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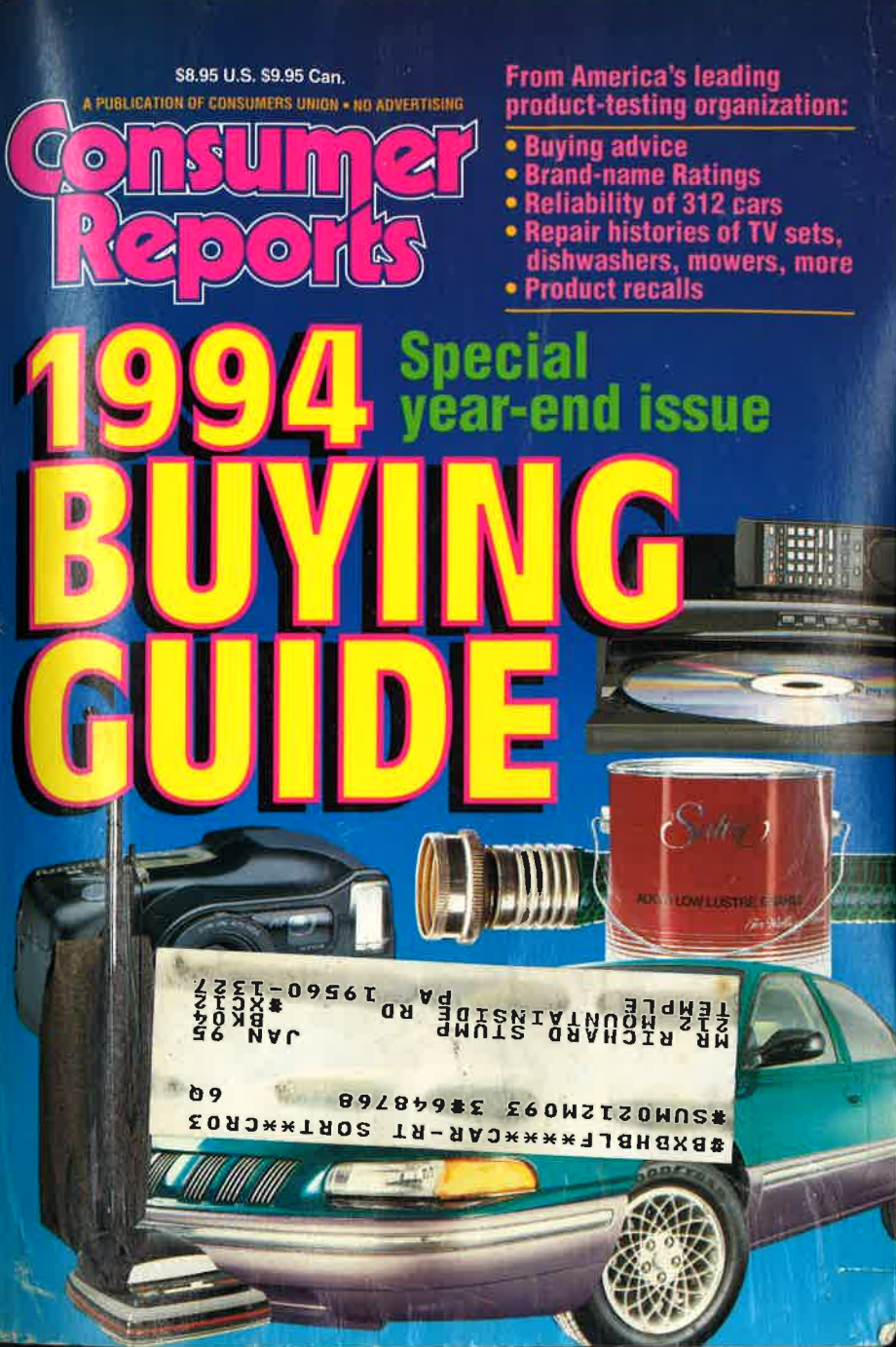

Water treatment

▶ Listings of water filters on page 355.

Most people's drinking water in the U.S. is not seriously polluted. Public supplies are either comparatively clean to start with or are purified to bring them up to par. Some people who sell water filters and other treatment devices, though, hope you don't know that. The less you know, the more easily they can sell you equipment you may not need.

What gives high-pressure or deceitful tactics an air of credibility is that there are some very real drinking water problems. More than 70,000 water contaminants—industrial and agricultural wastes, heavy metals, radon, and microbes—have been identified. While such contaminants may affect only a fraction of the population, those people have justified concerns.

If you're wondering about your water quality, the first step is to find out what's in the water. If you use a community water system, ask for your utility's latest laboratory test results. If you use a well, try to get information on local water problems from your public works department or the local agricultural extension service.

Testing your water

The surest way to know what's in your water is to test it. The *Nordic Ware Water Test Kit*, about $8 at a hardware store, lets you run a few basic water-quality tests at home. It's easy to use and accurate enough for home use. For an extra $6, the *Nordic Ware* kit offers a mail-in test for lead, a useful option. Unfortunately the kit cannot detect most toxic pollutants. If you suspect you have a problem with, say, organic solvents or pesticides, you need to have your water tested by a professional.

If you have your water tested by someone else, use a reputable, state-certified, independent laboratory, not a company that sells water-treatment equipment. Here are three reliable labs we've identified and their prices for a lead test: Clean Water Fund, 704 251-0518, $12; Suburban Water Testing Labs, 800 433-6595, $35; National Testing Laboratories, 800 458-3330, $58. If a test report says your water has a high level of a contaminant, seek confirmation by having the water retested or sent to a second lab before taking costly action.

Pollutants to worry about

Of the thousands of water pollutants, three of the most widespread are lead, radon, and nitrate. Most organic pollutants present only localized problems. Treatment methods are listed in the chart on page 327.

Lead. Significant levels of this toxic metal are more widespread in drinking water than was once assumed (see "Lead in household water" on page 329), and levels once considered safe are now considered health concerns, particularly for infants and children. Even low-level lead exposure may affect learning ability in children and is associated with elevated blood pressure in adults.

Lead gets in water primarily from corrosion of household plumbing or water company service lines or both. Very soft water and slightly acidic water are especially likely to leach lead from soldered pipes and brass fixtures. To help minimize your exposure, use only cold water for cooking and drinking (hot water dissolves more lead). Running water for a minute or so to flush the pipes may help, but it's not a sure cure.

If you have more than 5 ppb (parts per billion) of lead in your water even after letting it run, you should seriously consider doing something about it. This is especially true if your household includes someone at high risk for lead exposure or particularly vulnerable to lead—for example, an infant on a water-based formula (see page 329).

Radon. A naturally occurring radioactive gas, radon probably poses a greater health risk than all other environmental pollutants combined. According to the U.S. Environmental Protection Agency, radon may cause between 10,000 and 40,000 lung-cancer deaths each year. Most of the risk comes from radon that seeps into homes from the ground. But some well water contains dissolved radon, which escapes into the air in the home from sources like showers and washing machines. Exposure to radon from water may cause between 100 and 1800 deaths a year.

Water-borne radon is usually confined to wells in private or small community water systems. Larger systems generally remove any radon before it reaches the tap. Before you test your water for radon, test the air inside your house. If the level is high and you use ground (well) water, have the water tested. If the air level is low, don't worry about the water.

The level that should prompt remedial action is a matter of dispute. According to an EPA official, you should take action if your water's radon level is 10,000 picocuries per liter or higher (that corresponds to about 1 picocurie per cubic meter of airborne radon). Radon is easily dispersed in outdoor air, so aerating the water before it enters the house is usually the simplest solution. Ventilating the bathroom, laundry room, or kitchen may also help dissipate the radon. Other solutions include carbon filters.

Nitrate. High nitrate levels in water pose a risk mainly to infants. Bacteria in immature digestive tracts convert it into nitrite, which in turn combines with hemoglobin in the blood to form methemoglobin, which cannot transport oxygen. The resulting ailment, called methemoglobinemia, is rare but can result in brain damage or death. Some adults, including pregnant women, may also be susceptible to developing methemoglobinemia.

Nitrate in water comes mainly from agricultural activities. Rural families with private wells—especially those with infants or pregnant women—should have their water tested regularly. Some state health departments test wells for free. High nitrate levels may signal that other contaminants are also present.

Treatment choices

If tests show your water supply is contaminated, consider buying bottled water; CU's tests have shown that it's generally clean. If you have a well, you might also try digging deeper to an uncontaminated aquifer. Or you can treat your existing water supply with a water treatment device. Some products on the market use just one of the techniques explained here; others combine two or more. However, none of the types discussed below should be used to treat bacterologically contaminated water. That may require sterilization methods such as UV, ozone, or chlorine.

Carbon filters. These treat a variety of problems, so they're the most popular water-treatment device. They remove residual chlorine, which improves the water's taste, and can also remove organic compounds—chemicals such as pesticides, solvents, or chloroform. But they won't remove hardness minerals or microbes (under certain conditions, they actually breed them).

Carbon filters come in many forms. In-line filters, which serve a single cold-water faucet, are suitable for a household that uses lots of water. Price: about $100 to $500.

Tiny, faucet-mounted filters with a couple of ounces of carbon cost $20 to $30. Pour-through or pitcher devices are priced from $10 to $25. Whole-house carbon filters, which have five-foot-high tanks and can be backwashed, are especially useful for removing radon from the whole house's water. They are priced $1500 and up.

The most practical method of carbon filtration is an in-line filter that treats water at a single location, such as at the kitchen sink. The two main designs are under-sink models and countertop models, which attach with flexible tubes.

Filters and cartridges have to be periodically replaced, at costs ranging from $5 to $100 each time. Manufacturers typically recommend replacing a filter after a certain time or after a given quantity of water has passed through. Some filters have a water meter built in. For a high-volume in-line filter, expect to change cartridges every six months or 1000 gallons.

Reverse-osmosis devices. Reverse-osmosis devices are best at removing inorganic contaminants, such as dissolved salts, ferrous iron, chloride, fluoride, nitrate, and heavy metals such as lead. A carbon filter is incorporated in most reverse-osmosis systems to remove organic chemicals.

Reverse-osmosis devices can be clogged by high levels of hardness minerals. They work slowly, producing only a few gallons of fresh water per day, and they waste several gallons of water for every purified gallon they produce.

At the heart of these devices lies a fine sieve of cellophanelike material—a semipermeable membrane that screens out all but the smallest molecules. Under pressure, only water and other small molecules are able to pass through.

Some versions attach to the cold-water line under the sink; others sit on the counter. Under-sink models run $500 to $850, countertop models about $350 to $500.

Reverse-osmosis membranes need replacement every few years; filters, more often. Replacement membranes cost $45 to $234; filters, another $25 or so.

Distillers. Distillers boil water, then cool the steam until it condenses. Some models include a tiny carbon filter. Countertop units hold from one-half to 2½ gallons. Prices range from $150 to $429.

Distillers are best for brackish water or water polluted with heavy metals; they demineralize it. Anything that won't boil or evaporate stays behind in the boiling pot. Boiling water can also kill microorganisms, but distillers shouldn't be relied on for that purpose. Distillers aren't effective against volatile organics like chloroform and benzene, which vaporize in the distiller and can wind up in the condensed water. A carbon filter might help remove such chemicals, but the filters incorporated into distillers are too small to do it reliably. Distillers are slow, taking a couple of hours to produce the first quart of water.

Since distillers collect and concentrate minerals, scale can build up quickly and must be cleaned out. And since they heat up, they use a lot of electricity—about three kilowatt-hours per gallon of water purified.

Water softeners. Water softeners remove minerals that cause soap deposits, and also remove iron and lead. They don't remove hazardous contaminants like radon, nitrate, or pesticides. They also take a lot of space. A water softener consists of a tank of tiny resin beads loosely coated with sodium ions. When hard water flows in, minerals—principally calcium and magnesium—take sodium's place on the resin. Periodically the softener reverses its flow, taking salt out of a reservoir tank to regenerate the resin beads. The minerals are flushed down the drain.

Some models regenerate at preset intervals, using a timer. More sophisticated models ("demand-control" models) regenerate according to water use. Softeners also differ in size. "Cabinet" units are the most compact size.

The average price for a softener is about $1000, but the price varies depending on installation, local water conditions, and competition among local dealers.

A water softener doesn't require very much care, except for the salt you add now

Water problems and solutions

Recommended if drinking water contains more than "action level" amounts.

	Action level	Carbon filter	Reverse osmosis	Distiller	Water softener	Iron remover	Activated alumina cartridge	Sediment filter	Aerator
AESTHETIC PROBLEMS									
Dissolved iron	—				✔	✔			
Rust stains	—			✔		✔			
Calcium	—				✔			✔	
Magnesium	—				✔				
Chlorine	—	✔							✔
Salty taste	—		✔	✔					
'Skunky' taste	—	✔							
Total dissolved solids (TDS)	500 ppm		✔	✔					
HEALTH HAZARDS - Organic									
Benzene	5 ppb	✔							✔
Carbon tetrachloride	5 ppb	✔							✔
Lindane	4 ppb	✔		✔					
Methoxychlor	100 ppb	✔		✔					
Trichloroethylene	5 ppb	✔							
Trihalomethanes (THM)	100 ppb	✔							✔
HEALTH HAZARDS - Inorganic									
Arsenic	50 ppb		✔	✔					
Barium	1 ppm		✔	✔	✔				
Cadmium	10 ppb		✔	✔	✔				
Chromium	5 ppb		✔	✔	✔				
Fluoride	4 ppm		✔	✔			✔		
Lead	15 ppb		✔	✔			✔		
Mercury	2 ppb	✔	✔	✔					
Nitrate	10 ppm		✔	✔					
Selenium	10 ppb		✔	✔			✔		
HEALTH HAZARDS - Radiological									
Dissolved radon	10, 000 pc/l	✔							✔

and then. You can adjust the level of salt consumption. A high setting ensures softer water but means more frequent refills. A lower setting saves salt and money, but the resin may regenerate less completely.

Iron removers. Dissolved iron in water can leave rusty brown stains in the bathtub and sink. You can use a water softener to remove the iron, but special-purpose treatments are available for water where hardness is not a problem. An iron remover uses an oxidizing agent to precipitate the iron out. One common design is a canister similar to a water softener. Iron removers are priced anywhere from $400 to $650, and are best for removing clear ferrous iron.

Lead-removing filters. Reverse-osmosis or carbon filters designed specifically to remove lead come in different configurations: in-line filters (undersink or countertop), faucet filter, and carafe. Price: $65 to $350. If lead is your only problem, activated alumina cartridges are an effective treatment; cartridges cost $100, the housing $50. For more information, see the discussion of carbon filters on page 325.

The tests

Tests are geared to the type of device. We test the carbon filters using water spiked with chloroform, one of the most common organic compounds found in drinking water.

We test the reverse-osmosis devices using water laden with sodium chloride and 2 to 10 times the Federal limits for lead, cadmium, copper, and barium.

To test for lead removal, we feed tap water spiked with lead nitrate through the units until about 1000 gallons has been processed. For all the devices, we evaluated ease of installation and use.

Buying advice

The chart on page 327 sums up treatment methods recommended for the most common water problems. Before doing business with an unfamiliar water-treatment company, call the Better Business Bureau or a local consumer-protection agency to find out if there are unresolved complaints against it.

In a **carbon filter**, the more carbon the better. Based on our tests, small pour-through filters and fist-sized units that thread onto the faucet can improve the taste of water, but are simply too small to remove hazardous chemicals. High-volume under-the-sink or countertop filters do a much better job. Look for those with a replaceable filter cartridge. Cartridges made either with a "carbon block" or granulated carbon are better than those with powdered carbon.

If your carbon filter has a built-in sediment filter and your water contains a lot of undissolved solids, the sediment part may clog before the carbon is used up. To extend the filter's life, install a separate sediment prefilter upstream of the carbon. A 5- to 10-micron mesh is fine enough. A clear plastic sump on the filter housing indicates when the cartridge needs changing.

If you're considering a **distiller**, look at how easy it is to fill or clean. We found little variation in how well distillers removed inorganic compounds.

Any **water softener** will do an acceptable job of removing minerals, according to our tests. For greatest efficiency and minimum salt consumption where water use varies from week to week, a demand-control model is best.

For **iron removal**, costlier models have the advantage of removing more iron and regenerating automatically rather than manually. They're designed for high iron levels. Aeration devices can precipitate and remove iron and also radon.

Use the diagram on page 329 to determine whether you need a water-treatment device and, if so, what kind.

Lead in household water

To find out how common significant levels of lead are in drinking water, CU tested water from the homes of more than 2600 CONSUMER REPORTS subscribers in 1992. About 60 percent of those surveyed live in eight major cities and the rest are throughout the country. Samples included first-draw water, water that had stood in pipes for hours, and purged-line water, taken after running the tap for one minute. Both types were needed to distinguish lead due to household plumbing from that due to outside sources.

While results showed no sign that high lead levels in water are a widespread national problem among our readers, one region—the Northeast—had significantly more first-draw samples above the U.S. Environmental Protection Administration's "action level" of 15 parts per billion (ppb) than the rest of the country. Results from individual cities provided further reason for concern. Large numbers of households in Chicago and Boston had high levels of lead in both types of samples.

Lead levels were lower in New York, San Francisco, and Washington, but still above the national average. Households in Atlanta, Des Moines, and Seattle had relatively few high-lead samples.

Standard advice for houses with a potential lead problem has been to let the water run for a minute or two to clear the line of water into which lead has leached. Our tests showed that isn't always effective; in some cases, it seemed to worsen the problem. Our tests also point out that individual households can have high lead levels even if they're in communities that don't seem to carry a high risk.

Communities that fail the tests required of all public utilities by the EPA are legally required to institute some type of corrosion control by 1997.

WHAT ACTION SHOULD YOU TAKE?

If your water contains lead, you can use this diagram to decide whether you need a water-treatment device and, if so, what kind. First-draw water has stood in the pipe for a few hours; purged-line water is taken after you've let the tap run a minute or two.