

Chlorination, part two: the removal

In regulated municipal water systems, the U.S. Environmental Protection Agency's Surface Water Treatment Rule requires that a minimum disinfectant residual of 0.2 milligrams per liter (or parts per million) of free chlorine be present where the water enters the distribution system, and that it be detectable. The role of disinfectants in protecting public water supplies is well-documented and undisputed, but the reactions of some disinfectants with some natural materials in water and with other treatment chemicals, and the subsequent formation of unwanted by-products, are of concern. The risk to human health is not clearly documented, but experiments with laboratory animals do raise warning flags, and numerous studies suggest health risks of both chlorine and chlorine by-products.

Some consumers choose to remove disinfection chemicals and disinfection by-products from tap water. This does not itself constitute a health hazard, as your household-plumbing infrastructure is a closed system and you will not be compromising disinfection. What method you use to eliminate chlorine, should you choose to do so, depends on what is in your water (check your local Water Quality Report or lab test results for a well), your contaminant and health concerns, your budget, and (sometimes) your space limitations.

The options for point-of-use chlorine removal include carafes and pitchers, faucet-mounted systems, countertop filters, and undersink filters. These systems should be considered as "chlorine plus" filters, and some systems are limited to little more than chlorine removal. Shower filters are also available to minimize chlorine inhalation while bathing, and some showerheads contain media for reducing metals in the water. Distillation systems are also very effective in solving most drinking-water problems, but because of their high energy consumption they are not widely popular.

It is imperative to know exactly what the filter system you select will actually remove from your water. NSF/ANSI (National Sanitation Foundation International/American National Standards Institutions) standards represent the gold standard for water product certification. See nsf.org/Certified/DWTU/ to search drinking-water treatment units. Almost

all water-filtration products have parts and media certified under NSF/ANSI Standard 61 for "Drinking Water System Components - Health Effects." But the critical standards for contaminant removal are Standard 42 "Drinking Water Treatment Units - Aesthetic Effects" and Standard 53 "Drinking Water Treatment Units - Health Effects." Standard 58 covers the contaminants of known health risk. Technically speaking, chlorine is not considered a contaminant by the EPA.

The most common method of removing chlorine is by using carbon (often misidentified as "charcoal") filtration. Some carbon filters are predominantly made from coal (the use of "iodine content" is a tip-off). But the most effective chlorine filters use GAC (granulated activated carbon) made from coconut shells, a renewable resource that some manufacturers are now making with "green" technology — capturing the greenhouse gases from the ovens used to toast the carbon to create its high volume of surface area.

Activated carbon is effective, but it can provide a base for the growth of bacteria, has to be replaced (or wastefully backwashed) on a regular basis, and becomes less effective through time because of channeling. An increasingly popular method of removing chlorine is by whole-house filtration, both using canister filters and tanks. Both methods are limited by the type of carbon used. One method uses in-line canisters containing carbon block filters that are changed annually. Carbon block filters are created by compressing very finely pulverized, activated carbon in a binding medium and fusing it into a solid block. Carbon block filters can remove particles down to 0.5 microns and also remove Giardia and Cryptosporidium. These filters are so dense that they minimize the potential for bacterial growth.

Other whole-house, chlorine-removal devices are stand-alone carbon tanks used in complex treatment sequences, or tanks which may be combined with embedded electromagnetic devices. These latter systems are frequently backwashed and may waste as much water as a softener. Dealers make claims that such systems eliminate the need for bottled water (if you have not already eliminated it from your life) but they in no way protect you from

more harmful contaminants that might be of concern to you in both municipal and well water.

Remember that EPA regulations only require public water systems to reduce contaminants below the MCL (maximum contamination level) and at certain times of the year individual contaminants may be near or over the MCL. If you are on a well, you are responsible for knowing what is in your water and for electing what (if anything) to remove. Because of the potential for bacteria growth, carbon filtration is often a poor choice on wells except where chlorine is used for specific oxidation applications and then removed by carbon block filters typically changed on a scheduled basis.

Claims for contaminant removal beyond chlorine and chlorine by-products are often undocumented and highly exaggerated. Many filters and whole-house systems are "certified to" but not "certified by" true



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NSF/ANSI standards. Some manufacturers present a self-certified, sliding-scale rating of the contaminant-reduction potential of their products. There is no substitution for independent certification. Caveat emptor.

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NSF/ANSI Certification for Contaminant Reduction

NSF/ANSI Standard	Reduction Performance (Performance Data Sheet)
Standard 42 – Aesthetic Effects	Bacteriostatic effects, chloramine reduction, chlorine reduction, hydrogen sulfide, nominal particulate reduction, scale control, taste and odor reduction, zinc reduction.
Standard 53 – Health Effects	Cysts, lead, VOCs (Volatile Organic Chemicals), MTBE.
Standard 58 – Reverse Osmosis Drinking Water Treatment Systems *	Arsenic V, Barium, Cadmium, Chromium III and VI, Cysts, Fluoride, Nitrate, Nitrite, Radium 226/228, Selenium, and TDS plus effectively everything under Standard 53 because of GAC filtration to protect the RO membrane.

* NSF does not certify against uranium reduction, but post-reverse osmosis lab testing confirms the reduction of uranium

Contaminant Removal by Activated Carbon

Medium	Removes	Does Not Remove
GAC (granulated active carbon)	Chlorine taste and odor, chloramines, mercury, pesticides, radon (poses accum. hazard), THMs, VOCs (volatile organic compounds).	Arsenic, chloramines, chromium, cysts, fluoride, iron, nitrate, radionuclides.
Carbon block	AA plus cysts, lead and HAAs.	AA. (Must be changed regularly.)