee got cryptosporidiosis, and 30 died. In the spring of 1994 crypto killed 19 people and sickened more than 100 in Las Vegas. It must be stressed, though, that for healthy adults, cryptosporidiosis is not a life-threatening ill ness. (The people who died in both cities were immuno compromised, and suffering from some other medical condition, as well.)

Crypto also has a fecal/oral transmission path. Deer, elk, and cattle are all known carriers. “Newborns are the most susceptible to Cryptosporidium,” says Juranek, “and water downstream of a feed lot, stock farm, or dairy is particularly suspect.” The infectious dose for humans is extremely low, one to 10 organisms.

Unlike giardia, crypto in your water is tough to kill. Both iodine and chlorine are ineffective. Says DuPont, “You can wash these things in bleach and they will smile right back at you.” Crypto can also live for several months in cold water. Hence, the only practical way of getting crypto out of your water is boiling or filtering, and the filter must have an absolute pore size of 1 to 2 microns or less.

Entamoeba histolytica is the critter that causes amebic dysentery. Although now uncommon in the United States, it is still prevalent in developing countries. The E. histolytica cyst is 5 to 20 microns in size. The infection dose is not known, but the incubation period can be from one week to months. Symptoms include abdominal cramps, diarrhea, and sometimes bloody stools, and can last from a week to months in chronic cases. Metronidazole is the most common treatment. E. histolytica can be killed by boiling, treating with iodine or chlorine for the recommended length of time, or filtering with a filter that has an absolute pore size of 4 microns. E. histolytica is currently not a threat in American backcountry water.

Bacteria

There are many different kinds of bacteria, almost all of which are considerably smaller than protozoans. Those that live in the water and cause intestinal diseases include:

The various strains of Escherichia coli, or E. coli (causes diarrhea); 0.5 microns

- Shigella (causes dysentery); 0.4 microns
- Campylobacter (causes diarrhea, vomiting, fever); 0.2 microns
- Vibrio cholerae (causes cholera); 0.5 microns
- Salmonella (causes typhoid); 0.6 microns.

(Note: All sizes are just scientific guesses from the experts.)

Some bacteria are found only in human feces, like Shigella, whereas others, like Campylobacter and Salmonella, can he present in both domestic and wild animals, as well as some reptiles.

Once again, you get sick that is fecally infected—a good reason for you and everyone in your party to thoroughly wash hands after defecating in the woods. One study even suggests that you are more likely to get sick from sharing utensils and dinnerware used by unhygenic hiking partners than from drinking the water.

Most bacterial infections become active two to seven days from the time of ingestion. The infectious dose can range from just 10 bacteria for Shigella to around 1,000 for Salmonella. Depending on which ones you consumed, with out treatment you can be sick from three days to three months. In healthy adults, death has resulted only in extreme cases. Self- diagnosis in the field is practically impossible. The only way to really know what caused the illness is to have a stool analysis.

There are prescription drugs available for all of these diseases: for Shigella get Trimethoprim-sulfa methoxazole (TMP-SMX); for E. coli also get TMP SMX, except for regions with resistant strains, like Mexüto; for Campylobacter, erythromycin; for Vibrio cholerae, tetracycline; for Salmonella, one of the new fluoroquinolones, or, if you actually develop typhoid fever, chloramphenicol. New treatments and alter native medications are constantly being developed, so always check with your doctor before taking any medication.

In cold water, most bacteria can survive for weeks. Shigella has been shown to stay alive for months in frozen debris and ice. All these cooties are killed, however, by boiling or treating with iodine or chlorine for the recommended period of time, or they can be removed by filtration. The industry standard portable filter pore size for removing bacteria has been 0.45 microns (absolute), but with further research, 0.2 micron (absolute) will likely be established as the new standard.

Viruses

Size-wise, viruses are the tiniest of health hazards but, according to DuPont, are more prevalent in water than bacteria. “Protozoans—giardia and crypto—are the number one threat, then viruses, then bacteria. Bacterial contamination is much more common with food than with water.” Gerba agrees: “As a general rule of thumb, you can never be sure viruses aren’t in your water.” Viruses include:

- hepatitis A and E (causes hepatitis); 0.027 microns
- Norwalk virus (causes headache, fever, intestinal discom fort); 0.027 microns
- rotavirus (causes headache, fever, intestinal discomfort); 0.070 microns
- echovirus (causes meningitis, diarrhea); 0.020 microns
- poliovirus (causes polio); 0.020 microns.

Through vaccination programs, polio has been essentially eliminated from America, but hepatitis A, Norwalk virus, and rotavirus are still common. Rotavirus is one of the primary causes of diarrhea in infants and toddlers worldwide.

Again, transmission is via a fecal/oral path. The infectious dose, incubation period, and length of illness vary with the virus. For Norwalk, one of the most common viruses in adults, the infectious dose can be just one critter that incubates in 24 to 48 hours, causing the victim to start vomiting and racing to the toilet five to 10 times a day. The illness, however, is usually mild and lasts only a couple of days. Rotavirus, on the other hand, also has an infectious dose as low as one and incubates in 24 to 72 hours, but causes vomiting that can last up to a week and diarrhea that may last two weeks.

Currently, there is no treatment for viruses. Says Gerba, “You just have to live through them, which for fit backpackers is usually no fun, but not a problem. On the other hand, almost 20 percent of the American population is either over 55 years of age

or immuno-compromised, and all of these people should be extremely cautious about ingesting viruses. In developing countries, hepatitis A and E are extremely dangerous, with hepatitis E causing 1 to 2 percent mortality in the general population and a horrific 20 to 30 percent mortality in pregnant women."

To kill viruses, you can either boil your water or add iodine or chlorine to it in the recommended dosages. Because viruses are so small, most filters cannot effectively remove them.

Water Standards

As you see, there are a lot of cooties that can get you. Congress acknowledged this in 1986 by adding an amendment to the Safe Drinking Water Act that set standards for regulating surface water treatment plants. In 1987 these same standards were accepted as guide lines for portable water purifiers in the EPA Guide of Standard Protocol For Microbiological Purifiers. This guide requires that any microbiological water purifier be capable of removing or killing all three categories of waterborne pathogens: protozoans, bacteria, and viruses. Specifically, to meet the EPA guidelines, a filter must remove 99.9 percent of protozoans, 99.9999 percent of bacteria, and 99.99 percent of viruses.

Rather than test filters in a laboratory for all organisms, the EPA chose one specific organism from each category as the "indicator organism." It was assumed that if a filter can remove or kill the indicator organism, also called the "challenge" organism, it can remove or kill all creatures in that category. The indicator organism for protozoans was originally giardia, but it has been replaced by Cryptosporidium because of crypto's smaller size and greater resistance to disinfectants. The indicator organism for bacteria is klebsiella, which is not a pathogen but is easy to produce for lab tests, and is approximately the same size as other disease-causing bacteria. There are two indicator organisms for the EPA virus test, poliovirus and rotavirus.

The EPA Guide developed a specific protocol for testing filters, which included the required amount of pathogens in the challenge water, pH of challenge water, and turbidity, among other things. Almost all water filter manufacturers have quibbles with this protocol, but it is currently the best standardized methodology for comparing and contrasting different filters. And although protocol is an extremely complicated affair, its intent is quite simple: to determine which filters meet the EPA's standards and which don't.

For the EPA's water filter test, challenge water is seeded with specific amounts of crypto, klebsiella, poliovirus, and rotavirus, them pumped through the filters at given intervals throughout the life of the filter. Then the organisms that are still in the water are counted.

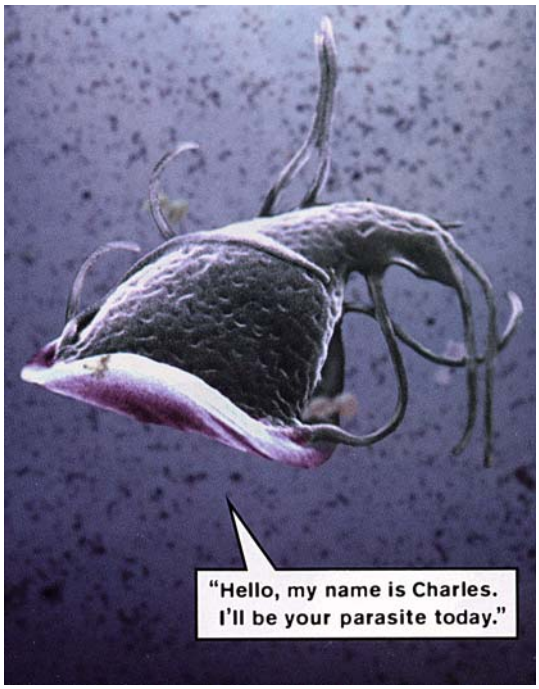
Note also that water can be contaminated with more than waterborne pathogens. Toxic substances like inorganic chemicals and metals (mercury, lead, and arsenic), non metallic inorganics (asbestos, cyanide, and selenium), and synthetic organic chemicals (pesticides, dioxin, phenols), can also be present. There are currently no national guidelines for portable filters with regard to removing these potential toxins. The activated carbon, as well as proprietary substrates found in most portable filters, remove some of these sub stances, but according to Gerba, "you usually don't have to worry about these guys unless you're drinking water that is downstream from a mine, mine tailing piles, or industry." In backcountry water, these substances pose "considerably less risk than microorganisms."

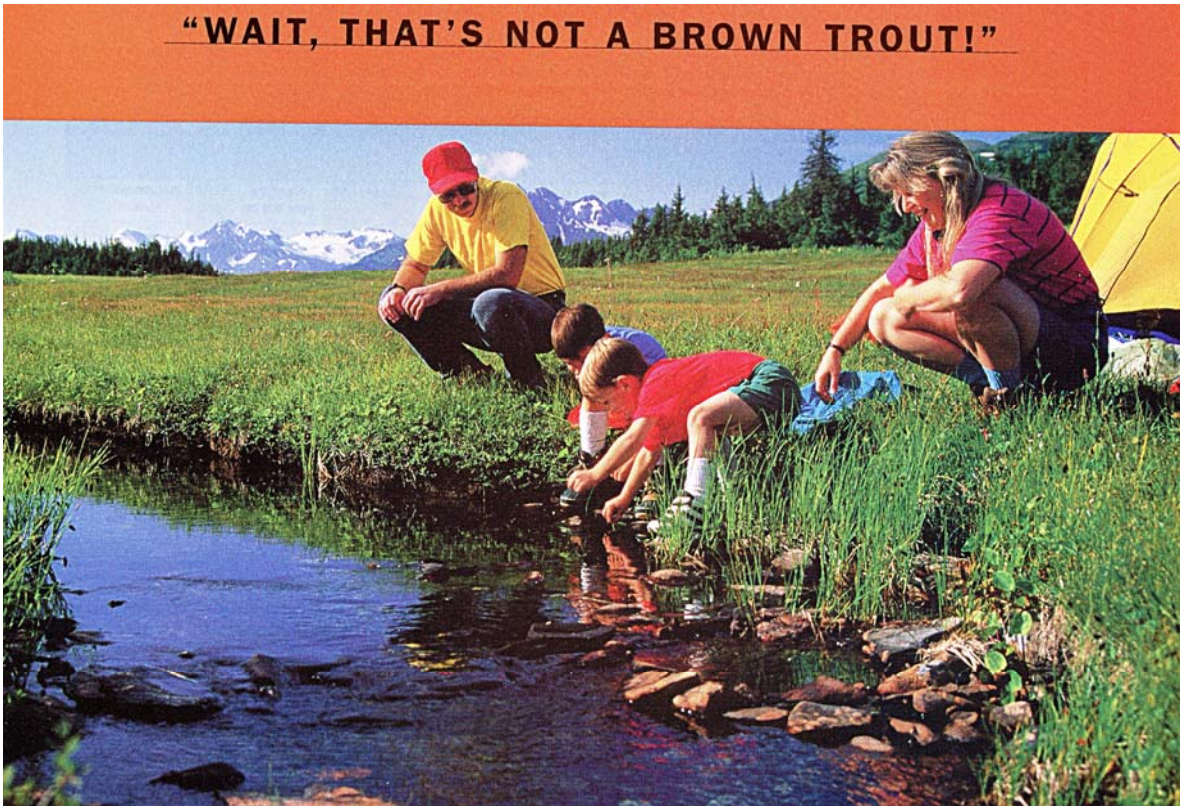
"This is the bottom line," says Gerba. "Filters that meet the EPA guidelines are like mini water treatment plants. You're getting water that is as clean as the water that comes out of your tap." He should know. Gerba's laboratory at the University of Arizona in Tucson has tested all the major backpacking filters on the market, and he remains optimistic about the filter market. "The units today are much better than they were just three or four years ago. And really, the consumer is the one who is benefiting."

There has never been an independently funded lab test of water filters. Water filter makers have all paid for their own tests based on EPA standards, but the results—not surprisingly—are inconsistent. The fact is, all of these filters have passed the tests they claim to pass at one time or another, and some or all have failed at one time or another. We have scoured all the latest lab tests and reports. Short of commissioning our own lab test, which we opted not to do because we are backpackers, not scientists, there's nothing we can do but accept the data that each company supplies.

In a nutshell, we assume that all these filters do what they claim to do. The other half of the equation is equally, if not more important to backpackers: How do the filters work in the field?

WHY PURIFY?





Each person needs one gallon (4 quarts) per day either as you need it or on a schedule

- Boil for one full minute (best method)
- Iodine or chlorine tables
- Filters

Need to kill bacteria & germs including *Giardia Lamblia* which can cause diarrhea, cramps, nausea, weakness, weight loss, belching, and vomiting