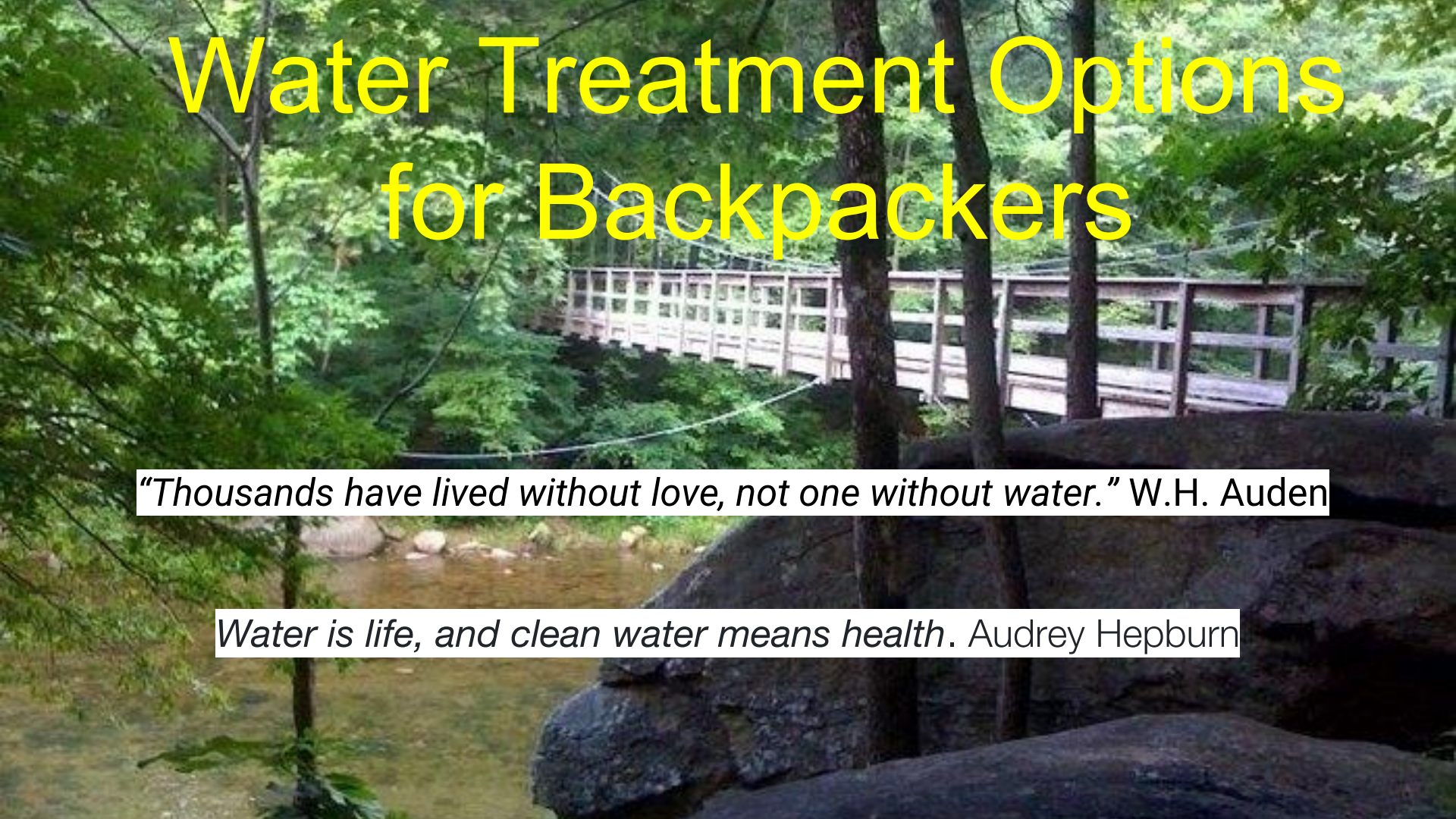
Water Treatment Options for Backpackers



"Thousands have lived without love, not one without water." W.H. Auden

Water is life, and clean water means health. Audrey Hepburn

I’m going to discuss the following:

1. Should you treat water sources along the trail?
2. What are the risks of consuming pathogens
3. Boiling
4. Filtering
5. Chemical treatment
6. Ultraviolet light purification
7. Combinations of treatment

I won’t read the entirety of every slide to you. You can do that.

I’m not discussing water sources from outside continental US

Hold up your cards in accord with the following categories.
Place yourself in one of these categories:

Red card for very experienced backpacker
Yellow card for moderately experienced backpacker
Green card for novice to backpacking

My goal is to provide information to each category of backpacker here tonight

On the following slides, tell me which of these water sources on the AT is safe to drink **without** some sort of water treatment to remove potential harmful pathogens?

Hold up you green card if you would drink from it **without** treating it, OR…

Hold up your red card if you would only drink it after treating it

WATER TREATMENT 101: UNDERSTANDING GIARDIA

JUL 30, 2018 BY MSR TEAM GLOBAL HEALTH SCIENCE

“At MSR, we believe ***the likelihood of contracting Giardia from backcountry water sources in North American wilderness areas is not especially high. A number of experienced outdoor professionals drink untreated water regularly without experiencing symptoms.*** *We still feel Giardia is a real concern to backcountry travelers, and one worth avoiding. MSR suggests you filter or purify all backcountry water to eliminate the possibility of contracting Giardia from a water source. The decision to filter or purify is yours to make. We recommend you use the information presented here to make your own decision based on the level of risk you’re willing to accept.”*

“Some individuals become infected with Giardia very easily. ***For a person with a weak immune system, ingesting as few as ten cysts can result in sickness****. Those with stronger immune systems can handle a much higher number before they experience symptoms.* ***Others can be exposed to Giardia and experience no symptoms at all.***

Variations in our immune systems and the number of cysts ingested also account for the differing time spans before victims show symptoms. Those who ingest a large number of cysts or have a weak immune system can show symptoms within 48 hours. Those who ingest a small number of cysts or have a strong immune system may not experience symptoms for 25 days. Once established, the cysts colonize and reproduce in the small intestines. This eventually leads to uncomfortable but usually non-life threatening illness”

E. coli (Escherichia coli)

E. coli (*Escherichia coli*) is a type of bacteria that lives in the intestines of people and animals. *E. coli* is commonly found in human and animal feces. Most strains of *E. coli* are harmless, but some can make people sick.

Why do we measure *E. coli*?

Water samples are collected to measure *E. coli* (Figure 1) to make sure water is safe for public recreation, such as swimming, fishing or canoeing. *E. coli* is considered an indicator organism, used to identify fecal contamination in freshwater and indicate the possible presence of disease-causing bacteria and viruses (pathogens). Individuals who swim or come in contact with water with elevated levels of *E. coli* and other fecal indicator organisms are at an increased risk of getting sick because of potential exposure to fecal pathogens. Common symptoms of ingesting a pathogenic strain of *E. coli* include vomiting and diarrhea. High numbers of *E. coli* (and other) bacteria may contribute to cloudy water, unpleasant odors, and increased oxygen demand (which may reduce levels of dissolved oxygen in the water).

Figure 1. E. coli under a microscope. Credit: Photo courtesy of National Institute of Allergy and Infectious Diseases

E. coli concentrations may be linked with other parameters such as high total suspended solids (TSS) be found with particles. *E. coli* concentrations may also be linked with high phosphorus, nitrate, and biological oxygen demand (BOD) concentrations.

What are EPA's recommended criteria for *E. coli*?

E. coli criteria are expressed as the number of colony-forming units (cfu) per 100 mL. The two sets of criteria shown in Table 1 were developed using different methods for calculating illness rates from scientific data. They are based on studies that show a link between illness and fecal contamination in recreational waters. Both are considered protective of human health, and either can be used to assess recreational water quality.

Recommendation 1. A geometric mean (GM) of 126 cfu per 100 mL and a statistical threshold value (STV) of 410 cfu per 100 mL measured.

Recommendation 2. A GM of 100 cfu per 100 mL and an STV of 320 cfu per 100 mL measured.

The GM is a statistic often used for bacterial counts in federal and state water quality standards. The GM of the monitoring samples should not exceed whichever criterion is selected from the two recommendations in any 30-day interval. The STV is similar to a 90th percentile, meaning that no more than 10% of samples should exceed it.

EPA recommends weekly sampling to evaluate the GM and STV over a 30-day period and encourages more frequent sampling at more densely populated beaches.

Table 1. Two sets of E. coli criteria based on two different estimated illness rates.

	Recommendation 1 Estimated Illness Rate: 36 per 1,000	
Indicator Organism	Geometric Mean (cfu/100 mL)	Statistical Threshold Value (STV- 90th percentile) (cfu/100 mL)
E. coli (freshwater)	126	410

	Recommendation 2 Estimated Illness Rate: 32 per 1,000	
Indicator Organism	Geometric Mean (cfu/100 mL)	Statistical Threshold Value (STV- 90th percentile) (cfu/100 mL)
E. coli (freshwater)	100	320

Source: Anderson and Rounds (2003)

Does the water in a mountain creek, that you might choose to gather drinking water from, contain more, the same amount, or less pathogens after a heavy rain as compared to before the rain?

Red card if you think MORE PATHOGENS than before the rain

Yellow card if you think SAME PATHOGENS as before the rain

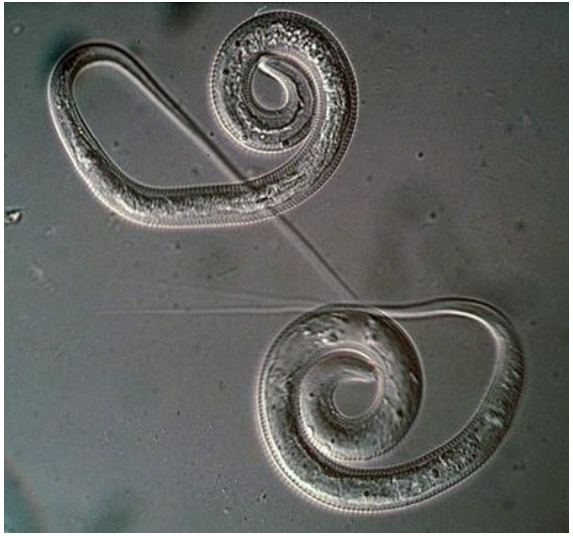
Green card if you think LESS PATHOGENS than before the rain

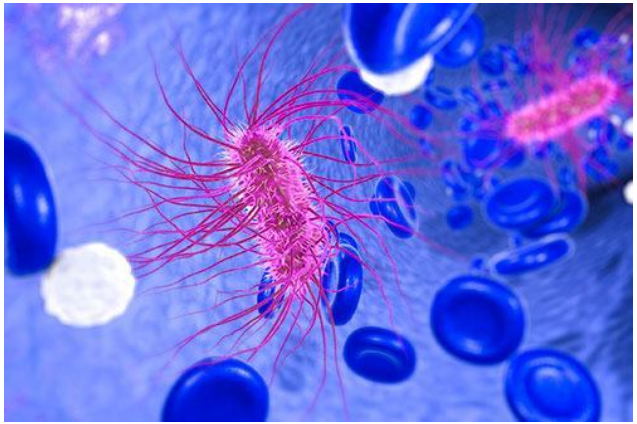
Does the water in a mountain spring, that you might choose to gather drinking water from, usually contain pathogens, or is the water directly from underground usually safe to drink without treatment?

Red card if you think it IT IS USUALLY FREE OF PATHOGENS

Green card if you think MAY CONTAIN PATHOGENS

Let me be clear:
I recommend treating wilderness water sources ALWAYS!





PROTOZOAN CYSTS

Protozoan cysts: Cryptosporidium parvum, Giardia lamblia. These things are tiny, like **1 to 300 microns; 1 micron = one-millionth of a meter. Giardia cysts are about 8–14 microns. Cryptosporidium cysts are typically 4–6 microns.**

When symptoms first appear: From 2 days to a few weeks. **Even ONE protozoa is capable of causing infection.**

Critter characteristics: Cryptosporidium and Giardia can both survive weeks, even months, in cold water. Cryptosporidium, not so affectionately nicknamed "Crypto" is an oocyst. It has a thick-walled shell that serves as a protective barrier for the individual protozoa and makes it more **resistant to disinfectants such as iodine and chlorine.**

Impact on humans: Terrible, frequent, watery diarrhea. Intense vomiting, gas and intestinal discomfort. **Most infections last 1 to 6 weeks with rare chronic cases lasting up to a year.** People with weakened immune systems: children, elderly, pregnant women and those with immune system deficiencies need to be extra cautious against contracting crypto.

BACTERIA

Bacteria: Salmonella, Escherichia coli (or E. coli), Campylobacter jejuni, Yersinia entercolitica, Leptospira interrogans and many others. These are even smaller than protozoa; only 0.1 to 10 microns. {Most bacterial size range from 0.2 to 2.0 μm in diameter and 2 to 8 μm in length. The ubiquitous Escherichia coli is about 1 μm in diameter and 1-2 μm long… **from most other references besides Sawyer**}

When symptoms first appear: From a few days to a few weeks. The **number needed to cause infection can vary widely based on the type of bacteria**.

Common impact: Potentially prolonged intestinal discomfort, certainly diarrhea.

VIRUSES*

Viruses:* Rotavirus, enterovirus, norovirus, Hepatitis A, Norwalk virus. Exceptionally tiny, not even a micron thick: **0.02 to 0.1 micron**…. {story about this size range later}

Viruses are **rarely (?) found in North American wilderness waters and only purifiers - not filters - eliminate viruses.*

When symptoms first appear: From 1 day to several weeks.

Common impact: Diarrhea, intestinal discomfort, and vomiting. An assortment of other potential ailments.

(from other sources…) Duration of impact can be from days to months.

BOILING WATER!

The old standard. EPA, NPS, and CDC recommend boiling water for 1 full minute or 3 minutes if you're above 6500 ft. It's the guaranteed method to kill ALL pathogens! So why don't we all do it?

Raise your green card , to answer "YES", or red card , to answer "NO", to indicate if you **routinely use boiling water as your primary method of water treatment**.

For many backpackers, boiling water requires too much fuel. It means carrying the weight and space needed by the fuel. It's time consuming to get the stove and pot out of your pack, setup the stove and start boiling, then put everything away after it cools. Most backpacking stoves and pots only boil a fairly small volume of water at a time, usually from 0.5-1.0 liters (L). However, we drink 4-6 L/day when hiking.

Is there a reasonable solution to make boiling water more efficient and easier to do?

RISKS! Drinking water involves risks!

Risk isn't binary. It's not yes or no. It's a sliding scale.

Which of these numbers is safe enough for you? Hold up your card, by the letter on the cards, indicating your answer:

A = 99.9% safe

B = 99.99% safe

C = 99.999% safe 

D = 99.9999% safe

Log Reduction Scales

1 log = 90%

2 log = 99%

3 log = 99.9%

4 log = 99.99%

Grade "A"

Pasteurized

Milk

Ordinance

(Includes provisions from the Grade "A" Condensed and Dry Milk Products and Condensed and Dry Whey--Supplement 1 to the Grade "A" PMO)

2019 Revision

U.S. Department of Health and Human Services
Public Health Service
Food and Drug Administration

Table 3. Pasteurization Temperature vs. Time

Batch (Vat) Pasteurization	
Temperature	**Time**
63°C (145°F)*	30 minutes
Continuous Flow (HTST and HHST) Pasteurization	
Temperature	**Time**
72°C (161°F)*	15 seconds
89°C (191°F)	1.0 second
90°C (194°F)	0.5 seconds
94°C (201°F)	0.1 seconds
96°C (204°F)	0.05 seconds
100°C (212°F)	0.01 seconds

So, why does the CDC recommend boiling?

“Pasteurization uses this principle to kill foodborne enteric pathogens and spoilage-causing organisms at temperatures between 140°F (60°C) and 158°F (70°C), well below the boiling point of water (212°F [100°C]).

Although boiling is not necessary to kill common intestinal pathogens, it is the only easily recognizable end point that does not require a thermometer.”

SCI
SOLAR COOKERS INTERNATIONAL

Solar Cooking Wiki

EXPLORE LEARN TEACH SEE ALL... ABOUT

in: Solar Cookers International Associates, NGOs, California, and 12 more

Solar Cookers International

VIEW SOURCE

Deutsch, español, Ελληνικά, français, Hausa, Igbo, Indonesian, italiano, Kiswahili, Kreyòl, Malagasy, Melayu, português, русский, Soomaaliga, Tagalog, Việt, Türkçe, Yorùbá, தமிழ், नेपाली, 中文, اردو, 한국어, 日本語, עברית, العربية, فارسی, हिन्दी, ไทย, বাংলা, తెలుగు, ગુજરાતી, ಎಂ, ਪੰਜਾਬੀ, සිංහල, پښتو

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SCI
SOLAR COOKERS INTERNATIONAL ASSOCIATE

Last edited: 29 March 2023

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Solar Cookers International (SCI) helps lead global efforts to promote solar cooking. Solar cookers have no emissions and use free solar energy accessible worldwide for cooking and water pasteurization. SCI raises solar cooking knowledge and awareness by organizing and attending international conferences. It also hosts the Solar Cookers International Association, the Solar Cooking Wiki, as well as SCI's organizational website. This work assists in the achievement of the United Nations Sustainable Development Goals.

CHARITY NAVIGATOR
★★★★
Four Star Charity

Tens of thousands of individuals and organizations from around the world have learned about solar cooking through SCI's advocacy, leadership, education resources, and information exchange

Solar Water Pasteurizers

A Point-of-Use Water Disinfection Technology

Will Hartzell, Safe Water Systems, Inc. [1]

The impact of contaminated drinking water is staggering:

- 80% of all illnesses in the developing world result directly from waterborne pathogens.
- An estimated 4.6 million children and adults die from diarrhea each year. The primary cause of diarrhea is contaminated drinking water.
- 2.5 billion incidents of illness are caused by contaminated water every year.
- 50% of hospitalizations in developing countries result from waterborne disease.
- The leading cause of death for children under the age of five in developing nations is infection from waterborne diseases.
- At any one time, approximately one billion people suffer from diseases contracted by consuming contaminated water.
- 1.2 billion people do not have access to drinking water free from disease-causing microbes. The World Health Organization predicts that by 2025, this number will increase to more than 2 billion.

In addition, water supplies that are stored for long periods of time, such as rain water catchment tanks, are prone to contamination from bacteria growth, insects and rodents. Even within major cities of developing nations, water systems are unsafe and water is boiled to prevent illness. Boiling contaminated water is an effective preventative measure for those who can afford it, but boiling consumes valuable and expensive energy resources. Millions of people cannot afford to

A solution is now available that uses the heat of the sun instead of heat from wood or electricity to disinfect drinking water. Solar Water Pasteurizers use the natural and free energy of the sun to make water safe to drink. Pasteurization is the universally accepted process of killing harmful microorganisms with heat. Pasteurization achieves the same result as boiling, but at a lower temperature. *E. coli*, for example, is killed rapidly at 140 degrees F, and most viruses are killed at 145 degrees F. Many people do not realize that it is not necessary to boil water to disinfect it. Independent laboratory tests confirm that Solar Water Pasteurizers are 99.999% effective in destroying disease-causing bacteria, viruses, protozoa and worms.

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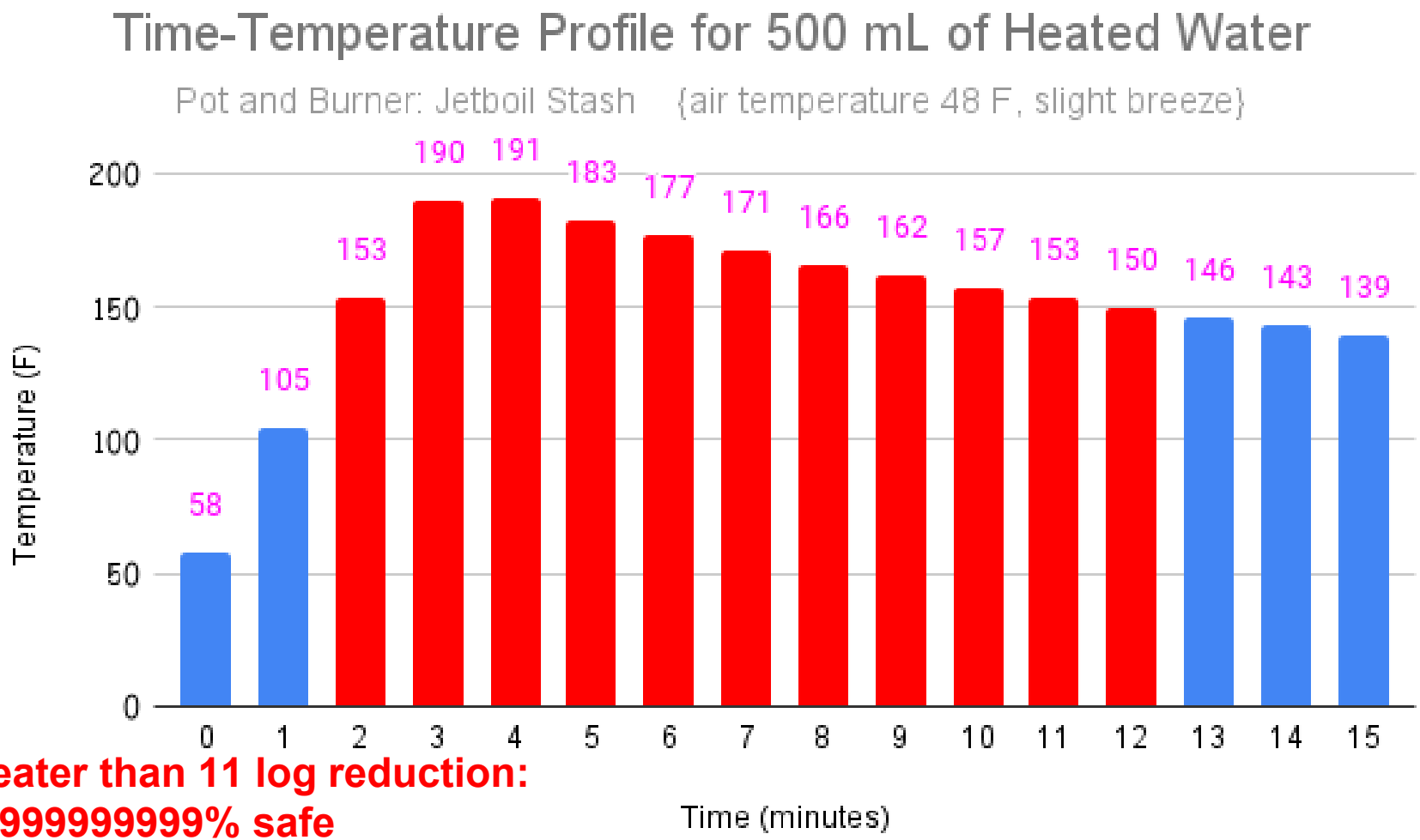
[1] President, Safe Water Systems, Inc., 1600 Kapiolani Blvd., Suite 721, Honolulu, Hawaii, 96822, will@safewatersystems.com, 808-949-3123

The chart below indicates the temperatures at which the most common waterborne pathogens are rapidly killed, thus resulting in at least 90 percent of the microbes becoming inactivated in one minute at the given temperature. (The 90 percent reduction is an indicator frequently used to express the heat sensitivity of various microbes.) Thus, five minutes at this temperature would cause at least a 99.999 percent (5 log) reduction in viable microbes capable of causing disease.

Microbe	**Killed Rapidly At**
Worms, Protozoa cysts *(Giardia, Cryptosporidium, Entamoeba)*	55 °C (131 °F)
Bacteria *(V. cholerae, E. coli, Shigella, Salmonella typhi)*, Rotavirus	60 °C (140 °F)
Hepatitis A virus	65 °C (149 °F)
(Significant inactivation of these microbes actually starts at about 5 °C (41 °F) below these temperatures, although it may take a couple of minutes at the lower temperature to obtain 90 percent inactivation.)	

MY BOILING WATER TEST SETUP



Greater than 11 log reduction:
99.999999999% safe

Visual stages of “near boiling”

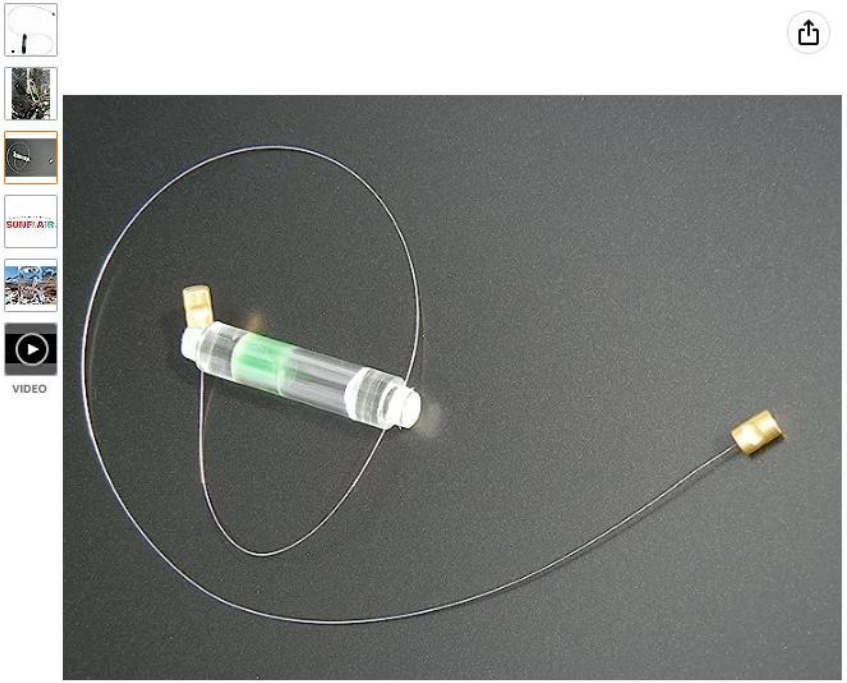
Small Pearls

In this stage, the water bubbles will be the size of small pearls. The rising steam will be stronger. This water is roughly 175°F–185°F.

Streaming Pearls

This water is around 185°F–200°F. The bubbles should be streaming to the top and it should almost be boiling.

Or, if you want a visual aid device to determine when pasteurization has been reached… the **Water Pasteurization Indicator!**



Sunflair Water Pasteurization Indicator (WAPI)

Brand: Sunflair

4.5 out of 5 stars 109 ratings | 3 answered questions

Amazon's Choice for "water pasteurization indicator"

$14.99

prime

FREE Returns

Get 5% back ($0.74 in rewards) on the amount charged to your Amazon Prime Rewards Visa Signature Card.

Brand	Sunflair
Color	Silver, Gold, Green, Clear
Material	wax
Package Information	Tube

About this item

- Indicates when Water has reached Pasteurization Temperatures; NOT A WATER PURIFIER
- Perfect for Camping, Hiking, Backpacking
- Essential for Emergencies

So what is my practice when using boiling to provide safe drinking water when backpacking?

At most, heat the water to boiling and stop! Over the course of bringing the water to boil and cooling from boiling, you will have reached more than a 5 log reduction or more than 99.999% safe water.

I never boil water for a full minute, and that's in agreement with the FDA and CDC. I conserve fuel and shoot for the beginning of a slow boil (~190 F). From the FDA Table 3, the pasteurization time at 180 F is about 6 seconds. At 190 F, pasteurization is achieved in 1 second!

Other considerations with boiling water as water treatment

1. Little no maintenance. You already have the stove and pot for cooking
2. Freeze dried or dehydrated foods will aso be cooked by slow boiled water.

Chemical Water Treatment

Raise your red card , green card , yellow card or orange card to indicate if you **routinely use one of these chemicals as your primary method of water treatment**.

Iodine = hold up red card

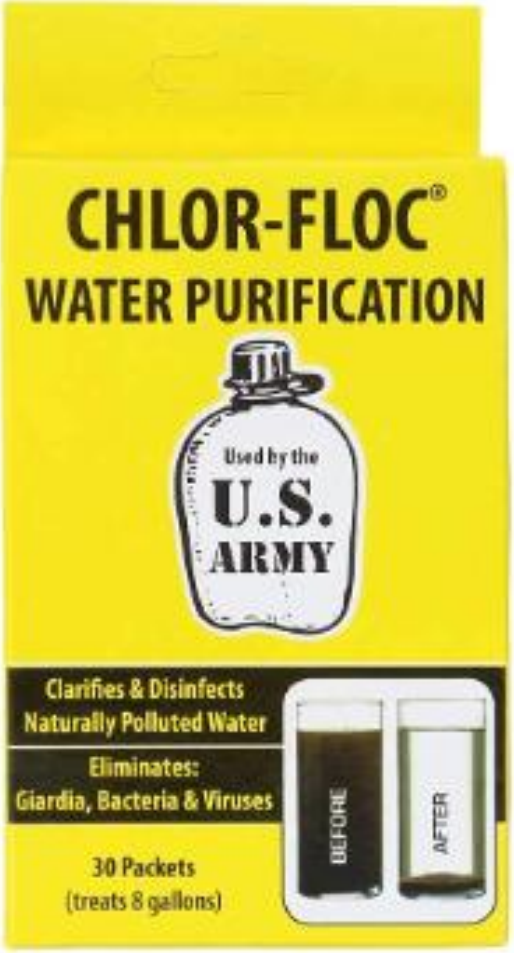
Chlorine = hold up green card

Chlorine dioxide = hold up yellow card

Other chemical = hold up orange card

There isn't a perfect chemical water treatment additive for backpackers and hikers… or for anyone else!

1. They all have limitations in the pathogens they treat, or under some conditions (temperature, turbidity, pH)
2. They may pose health risks themselves when consumed
3. Easy to do, reliable, and requires very little maintenance



Roll over image to zoom in

Rothco Chlor-Floc Us Military Water Purification Tablets

Visit the Rothco Store

4.5 out of 5 stars 214 ratings | 7 answered questions

$17.81

prime One-Day

FREE Returns

Get 5% back ($0.89 in rewards) on the amount charged to your Amazon Prime Rewards Visa Signature Card.
May be available at a lower price from other sellers, potentially without free Prime shipping.

Brand	Rothco
Capacity	1 Liters
Package Information	Box
Model Name	Chlor-Floc

About this item

- Currently used by the US Military
- 30 tablets per box
- Eliminates giardia, bacteria and viruses
- 1 or 2 tablets per 1 quart or 1 liter of water
- Used for water purification

View the full text of this report

Accession Number: ADA262226

Title: Evaluation of the Military Effectiveness of Chlor-Floc Water Purification Tablets for Treatment of Waterborne Micro-Organisms

Descriptive Note: Technical rept. Oct 1989-Sep 1991

Corporate Author: ARMY BIOMEDICAL RESEARCH AND DEVELOPMENT LAB FORT DETRICK MD

Personal Author(s): Schaub, Stephen A. ; Hargett, Helen T. ; Kamrud, Kurt I. ; Sterling, Charles R. ; Marshall, Marilyn M.

Report Date: 1992-10-01

Pagination or Media Count: 60.0

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Report Date: 1992-10-01

Pagination or Media Count: 60.0

Abstract:

Tests were conducted to determine the efficacy of CHLOR-FLOC water purification tablets for treating microbiological contaminants in drinking water. The test waters represented various physicalchemical challenge conditions. Microbial challenges consisted of enteric bacteria Klebseilla terrigena enterovirus Echovirus 1, protozoan oocysts Cryptosporidium parvum , and cyst simulant latex beads. Studies used the U.S. Environmental Protection Agencys interim Guide Standard and Protocol for Testing Microbiological Water Purifiers for guidance. Results indicated that the CHLOR- FLOC system effectively reduced both bacterial and viral challenge components of the study to the required levels under all conditions, but failed to physically remove the oocysts and cyst simulant to the required levels under all conditions. Viability studies also indicated that the chemical disinfection component of the CHLOR-FLOC tablets had minimal capabilities to kill the encysted organisms over the 20-minute contact time. The overall study results revealed that the CHLOR-FLOC system was not adequate to physically remove, or to provide adequate chemical disinfection of, Cryptosporidium oocysts to the required level of 99.9 percent reduction. Water, Purification, CHLOR-FLOC tablets, Micro-organisms, Cryptosporidium, Klebseilla, Echovirus, Latex beads, Protozoan cysts, Bacteria, Disinfection, Coagulation.

Descriptors:

*DRINKING WATER ; *WATER TREATMENT ; *PURIFICATION ; TEST AND EVALUATION ; CHEMICALS ; BACTERIA ; VIABILITY ; PROTECTION ; CONTAMINANTS ; GUIDANCE ; ENVIRONMENTAL PROTECTION ; OOCYSTS ; MICROORGANISMS ; COAGULATION ; DISINFECTION ; CYSTS ; ENTERIC BACTERIA

Subject Categories: Hygiene and Sanitation; Water Pollution and Control

Distribution Statement: APPROVED FOR PUBLIC RELEASE

View the full text of this report

No matter if you're in Peruvian mountain passes or high-traffic wilderness areas closer to home, Aquatabs water purification tablets quickly and reliably purify drinking water.

Features

- EPA-approved tablets are effective against viruses, bacteria and giardia cysts, providing safe drinking water in just 30 min.
- Each tablet treats up to 2 quarts of clean water or 0.8 quart of dirty water
- Ideal for ultralight backcountry trips, international travel and domestic emergency use
- Individually packaged, perfect for backing up your microfilter in an emergency
- Note: Aquatabs are not effective against cryptosporidia
- Package contains 30 tablets

Imported.

View all Aquatabs Chemical Water Treatments

Technical Specs

Best Use	Backpacking Emergency Preparedness Travel
Filter Type	Tablet
Active Ingredient(s)	Sodium Dichlorisocyanurate
Removes/Destroys	Protozoa, Bacteria And Viruses

Swimming Pools and chlorine!

Facts About *Giardia* and Swimming Pools

What is *Giardia* and how can it affect me?

Giardia is a **germ that causes diarrhea**. It is found in the poop of a person who has been infected with *Giardia*. *Giardia* is protected by a tough outer shell, which allows it to survive for up to 45 minutes, even in properly chlorinated pools and water playgrounds. *Giardia* can make anyone sick and can cause prolonged diarrhea (lasting 2 weeks or more).

How is *Giardia* spread in pools?

Giardia is spread by swallowing water that has been contaminated with poop containing *Giardia*.

You share the water—and the germs in it—with every person who enters the pool. If one person infected with *Giardia* has diarrhea in the water, the water can be contaminated with tens of millions of *Giardia* germs. It only takes 10 or fewer germs to cause infection, which means that swallowing even a small amount of contaminated water can make you sick.

Giardia can also be spread by swallowing contaminated water in water playgrounds, hot tubs, lakes, rivers, springs, ponds, streams, and oceans.

How do I protect myself and those I care about?

Giardia can stay alive for almost an hour, even in properly chlorinated water. Therefore, it's critical to stop the germ from getting in the water in the first place and to make sure the water has the proper disinfectant level and pH.

All of us can take the following healthy swimming steps:

- **Stay out of the water if you are sick with diarrhea.**
- **Use test strips to make sure the water has a proper free chlorine (amount available to kill germs) or bromine level and pH.**
  - Free chlorine level: at least 1 part per million (ppm) in pools and water playgrounds and at least 3 ppm in hot tubs.

SWIMMERS AND PARENTS

For more information on

- Healthy Swimming, visit www.cdc.gov/healthywater/swimming/
- Diarrhea and Swimming, visit www.cdc.gov/healthywater/swimming/swimmers/rwi/diarrheal-illness.html
- *Giardia*, visit www.cdc.gov/parasites/giardia

Facts About Crypto and Swimming Pools

What is Crypto and how can it affect me?

"Crypto," short for *Cryptosporidium*, is a germ that causes diarrhea. It is found in the poop of a person who has been infected with Crypto. Crypto is protected by a tough outer shell, which allows it to survive for more than 7 days, even in properly chlorinated pools and water playgrounds. Crypto can cause prolonged diarrhea (lasting 2 weeks or more, during which the diarrhea might stop and start again). Crypto can make anyone sick, but people with weakened immune systems are more likely to become seriously ill when infected with Crypto.

How is Crypto spread in pools?

Crypto is spread by swallowing water that has been contaminated with poop containing Crypto.

You share the water—and the germs in it—with every person who enters the pool. If one person infected with Crypto has diarrhea in the water, the water can be contaminated with tens of millions of Crypto germs. It only takes 10 or fewer germs to cause infection, which means that swallowing even a small amount of contaminated water can make you sick.

Crypto can also be spread by swallowing contaminated water in water playgrounds, hot tubs, lakes, rivers, springs, ponds, streams, and oceans.

How do I protect myself and those I care about?

Because Crypto can stay alive for days, even in properly chlorinated water, stopping the germ from getting in the water in the first place is critical.

SWIMMERS AND PARENTS

For more information on

- **Healthy Swimming, visit** www.cdc.gov/healthyswimming
- **Diarrhea and Swimming, visit** www.cdc.gov/healthywater/swimming/swimmers/rwi/diarrheal-illness.html

Potable Aqua iodine tablets are a lightweight and economical way to make water suitable for drinking.

Features

- Iodine tablets kill bacteria, viruses and giardia without the weight, bulk and cost of a water filter
- Includes 50 tablets; 2 tablets treat 1 quart of water
- Each tablet contains 20mg of tetraglycine hydroperiodide, which releases 8 ppm of titratable iodine
- Potable Aqua tablets require that you wait at least 30 min. before drinking the treated water
- Unopened bottles of Potable Aqua tablets should remain effective up to 4 years when maintained under controlled temperatures between 60 and 86°F
- An opened bottle of Potable Aqua should not be kept for more than 1 year
- Caution: Iodine tablets are not effective against cryptosporidia

Made in USA.

Caution: Iodine is not effective against *Cryptosporidium*.

View all Potable Aqua Chemical Water Treatments

Technical Specs

Best Use	Backpacking
Filter Type	Tablet
Active Ingredient(s)	Tetraglycine hydroperiodide
Removes/Destroys	Protozoa, Bacteria And Viruses
Output	25 quarts
Weight	3 ounces

Use of iodine for water disinfection: iodine toxicity and maximum recommended dose.

H Backer and J Hollowell

▸ Author information ▸ Copyright and License information Disclaimer

Abstract

Iodine is an effective, simple, and cost-efficient means of water disinfection for people who vacation, travel, or work in areas where municipal water treatment is not reliable. However, there is considerable controversy about the maximum safe iodine dose and duration of use when iodine is ingested in excess of the recommended daily dietary amount. The major health effect of concern with excess iodine ingestion is thyroid disorders, primarily hypothyroidism with or without iodine-induced goiter. A review of the human trials on the safety of iodine ingestion indicates that neither the maximum recommended dietary dose (2 mg/day) nor the maximum recommended duration of use (3 weeks) has a firm basis. Rather than a clear threshold response level or a linear and temporal dose-response relationship between iodine intake and thyroid function, there appears to be marked individual sensitivity, often resulting from unmasking of underlying thyroid disease. The use of iodine for water disinfection requires a risk-benefit decision based on iodine's benefit as a disinfectant and the changes it induces in thyroid physiology. By using appropriate disinfection techniques and monitoring thyroid function, most people can use iodine for water treatment over a prolonged period of time.

Purifying water couldn't be easier! Simply drop a Potable Aqua chlorine dioxide tablet from this packet of 30 into a quart of water and let it go to work.

Features

- Features the same proven technology used in municipal water supplies; effective against viruses, bacteria, giardia and cryptosporidia
- Requires a 4 hr. treatment time to kill contaminants
- Each tablet is individually wrapped and sealed
- Unopened Potable Aqua tablets that are stored at temperatures between 60 and 86°F should remain effective up to 4 years
- Exposure to heat, humidity, moisture and air will reduce the effectiveness of the tablets

Made in USA.

View all Potable Aqua Chemical Water Treatments

Technical Specs

Best Use	Backpacking
Filter Type	Tablet
Removes/Destroys	Protozoa, Bacteria And Viruses
Output	30 quarts
Weight	0.9 ounce

People also viewed

Table 1-6. Summary of Disinfectant Properties

(Based on Typical Disinfectant Application)

Condition	Chlorine	Ozone	Chlorine Dioxide	Permanganate	Chloramine	Ozone/Peroxide	Ultraviolet
Produce THM with TOC	y	s	n	n	y	s	n
Produce oxidized organics	s	y	s	s	n	y	s
Produce halogenated organics	y	s	n	n	y	s	n
Produce inorganic byproducts	n	s	y	n	n	s	n
Produce BOM	s	y	s	n	n	y	n
MRDL applies	y	n	y	n	y	n	n
Lime softening impacts	y	n	n	n	y	n	y
Turbidity impacts	n	s	n	n	n	s	y
Meet *Giardia* - <2.0 log	y	y	y	n	n	n	n
Meet *Giardia* - >2.0 log	n	y	y	n	n	n	n
Meet *Crypto* - <2.0 log	n	y	y	n	n	n	n
Meet *Crypto* - >2.0 log	n	y	n	n	n	n	n
Meet Virus - <2.0 log	y	y	y	n	n	n	y
Meet Virus - >2.0 log	y	y	y	n	n	n	y
Secondary disinfectant	y	n	s	n	y	n	n
Operator skill (1=low; 5=high)	1	5	5	1	2	5	3
Applicable to large utilities	y	y	y	y	y	y	n
Applicable to small utilities	y	y	y	y	y	y	y

y = yes, n = no, s = sometimes

WATER FILTRATION

1. Probably the most common solution selected by backpackers
2. Works very well for bacteria and cysts, but not for viruses
3. Easy to do and reliable, but requires some maintenance
4. Water filters vary in size, weight, technology employed, flow rate and lifetime.


smartwater

How many of you use a water filter as your primary water treatment method in the backcountry?

Raise your green card , to answer “YES”, or red card , to answer “NO”,

Let’s compare two filters


Get to Know the LifeStraw Peak Series Straw
LifeStraw
0:25 / 1:11

Occasional oddities in reported specs

Features

- Unlimited shelf life—no need to worry about how long the filter has been sitting in your go-bag unused
- Can also be attached to water bottles and to standard gravity hoses
- Reengineered LifeStraw filter helps reduce clogging from sand and silt
- Built with premium materials to endure outdoor use and make it leakproof
- 0.2-micron filter physically removes 99.999999% of all bacteria, such as salmonella, cholera and E.coli; removes 99.999% of all parasites; removes 99.999% of microplastics
- Also removes silt, sand and cloudiness greater than 0.2 micron
- Membrane microfilter lasts up to 1,000 gal. (4,000 liters)
- Meets U.S. EPA and NSF P231 drinking water standards for the removal of bacteria and parasites

Imported.

View all LifeStraw Straw Water Filters

Technical Specs

Best Use	Emergency Preparedness Backpacking
Filter Type	Straw
Filter Medium	Hollow-core membrane microfilter
Removes/Destroys	Protozoa And Bacteria
Output	3 liters per minute
Housing Material	Tritan Renew copolyester
BPA Free	Yes
Field Cleanable	Yes
Dimensions	10.43 x 3.62 x 2.16 inches
Weight	2.3 ounces
Sustainability	Contains recycled materials

Occasional oddities in reported specs

Features

- Updated from the original version, the Squeeze Filter includes 2 32 fl. oz. pouches, a cleaning coupling and additional accessories for gravity and inline use
- Hollow-fiber membrane filter removes 99.99999% of all bacteria, such as salmonella, cholera and E.coli; removes 99.9999% of all protozoa, such as giardia and cryptosporidia
- Collapsible pouches are made from durable Mylar foil and can be reused hundreds of times
- Simply fill up the included water pouches at a lake or stream, screw the hollow-fiber filter onto the pouch and squeeze the pouch to push the water through the filter
- Filter has a built-in flip-top cap so you can spray water straight into your mouth or use it to fill a water bottle; squeeze filter fills most water bottles in only 30 sec.
- Includes the Inline Adapters so you can use your squeeze filter inline on a hydration pack
- Includes gravity tubing which allows you to hook up the Squeeze Filter as a gravity filter
- Also comes with a syringe to back-flush the filter to maintain a high flow rate
- Filter fits the threads on most bottles of water that you buy at a grocery store
- Includes a mesh carrying case
- Avoid freezing this filter; freezing may ruin the hollow-fiber membrane

Technical Specs

Best Use	Backpacking
Filter Type	Squeeze Gravity
Filter Medium	Hollow-fiber membrane
Removes/Destroys	Protozoa And Bacteria
Pump Force	Not applicable
Pump Strokes per Liter	Not applicable
Output	1.7 liters per min.
Housing Material	ABS plastic
Field Cleanable	Yes
Dimensions	Filter: 2 x 5; squeeze pouch: 11 x 6 inches
Weight	3 ounces

This Sawyer filter has a 0.1 micron pore size

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY

Registration Division
Office of Pesticide Programs
Criteria and Standards Division
Office of Drinking Water

GUIDE STANDARD AND PROTOCOL FOR

TESTING MICROBIOLOGICAL WATER PURIFIERS

Sawyer says their filter really removes 100% of cysts, but they can only claim 5 log reduction

customer services

Mon, Mar 20, 2:34 PM

to me

Hi Donald,

Thanks for reaching out to us and for your interest in our filters.

While our filters remove 100% of the cysts, 5 log is all we are allowed to claim.

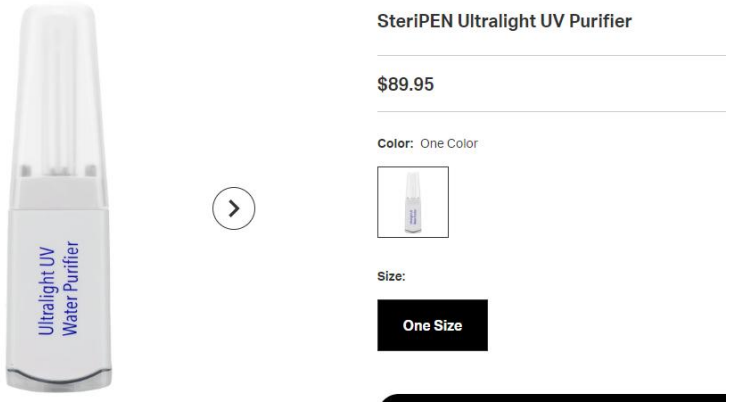
Best,

Jeannie
Sawyer Customer Service
(727) 725-1177

•••

One last method to disinfect water

Ultraviolet light kills all pathogens (bacteria, protozoa/cysts, and viruses), but works best in clear water. Cloudy/turbid water will provide hiding places for pathogens. Water on the trail will sometimes be cloudy/turbid.



Water treatment while hiking, camping, and traveling

When visiting places with unknown water quality, you may need to treat water to make sure it's safe to drink. **Boiling water is the most reliable way to kill germs.** If you cannot boil your water, the next best option is to use a filter (especially if water is cloudy) and then use another treatment method. Follow instructions on the treatment product's label, including the contact time for disinfectants. This guide can help you decide which treatment method or combination of methods to use to make your water safe to drink.








TYPE OF GERM	BOIL (for 1 min., or 3 mins. at elevations above 6,500 feet)	FILTER	PURIFIER	CHLORINE TREATMENT (disinfectant)	IODINE (disinfectant)	CHLORINE DIOXIDE (disinfectant)	COMBINING FILTER AND DISINFECTANT	UV LIGHT USED IN CLEAR WATER
BACTERIA *(such as Campylobacter, Salmonella, Shigella, E. coli)*	✓	✓ 0.3 micron or smaller filter	✓	✓	✓	✓	✓ 0.3 micron or smaller filter, plus disinfectant	✓
VIRUSES *(such as norovirus, hepatitis A, enterovirus, rotovirus)*	✓	✗	✓	✓	✓	✓	✓	✓
PARASITE *Giardia*	✓	✓ Filter certified for "cyst" and "oocyst" reduction	✓	!	!	✓	✓ Filter certified for "cyst" and "oocyst" reduction, plus chlorine dioxide	✓
PARASITE *Cryptosporidium*	✓	✓ Filter certified for "cyst" and "oocyst" reduction	✓	✗	✗	!	✓ Filter certified for "cyst" and "oocyst" reduction, plus chlorine dioxide	✓

Centers for Disease Control and Prevention
National Center for Emerging and Zoonotic Infectious Diseases

Learn more: www.cdc.gov/healthywater/drinking/travel/backcountry_water_treatment.html

✓ **EFFECTIVE**—will remove or kill this type of germ

! **SOMEWHAT EFFECTIVE**—may remove some germs of this type, but water could still be unsafe

✗ **NOT EFFECTIVE**—will not remove or kill this type of germ

CS326248-A

SO! What do I recommend and why?

1. Filtration followed up with chemical treatment by chlorine dioxide or UV light.
2. Why? Because it will kill bacteria, protozoa/cysts, and viruses.
3. With protozoa/cysts removed, the time to kill bacteria and viruses using chlorine dioxide is a matter of 15-30 minutes, not 4 hours.
4. Who else has this combined systems recommendation? ATC

LEARN MORE

Food, Water, and Gear

Thoughtful planning of your food, water, and gear is key for an enjoyable and successful time on the Appalachian Trail.

Hiking-Friendly Foods

If you're out for the day or the weekend, you can probably pack whatever foods you like best, including

Under the topic

“Finding Water on the Trail”:

These chemicals are either completely ineffective or at best, moderately effective at killing the protozoa Cryptosporidium.

Combined Water Treatment

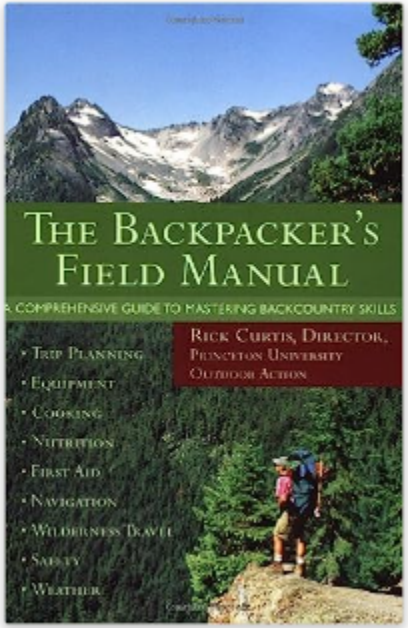
THE GOOD: If boiling water is not desired or possible, a combination of filtration and chemical disinfection is the most effective pathogen reduction method in drinking water for backcountry use. For short trips, take a supply of water from home or from other treated domestic sources.

THANK YOU

I hope you all learned something, from the novice to the most experienced among you. I hope you learned something or have some new considerations for water treatment.

Be SAFE and HAPPY TRAILS!

Story about virus size range and my efforts to get websites to make *corrections*!



The Backpacker's Field Manual: A Comprehensive Guide to Mastering Backcountry Skills Paperback – February 24, 1998

by Rick Curtis (Author)

4.5 out of 5 stars 40 ratings

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The Backpacker's Field Manual has been the bible of the Princeton University Outdoor Action Progra more than a decade, field-tested by one of the most respected outdoor programs in the country. It is t comprehensive backpacking guide available--broad in scope while still focused on the essential skills a information that backpackers need to travel safely and comfortably in the wilderness. Backpackers of

Filtration

There are a number of devices on the market that filter out microorganisms. A water filter pumps water through a microscopic filter that is rated for a certain-size organism. The standard size rating is the micron (the period at the end of this sentence is about 600 microns). Depending on the micron rating of the filter, smaller organisms (like viruses) can pass through. Be cautious when selecting a filter. You should know what potential organisms you need to treat for. You don't want to go to an area where a virus like hepatitis A is present in the water (a problem in some developing countries) with a filter that will handle only a larger organism like *Giardia.*

Common microorganisms and the filter size needed:

Organism	Examples	General Size	Filter Type	Particle Size Rating
Protozoa	*Giardia, Cryptosporidium*	5 microns or larger	Water filter	1.0–4.0 microns
Bacteria	*Cholera, E. coli, Salmonella*	0.2–0.5 microns	Microfilter	0.2–1.0 microns
Viruses	Hepatitis A, rotavirus, Norwalk virus	0.004 microns	Water purifier	to 0.004 microns

References

1. https://wwwnc.cdc.gov/travel/yellowbook/2020/preparing-international-travelers/water-disinfection
2. https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=2000229L.TXT
3. https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=9102362E.TXT