

Water Treatment in the Backcountry

No matter how remote or clean-looking a water source may seem, it may still contain microorganisms that can make people sick. Water collected in the backcountry should always be treated before drinking.

Boiling

Boiling water is the most effective way to remove harmful microorganisms from untreated water sources.

- Bring water to a rolling boil. Continue to boil for 1 minute or, to conserve fuel, remove from heat but keep pot covered for several minutes.
- Muddy water should stand for a while to allow silt and debris to settle. Pour off the clear water on top for boiling.

Filtration

Filters can be effective at removing microorganisms from the water depending on the filter's pore size and the microorganism's size and charge. Always follow manufacturer instructions.

- Filters with an absolute pore size ≤ 1 micron (NSF Standard 53 or 58) have a high effectiveness in removing *Giardia* and *Cryptosporidium*.
- Filters with an absolute pore size ≤ 0.3 microns have a moderate effectiveness in removing bacteria.
- Only filters that contain a chemical disinfectant matrix will be effective against some viruses.

Disinfection

Contact time, disinfectant concentration, and water temperature, turbidity, and pH along with other factors impact the effectiveness of chemical disinfection. Always follow manufacturer instructions.

- Chlorine dioxide, chlorine, and iodine have a high effectiveness in killing bacteria and viruses.
- Chlorine and iodine have a low effectiveness in killing *Giardia* and are not effective in killing *Cryptosporidium*.
- Chlorine dioxide has a high effectiveness in killing *Giardia* and a low to moderate effectiveness in killing *Cryptosporidium*.

Filtration & Disinfection

Used together, filtration followed by disinfection has a very high effectiveness in removing all microorganisms from water.

Other Methods

Ultraviolet (UV) light might be an effective pathogen reduction method in the backcountry, but there is a lack of independent testing data on individual systems. UV light requires prefiltering because it needs low water turbidity (cloudiness) to work effectively. Correct power delivery and contact times are also required for maximum pathogen reduction.

Guide to Backcountry Water Treatment Methods

Treatment Method	Parasites		Bacteria	Viruses
	<i>Cryptosporidium</i>	<i>Giardia</i>	e.g., <i>E. coli</i> , <i>Shigella</i>	e.g., norovirus, rotavirus
Boiling	✓	✓	✓	✓
Filtration				
≤ 1.0 micron ¹ filter	✓	✓	X	X
≤ 0.3 micron ¹ filter	✓	✓	!	X
Disinfection				
<i>Iodine</i> ²	X	!	✓	✓
<i>Chlorine</i>	X	!	✓	✓
<i>Chlorine dioxide</i>	!	✓	✓	✓
Filtration + Disinfection	✓	✓	✓	✓

✓	High effectiveness
!	Moderate-Low effectiveness
X	Not effective

¹ Absolute pore size.

² Water that has been disinfected with iodine is NOT recommended for pregnant women, people with thyroid problems, those with known hypersensitivity to iodine, or continuous use for more than a few weeks at a time.

Boiling water for 1 minute is most effective at removing all harmful microorganisms from untreated water sources. If boiling is not possible, a combination of filtration followed by chemical disinfection is also effective against all microorganism types. Water conditions, filter pore size, disinfection concentration, treatment time, and other factors impact a product's effectiveness. Always follow manufacturer instructions.

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