

Making Water Fit to Drink

How to Select an Appropriate Technology

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An “appropriate technology” is a method which achieves a desired outcome in the simplest and cheapest possible way. To choose the appropriate water treatment technology, you have to (1) know the health problems posed by your water supply, (2) study the treatments available, and (3) decide how much purification you need or want.

Get Water Tested

Laboratory testing is the only sure way to know if your water supply contains disease-causing microorganisms, toxic metals, or agricultural and industrial pollutants. Fortunately, purification methods exist for almost any problem. Without test results, you have two bad choices: either endanger everyone who drinks the water or buy an expensive, high-tech system that treats for every possible problem (silly if all you need is a carbon filter).

If you plan to use a private laboratory, make sure you get a quality certified lab. Call the Environmental Protection Agency (EPA) Safe Drinking Water Hotline at (800) 426-4761 (382-5533 in the Washington D.C. area) to find out which agency certifies labs in your state. Ask EPA to send current or proposed drinking water standards **and** guidelines for contaminants that currently have no established standards.

After testing, think about how stable the results are. Consider factors which may make the water quality change. Does the river flood? Will crop-dusting or other periodic pollution change the results? Are dead animals likely to show up in your water supply from time to time? If so, you may want to choose a water treatment that goes



Start with a laboratory test.

beyond needs indicated by current test results.

Emergency Quick Fix Tricks

There are procedures you can use in an emergency to reduce the immediate risk in drinking water of unknown quality. These are only stop-gap measures until a more reliable method or safer water supply is available.

Boiling. Boiling water for about 20 minutes will kill bacteria. A “slow boil” in a covered container is best -when steam escapes, the remaining water becomes concentrated with salts and minerals. Boiling is impractical except for small amounts of water.

Chlorine. Water can be disinfected with ordinary household bleach-as long as sodium hypochlorite is the only active ingredient listed on the label. (Do not use bleach with perfumes or other ingredients added.) Chlorine works best and fastest in slightly warm ‘ clear water. Murky water can be clarified somewhat by using a backwoods filter (see below) prior to chlorination.

A medicine dropper is a good mea-

suring device. Clear water needs only about 2 drops to a quart, 8 drops to a gallon, or about 1/2 teaspoon to a 5 gallon jug. Double the amounts for cloudy water. Stir in the bleach and let the water sit for about 30 minutes. Water should have a **slight** chlorine smell. If not, keep adding a few drops at a time until it does. Chlorine kills bacteria and most viruses. It removes some bad tastes and odors.

Ascorbic Acid. Vitamin C does not purify water, but adding a bit to chlorinated water just prior to drinking can help cut the chlorine flavor. Also, chlorine is a strong alkaline and large quantities has been shown to damage red blood cells. Since vitamin C is an acid, it helps bring the water back to neutral.

Beat the Daylights Out of It.

Chlorine and many chlorinated organic chemicals can be beaten out of water with a wire whip or an egg beater. One big drawback -you have to beat it for about 15 minutes.

Pipe Flushing. Water that sits all night in a pump or pipes can absorb large amounts of toxic heavy metals like lead and cadmium. It is a good idea to clear out the lines by running the water full blast for a couple of minutes first thing in the morning.

A Backwoods Carbon Filter.

You can make a reasonably effective filter using a large funnel (or one of those stove top coffee cones), a large coffee filter, and granular activated carbon.

Wash about a quarter cup of the carbon (or soak it several times and pour off the water) to remove the carbon dust. Put the funnel or cone over a jar and line it with a cone-shaped coffee filter. Dump in the washed carbon granules and put another filter paper or a clean cloth on top of the granules to keep them from sloshing around. Pour about a quart of water through the granules. Do not rush. The slower the water passes through the better the carbon can filter it. This backwoods water filter can remove significant amounts of pesticides, chloroform, and organic chemicals. For bacteria problems, it is safest to follow filtering with boiling or chlorination.

Longer Term Solutions

Very Low Technology

Water Bank Wells. If you have no choice but to use surface water, the water quality often can be improved by digging a shallow well 20-30 yards from the water bank. The well will fill with river water, but it will be naturally filtered. Water which travels through 20-30 yards of fine soil (clay, silt, and sand) usually has been stripped of disease-causing microorganisms. Rock and gravel is less effective. If the river floods regularly, you will want to dig the well on higher ground. That means having to dig a deeper well to get to water level, but this precaution avoids having the well flooded with unfiltered water.

Change Drawing Location. A well or spring can become contaminated because underground streams leech contaminants from a polluted site nearby (such as an outhouse or septic tank). If this is the only problem with the water supply, the simplest answer is to move the drawing location and tap into the water supply at an elevation higher than the polluted site.

Low Technology

A Backwoods Water Pre-treatment System. A simple water pre-treatment system can be constructed using a 50 gallon drum (with a lid), gravel, activated carbon granules, and sand. It is a very economical way to remove harmful bacteria and suspended organic matter. Even if lab tests show the resulting water needs further treatment, water pre-treated with this backwoods filtration system will require simpler processing equipment and less chemical treatment. The Environmental Protection Agency's *Manual of Individual Water Supply Systems* provides specifications for this kind of system and Carol Keough's *Water Fit to Drink* contains schematic diagrams.

Commercial GAC Systems. Granular activated carbon (GAC) is an

efficient filter. The best systems drip the water very slowly through a tall column of GAC. (The little filters that screw onto the end of the faucet let the water through too fast to do much good.) These systems can remove or reduce the level of heavy metals (like lead), many halogenated organic compounds like polychlorinated biphenyls (PCBs), and many organic industrial and agricultural chemicals. But they cannot remove asbestos fibers, nitrates or other salts.

GAC filters are breeding grounds for bacteria. Some manufacturers claim to solve this problem by impregnating filters with silver. But, test results show silver is not a reliable bacteriostatic. Worse, the silver may leech into your water and add another toxic metal. The best bet is to skip the silver and change the GAC filter frequently—about every twenty gallons or every three weeks, whichever comes first.

A slow-drip GAC that allows for faucet bypass is the most efficient. It is also the most economical because it allows you to water the garden with unfiltered water.

A Medium Technology Solution

Reverse Osmosis (RO). Reverse osmosis is one of the best all-around water treatment systems. Some people criticize RO systems because they waste water. Reverse osmosis is certainly not a water conservation method. If water is scarce and a sim-

pler process meets the need, you may want to skip reverse osmosis. On the other hand, RO removes many toxic chemicals, detergents, asbestos fibers, fluoride, chlorides, chlorinated compounds, sodium, sulfates, nitrates, silicates, magnesium, copper, manganese, organic matter, and microorganisms. A good reverse osmosis system can even draw drinking water out of seawater.

If water is pre-treated to remove large particles, has a pH under 7.0 (slightly acidic), and isn't too "hard," an RO system with a built-in activated carbon post-treatment filter is hard to beat for most situations. An RO system will work with water that doesn't meet these requirements, but requires more maintenance.

Best of all, the only energy input to a reverse osmosis system is water pressure. That's also the bad news—without water pressure, reverse osmosis can not work at all.

High Technology Solutions

High-technology systems exist which use various combinations of multistage filtering, deionization, distillation, high temperature "flash pasteurization," ultraviolet radiation, or ozone gas treatment. It is unlikely the backwoods homesteader needs to know any more about these.

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