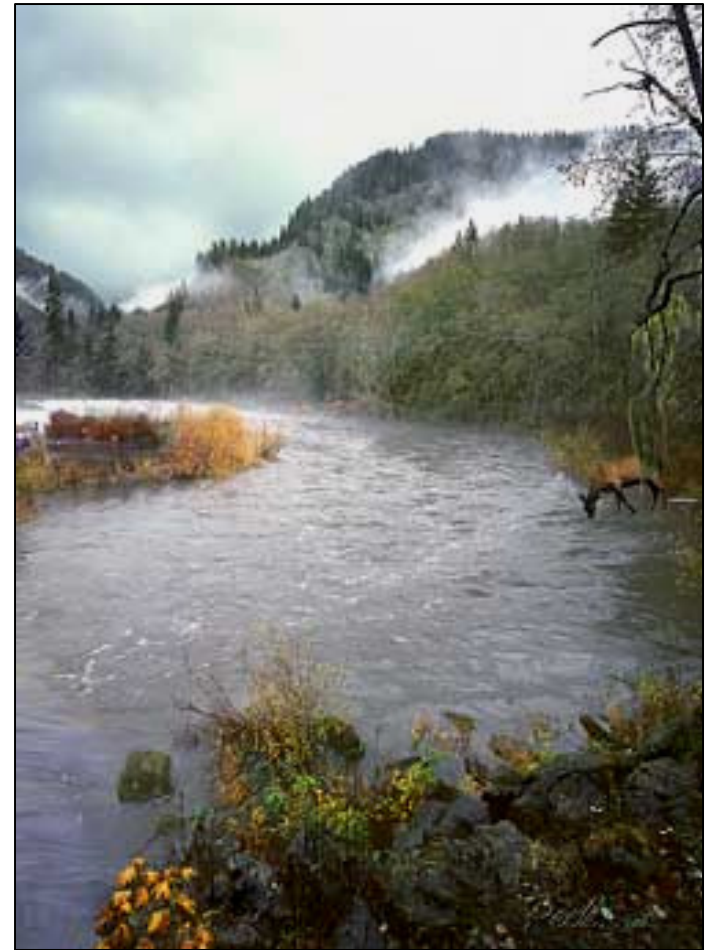


Water



You Need Water



- Avoid Dehydration
 - Searching is hard work!
 - Must drink $\frac{1}{2}$ - 1 gallon/day
 - Eat too!
- Water for the lost subject?

Sometimes You Cannot Carry Enough



Natural caches

Lakes



Streams



**Bogs or lowlands, meadows
hollow logs, natural rock bowls**

Natural cache

- **Snow** – needs to be melted. *You can get sick eating too much snow.*



Contamination



Tips for Selecting Safer Water

- Avoid areas of animal activity
 - Beavers?
 - Deer scat?
 - Cow patties?
 - Humans?
- Still, clear water sources
 - Many microorganisms (Giardia) sink
- Snow or Ice
 - Ice supplies greater water content / snow cleaner
 - Many bacteria impervious to freezing
 - Beware pinkish – toxic algae

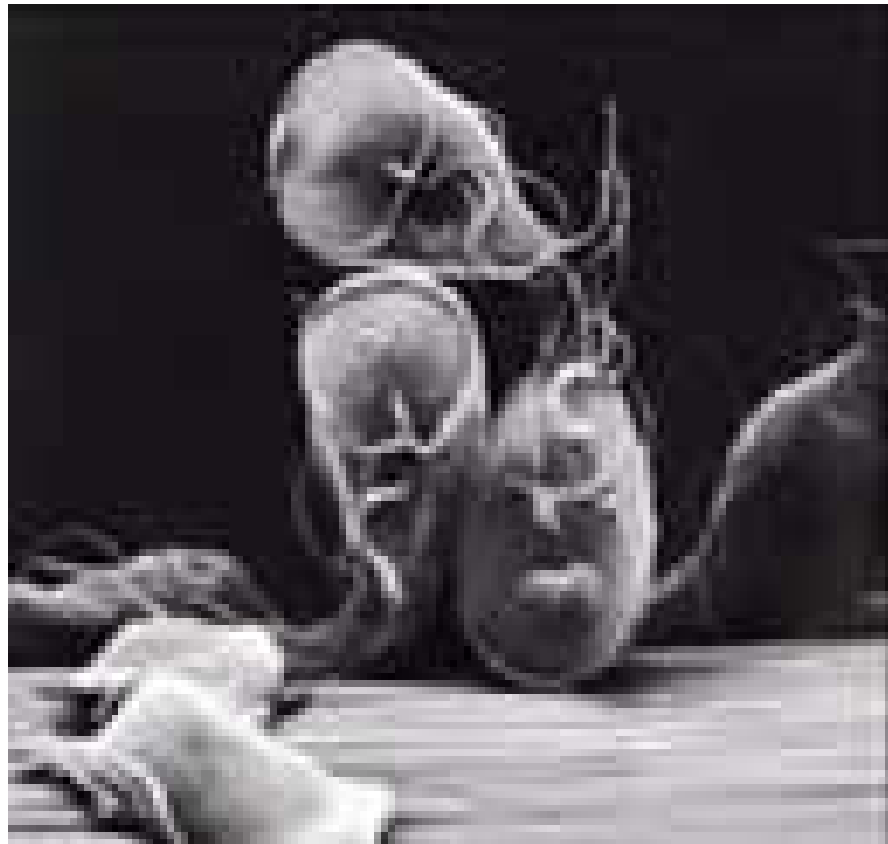
Contaminants - Protozoans

Giardia

- 5 to 20 microns
- As few as 10 cysts will cause gastrointestinal illness.



Trophozoite Stage

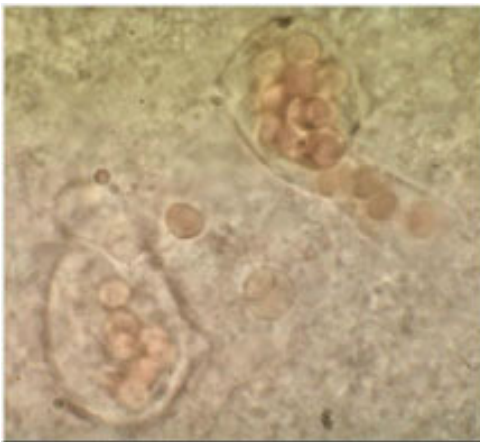


Cyst Stage

Contaminants - Protozoans

Hystolytica

- 5 to 15 microns
- Causes dysentery and ulceration of the colon and liver



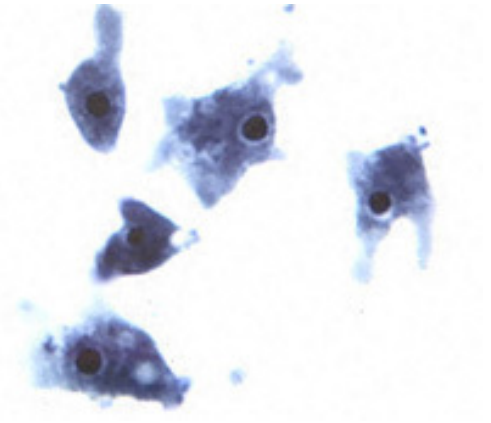
Cryptosporidium

- 3 to 5 microns
- infects the cells of the digestive tract, liver, kidneys, and blood.



Naegleria

- 5 - 20 microns
- Causes meningoencephalitis
- Only 24 infections between 1989 and 2000.



Contaminants - Bacteria



There are many types

- *Escherichia coli (E. coli)*
- *Campylobacter*
- *Salmonella*
- *Shigella*

Most problem bacteria are fecal

Very small (.2 – 10 microns)

Common Symptoms :

- Diarrhea
- Cramping
- Fever

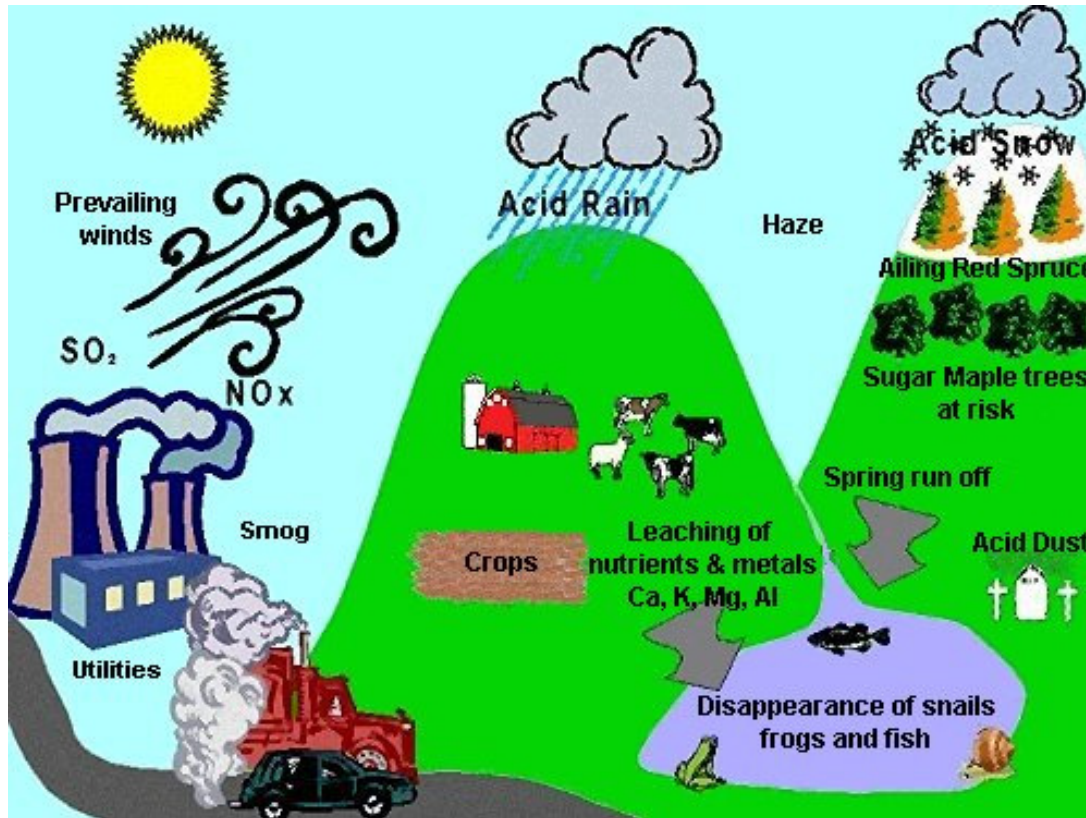
Contaminants - Viruses

Table 1 Human enteric viruses that may be waterborne transmitted

Genus	Popular name	Disease caused
<i>Enterovirus</i>	Poliovirus	Paralysis, meningitis, fever
	Coxsackievirus, A, B	Herpangina, meningitis, fever, respiratory disease, hand-foot-and-mouth disease, myocarditis, heart anomalies, rash, pleurodynia, diabetes?
	Echovirus	Meningitis, fever, respiratory disease, rash, gastroenteritis
<i>Hepatovirus</i>	Hepatitis A	Hepatitis
<i>Reovirus</i>	Human reovirus	Unknown
<i>Rotavirus</i>	Human rotavirus	Gastroenteritis
<i>Mastadenovirus</i>	Human adenovirus	Gastroenteritis, respiratory disease, conjunctivitis
<i>Calicivirus</i>	Human calicivirus	Gastroenteritis
	Norwalk virus	Gastroenteritis, fever
	SRSV	Gastroenteritis
	Hepatitis E	Hepatitis
<i>Astrovirus</i>	Human astrovirus	Gastroenteritis
<i>Parvovirus</i>	Human parvovirus	Gastroenteritis
<i>Coronavirus</i>	Human coronavirus	Gastroenteritis, respiratory disease
<i>Torovirus</i>	Human torovirus	Gastroenteritis

- Polio, Hepatitis A and B, Coxsackie, Norwalk, and ROTA for example
- Viruses pose little danger in the water throughout the U.S. and Canada
- The smallest, and the most dangerous.
- Size – 0.004 to 0.1 microns

Contaminants - Chemicals



- Atrazine
- Arsenic
- Copper
- Mercury
- Nitrates
- *Acid Rain*

Water Treatments

	<i>Boiling</i>	<i>Filters</i>	<i>Osmosis</i>	<i>Chemicals</i>	<i>U.V.</i>
Protozoa	E	C	E	C	C
Bacteria	E	C	E	E	E
Viruses	E	N	E	E	E
Chemicals	N	N	C	N	N
E: Effective C: Conditionally Effective N: Not Effective					

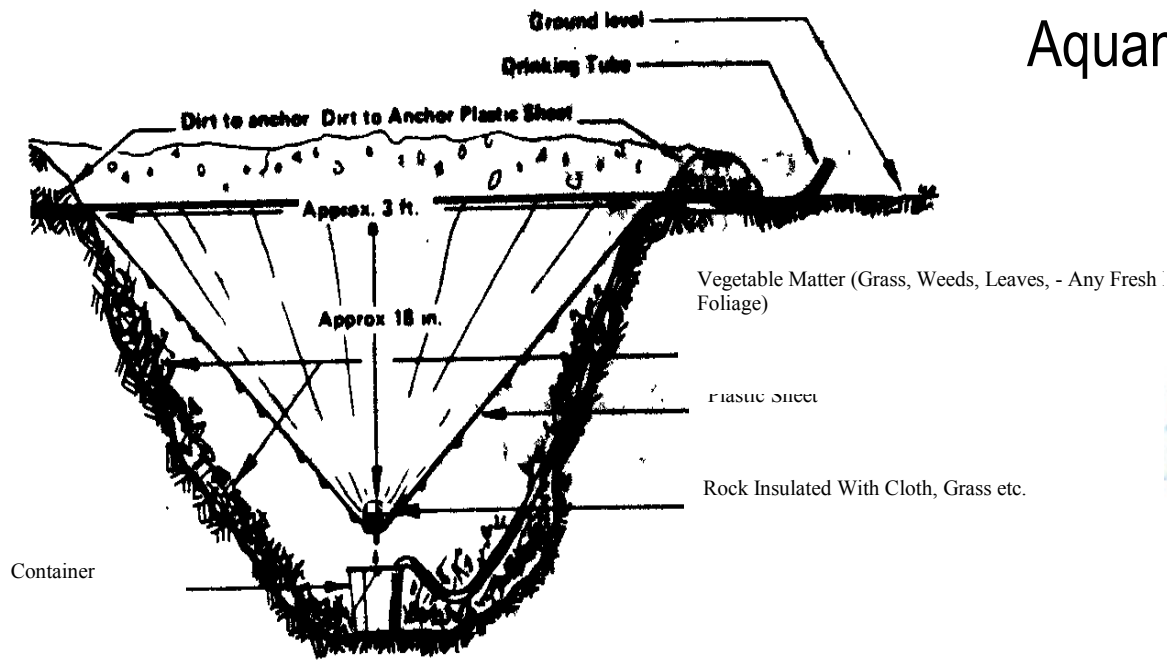
- No perfect treatment solutions
- Many options

Water Treatments: Boiling

- Pre-filter if needed
- *Bring water to a rolling boil* to know temperature is high enough to kill Giardia, Vegetative Bacteria, and Viruses.
- Avoid recontamination



Water Treatments: Condensation/Distillation



Aquamate Inflatable Solar Still



- Practice before you have to build one
- Build more than one to make water

- Inflatable, floats
- <2.4 lbs
- 1-4 pts./day

Water Filters



\$95



\$45



\$75



\$120



\$140



\$70



\$80



\$60



\$50




Basic anatomy of pump filter

*does not remove viruses



Filtering Efficiency is *Relative*

- Pore Size
- Contaminant Concentration
- Pressure, path length, diameter, and extras

Giardia and Cryptosporidium <1.0 micron		Fast and easy. Bacteria can be killed chemically afterwards.
Bacteria < 0.1 micron		Slower. May have pre-filters,
Viruses: < 0.005 micron.		Filtration alone doesn't work. Treatment add-ons (purifiers)

Better filters are tested and certified.

How to select a filter

STEP 1: Decide what level of protection you want.

Protozoans? Bacteria? Viruses? Chemicals? .

STEP 2: Check the pumping rate:

1 liter per minute is reasonably fast.

STEP 3: Filter cleaning & replacement

How often do you plan on using it?

STEP 4: Compare several filters to find the best combination of these features

Chemical Treatments:

Kills

protozoa

bacteria

viruses

Disinfects !



Effectiveness varies by:

- the chemical (tablets, liquids, active ingredients)
- concentration, dosage and water pH
- water temperature (cold takes longer to work)
- what's in the water (turbid water reduces potency)
- contact time

Chemical Treatment Examples

Iodine Based



Coghlan's dry tablets
+ flavor neutralizer



Potable Aqua
dry tablets



Polar Pure
crystals

- Typically takes 20 to 30 minutes to work
- + Indefinite shelf life
- + From \$6 to \$10
- Iodine taste (can be partially neutralized)
- Health restrictions for some

Chemical Treatments:

Chlorine Dioxide Based



Pristine



Aqua Mira

These 2-part systems take 15 to 20 minutes to work (normal chlorine takes longer)

- + Better tasting than iodine systems***
- Four year shelf life**
- From \$10 to \$15**

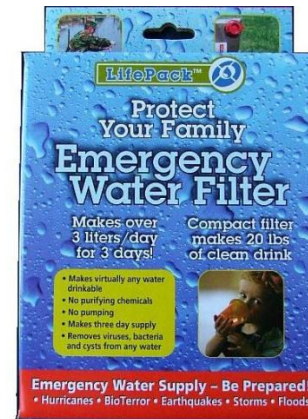
* <http://www.backpackgeartest.org/reviews/>

New Technology

SteriPEN™



- Uses UV light- No pump
- Kills protozoa, bacteria, viruses
- **IF** not hiding behind particles (pre-filter cloudy water)
- \$100 - \$180 (w/solar charger)



- Uses forward osmosis
- No pump- driven by sugar
- Makes a “sports-drink”
- THE MOST THOROUGH FIELD FILTER YOU CAN GET
- \$35 Makes 3L/day x 3 days

Facts & Myths

- If possible drink water that was drawn from
 - The center of lakes
 - Or slow moving rivers
 - Giardia cysts tend to sink to the bottom in quiet waters
 - Fast moving streams keep them suspended
- Freezing will not purify water
- Most disease causing bacteria are resistant to freezing
- Clean snow is preferable to frozen surface water
- Alcohol in liquor can not be relied on to sterilize water in the field
- Rubbing alcohol should **never** be taken internally