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1992 BUYING GUIDE ISSUE

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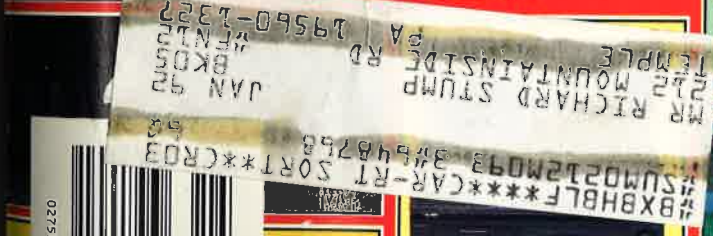

WATER TREATMENT

Brand-name Ratings of devices begin on page 259.

For most people in most parts of the country, there's nothing harmful in the drinking water. Public supplies, whether from wells or municipal reservoirs, are either clean to start with or are clarified to bring them up to par. Some of the people who sell water filters and other treatment devices hope you don't know that. The less you know about what's in your water, the easier less-than-scrupulous salespeople can sell you equipment you may not need.

Plenty of responsible businesses and salespeople are in the water-treatment business. But the selling of water-treatment devices has itself become polluted by high-pressure sales tactics used by sellers of legitimate products and by deceitful sales tactics used by scam artists selling unneeded products.

Door-to-door water-treatment purveyors sometimes pose as pollsters taking a survey. Once inside the door, they may flourish newspaper clippings about local water problems and "test" your water on the spot. In one supposed test, an unnamed chemical, often a flocculating agent, is added to a sample of the homeowner's tapwater. When a sludgelike residue precipitates to the bottom of the container, the salesperson cites that as proof that the household water needs treatment. Actually, the chemical agent has just made ordinarily harmless minerals settle out in a way that visually exaggerates their importance.

What gives these scare tactics an air of credibility is that some drinking water problems are very real. More than 70,000 known contaminants—industrial and agricultural wastes, heavy metals, radon, and microbes—have been found in water. While such contaminants may affect only a portion of the population, they have with good reason drawn attention.

If you're concerned about your water quality, the first step is to find out what's in the water. If you draw your water from a community water system, ask to see the water utility's latest laboratory test results. If you have a private well, you might be able to get information on local water problems from your town public works department or from the local agricultural extension service.

Before doing business with any company you don't know, call your local Better Business Bureau or consumer-protection agency to find out if there are unresolved complaints against it. If you have complaints yourself, report them to the local office of the BBB and to the Federal Trade Commission (Washington, D.C. 20580). You can get information about water treatment from the Water Quality Association, a trade group (4151 Naperville Rd., Lisle, Ill. 60532).

How to test your water

Don't depend on tests done by companies that sell water-treatment equipment. Consult a reputable, state-certified, independent laboratory. Tests cost from $20 to $200, depending on their complexity.

You can often find a lab by asking a local realtor or by looking in the Yellow Pages under "Laboratories—Testing." Or you can use a mail-order lab. Our past tests have turned up three reliable ones: *WaterTest*, 33 South Commercial St., Manchester, N.H. 03101, telephone 800-426-8378; *National Testing Laboratories*, 6151 Wilson Mills Rd., Cleveland 44143, telephone 800-458-3330; and *Suburban Water Testing Laboratories*, 4600 Kutztown

Rd., Temple, Pa. 19560, telephone 800-433-6595. (The 800 numbers are for out-of-state callers.) Mail-order labs send you a kit containing collection bottles and detailed instructions. You ship back samples to them by overnight express delivery and receive the results two to three weeks later.

Over the years, we have found that all labs tend to overstate or understate results occasionally. If the test report says your water has an especially high level of a contaminant, have it retested or sent to a second lab before taking costly action.

Pollutants to worry about

Of the thousands of potential water pollutants, three stand out as most worrisome—lead, radon, and nitrate. According to health experts we consulted, those substances account for most of the waterborne health hazard posed to the U.S. population, based on the number of people exposed and the strength of the evidence indicating a hazard.

Most organic chemicals that pollute water present only localized problems. But many public water supplies contain low levels of trihalomethanes and related compounds that are byproducts of water chlorination. Some evidence suggests that those chemicals may contribute slightly to cancer risk. That risk, however, must be weighed against the significant disease-prevention benefits of chlorination. The U.S. Environmental Protection Agency requires water systems that serve more than 10,000 to keep the byproducts below 100 parts per billion. Treatment methods for trihalomethanes and other pollutants are listed in the table on page 253.

Lead

It has been known for decades that lead is highly toxic and that it often turns up in drinking water. But two recent developments have heightened concern. Surveys have found that significant lead levels are much more commonplace than had been assumed. And levels once considered safe are now known to threaten health, particularly the health of infants and children. Recent studies show that low-level lead exposure may cause permanent learning disabilities and hyperactivity; such exposure is associated with elevated blood pressure, chronic anemia, and peripheral nerve damage.

Who's likely to have the problem? Very little lead occurs naturally in water. It gets there primarily from corrosion of plumbing that contains lead. There are three main sources: lead service pipes from mains, banned since 1986 but widely used before that in the northern U.S., especially in homes built between 1910 and 1940; leaded solder (also banned in 1986) used to join copper pipes within the house; and the brass in faucets, which contains from 3 to 8 percent lead. Very soft water, which is more corrosive than hard water, is especially likely to leach out any lead that may be present in the plumbing.

What to do. Lead levels are measured in parts per billion, or ppb. While a level of 50 ppb or less was long considered safe, concern over the effects of chronic low-level exposure has prompted the EPA to set a tougher standard. A new level of 15 ppb was set in 1991. (For more information, you can call the EPA Safe Drinking-Water Hotline, 800-426-4791.)

You can minimize your exposure to lead by using these steps:

Use only cold water for cooking and drinking. Hot water can draw more lead from the plumbing.

Run the water until it's as cold as it's going to get before drinking it, especially first thing in the morning.

If a test reveals that your water contains more than 15 ppb of lead even after it has run cold, you may want to switch to bottled water or install a treatment de-

vice. The least troublesome device is an activated alumina lead-removal cartridge installed on a cold-water line. We liked one we tested, the *Omni Total* (formerly the *Selecto Lead Out-20*). The cartridge costs about $80, and is claimed to be able to treat 15,000 gallons of water. It fits a standard water-filter housing, which costs about $35 plus installation. You could also use a distiller or reverse-osmosis device, but they're needlessly slow if lead is your only water problem.

Radon

Radon, a naturally occurring radioactive gas, may pose a greater health risk than all other environmental pollutants combined. According to EPA estimates, inhaled radon gas causes between 10,000 and 40,000 lung-cancer deaths each year. Most of that exposure comes from radon gas that seeps into a house from the ground. The inhalation exposure caused by radon gas that is released from household water may cause between 100 and 1800 deaths a year, making radon gas more lethal than any other drinking-water contaminant.

Who's likely to have the problem? Water-borne radon is usually confined to well-water systems, either private wells or small community water systems serving fewer than 500 people. Larger systems may include some form of aeration device that allows the dissolved radon gas to bubble out and disperse harmlessly before water is delivered to the tap. The EPA estimates that at least eight million people in the U.S. may have high levels of radon in their water supply.

What to do. Before you test your water for radon, test the air inside your house (see CONSUMER REPORTS, October 1989). If the radon level in the air is high and you use ground water, have the water tested as well. If the level of radon in the air is low, you needn't worry about the water.

The level that should prompt remedial action is a matter of dispute. According to an EPA official we consulted, you should definitely take action if the water's radon level is 10,000 picocuries per liter or higher (that corresponds to about 1 picocurie per liter of airborne radon).

Radon, so dangerous in a closed space, is easily dispersed in outdoor air. Simply ventilating the bathroom, laundry, or kitchen may be sufficient to dissipate waterborne radon gas. To remove radon from water requires treating all the water entering the house, not just a tap you use for drinking water. That means installing a whole-house granular activated-charcoal filter (about $1500, plus installation) or a home aerator that vents the radon outdoors (about $1000 to $2000, plus installation).

Nitrate

High nitrate levels in water affect mainly infants. Their immature digestive tracts convert the relatively harmless substance into nitrite, which in turn combines with some of the hemoglobin in the blood to form methemoglobin, which cannot transport oxygen. The ailment is rare, but can result in brain damage or death. Some adults, including pregnant women, may also be susceptible to developing methemoglobinemia.

Who's likely to have the problem? Nitrate occurs mainly in well water, usually as a result of agricultural activities. Chemical fertilizers and manure contain nitrates and other nitrogen compounds that convert to nitrate in the soil, where it readily migrates into ground water. Rural families—especially those with infants or pregnant women—should have their wells tested regularly for nitrate. Some state health departments test private wells for free. High nitrate levels may signal that other contaminants—agricultural pesticides or bacteria and viruses from a leak-

ing septic tank—are also present.

What to do. Removing nitrate from household water is not so simple. You could treat the water with a reverse-osmosis or distillation device. Or you could dig a deeper well, to an uncontaminated aquifer, or solve the problem by switching to bottled water.

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	✔							✔

Water-treatment devices

Carbon filters

Carbon filters can treat a variety of both aesthetic and safety problems, so they're the most popular and versatile water-treatment device. They come in many forms. High-volume filters—in-line filters that serve a single cold-water faucet—typically cost $100 and up. Tiny, faucet-mounted filters that contain a couple of ounces of carbon cost $20 to $30. Pour-through devices that work a little like manual drip-style coffee makers can cost less than $10. Whole-house carbon filters ($1500 and up) have five-foot-high tanks and can be backwashed.

The most practical are in-line filters that treat water at a single location, such as at the kitchen sink. The two main designs are under-sink models, which tie into a water line and have their own spigot next to the sink taps, and countertop models, which sit on a counter and attach with flexible tubes to a sink faucet.

At the heart of a carbon filter is activated charcoal: carbon that has been heated until it develops a honeycomb of tiny channels. As water passes through that labyrinth, specific contaminants adhere to the walls of the channels. Carbon filters work best when they work slowly enough to ensure adequate contact time between water and carbon. Most we tested come with narrow, quarter-inch tubing, which helps limit the water flow.

Best at: Removing organic compounds—chemicals such as pesticides, solvents, or chloroform. Carbon units can also improve water's taste by removing (usually) harmless chemicals causing off-flavors and smells. Carbon won't remove hardness minerals or most heavy metals.

The down side. Carbon can't remove microbes (indeed, under certain conditions, a carbon filter can breed them) or much sediment.

Upkeep. The filter or its cartridges have to be routinely replaced, at a cost of $5 to $100. A filter's longevity depends on water use and the level of pollutants in the water, not easily gauged. 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 to make assessing that easier. For a high-volume in-line filter, you should expect to change the cartridge about every six months or 1000 gallons.

The tests. We used water spiked with 1 part per million of chloroform, 10 times the maximum allowed by the EPA. Since chloroform can show up as a byproduct of chlorination, it's one of the most common organic compounds in drinking water.

Buying advice. The more charcoal the better. Our tests showed that the small pour-through filters that work like drip-style coffee carafes and the fist-sized units that thread onto the end of a faucet are simply too small to be relied on for removing hazardous chemicals. High-volume filters such as under-sink or countertop devices do a much better job.

Look for those that have replaceable filter cartridges. Some do not, which means that the whole filtration unit has to be returned to the manufacturer—or thrown out—when the carbon is spent.

A standard-sized carbon cartridge measures about 9¾ inches high by 2½ to 3 inches in diameter. Look for replacements made either with a "carbon block" or with granulated charcoal. They do better than the designs with powdered charcoal.

Some carbon filters come with a built-in sediment filter, but if your water contains significant amounts of undissolved solids,

the sediment part may clog before the carbon is used up. To extend the life of the filter, install a separate sediment prefilter upstream of the carbon. A 5- to 10-micron filter is usually fine enough. A clear plastic sump enables you to see when the cartridge needs changing. Cost of such a prefilter: about $50 plus installation.

Reverse-osmosis devices

If a carbon filter resembles a dense maze, a reverse-osmosis device resembles a fine sieve. At the heart of the system is a rolled-up cellophanelike material, the semipermeable membrane that screens out all but the smallest molecules. When water under pressure is pushed against the membrane, only water molecules and small organic molecules are able to pass through.

Reverse-osmosis systems generally attach to the cold-water line under the sink or sit on the counter. Under-sink models run $500 to $850 or so. Countertop models run a little less, perhaps $350 to $500.

A reverse-osmosis system typically consists of three filter elements: a sediment filter to cull out coarse solids, the semipermeable membrane, and a carbon-cartridge postfilter. Under-sink models usually come with a two-gallon storage tank, which feeds a spigot next to the sink. With countertop models, water drips directly into the collection vessel.

Best at: Removing inorganic contaminants, such as dissolved salts, ferrous iron, fluoride, nitrate, and heavy metals such as lead. The carbon filter integral to most reverse-osmosis systems removes organic chemicals.

The down side. Reverse-osmosis devices can be clogged by high levels of hardness minerals, such as calcium and magnesium. They also work slowly. The units we tested produced a few gallons of fresh water per day at most. Most took three to six hours per gallon. And they waste a lot of water. Only 10 to 20 percent of the water pumped through them is processed. The rest is rejected as a waste stream, at the rate of 10 to 25 gallons a day for most models tested. Some units stay on all the time, pouring up to 40 gallons a day down the drain, even if not in use.

Upkeep. Filters and the semipermeable membrane will probably need replacement about once a year. Replacement membranes cost $45 to $234, filters another $25 or so. Annual upkeep costs would range from 10 to 36 cents per gallon of drinking water produced.

The tests. We used water laden with 600 parts per million of sodium chloride (a representative dissolved solid) and 2 to 10 times the Government's allowable limits for lead, cadmium, copper, and barium. We also measured the removal of calcium, a hardness mineral.

Buying advice. The best models in our tests removed at least 96 percent of the dissolved solids; the worst, less than 70 percent. All the models did well at removing lead and other heavy metals. (But a cheaper and faster method for removing lead is an activated-alumina filter system.)

The semipermeable membrane can be made of thin-film composite (TFC, in the trade) or cellulose triacetate (CTA). TFC does a faster, more efficient job, but degrades in the presence of chlorine. It requires a carbon prefilter when used on chlorinated water. The cellulose type is cheaper (replacements cost $45 to $130, about half what TFCs cost) and holds up better in chlorinated water, but can be degraded by microbial contamination. The TFC type performed best in our tests.

Distillers

Distillation is the brute-force way to remove impurities from water. A distiller boils water, then cools the steam until it condenses; the resulting distillate drips into a jug. Some models include a tiny

carbon filter. The countertop units we tested hold from one-half to 2½ gallons. We paid $150 to $429 for them.

Best at: Brackish water or water polluted with heavy metals. Distillation demineralizes water. Salts, sediment, metals—anything that won't boil or evaporate—stay behind in the boiling pot. Boiling water long enough can also kill microorganisms. The models we tested should be used only on microbiologically safe water, however.

The down side. Distillers are not effective against chemicals known as volatile organics, which include chloroform and benzene. Volatile chemicals vaporize in the distiller and can wind up in the distilled water. The carbon filter built into many models might help remove such chemicals for a while, but the ones we saw were tiny; far too small to do it reliably. Distillation is slow; most models took about two hours to produce the first quart of water and about an hour to produce additional quarts.

Maintenance. Since distillers collect and concentrate whatever minerals are present in the tap water, white, powdery scale can build up quickly and must be cleaned out periodically. Distillers cost a lot to run, as it takes considerable energy to convert a gallon of water into steam. We calculate that these units would use about 24 cents worth of electricity per gallon (at the national average rate of 7.75 cents per kilowatt-hour). Heat is also added to the room, enough to add maybe 6 cents per gallon of water produced to the cost of running an air-conditioner.

The tests. We used water spiked with phenol, a volatile organic. We also distilled 50 successive batches of mineral-laden water.

Buying advice. We found little variation in how well distillers removed inorganic compounds. Differences in design might matter. One design helps keep scale from building up with a floater switch that prevents the unit from boiling dry. Lifting the head off a distiller to refill or clean it can be heavy work. On one model, the cover alone weighs seven pounds.

Water softeners

The principle of water softening has changed little over the last 60-odd years. Despite that fact, water-treatment sellers may describe softeners as "water conditioners" or "treatment devices," and expand the sales pitch to include other products. A water softener consists of a tank of tiny synthetic resin beads loosely coated with sodium ions and a reservoir of rock salt. When hard water flows into the softener, hardness minerals cling to the resin, changing places with the sodium. Periodically the softener reverses its flow, taking salt out of its reservoir tank to regenerate the resin beads. Hardness minerals, which are principally calcium and magnesium, are flushed down the drain. The regeneration process usually takes an hour or two, during which you'll have no softened water.

Softened water contains extra sodium (about 100 milligrams of sodium per quart, if the water is moderately hard). People on sodium-restricted diets should avoid drinking softened water; if a softener is needed in a household where someone must watch their sodium intake, it can be plumbed to serve appliances and the bath or shower by softening only the intake to the water heater.

Softeners differ in how often they regenerate. A softener controlled only by a timer will regenerate at regular intervals whether it really needs to or not. More sophisticated models, called "demand-control" types, electronically monitor either water flow or hardness to tailor regenerations to actual water usage. Some models use mechanical flow meters to determine the regeneration cycle and wa

ter pressure to do the flushing. No electrical connection is needed.

Softeners also differ in size. "Cabinet" units are the most compact. Their resin tank is enclosed within a larger tank that holds anywhere from 60 to 260 pounds of salt. Models with separate salt tanks can hold up to 360 pounds.

The average price for a softener is about $1000, but prices vary dramatically depending on installation, local water conditions, and dealer competition.

Best at: Removing the hardness minerals that lead to soap deposits in tub and sink, dull-looking clothes, spots on dishes, scaly deposits on faucets and kettles, and scale inside water heaters. They can remove some iron and lead from water.

The down side. Water softeners don't remove hazardous contaminants like radon, nitrate, or pesticides. Every time the unit regenerates, it flushes water down the drain (typically 30 to 50 gallons per 1000 gallons softened, along with a few pounds of salt, in our tests). Water softeners take a lot of space, consisting of one or more canisters about four feet tall.

Upkeep. A water softener shouldn't require much care and feeding beyond the periodic addition of salt. A softener consumes about a pound of salt to remove 3600 to 5000 grains of hardness from the water. For the models we tested, which have a capacity of 20,000 to 30,000 grains, each complete regeneration would use five to six pounds of salt. The frequency of regeneration depends on the type of unit; demand-control models are most efficient.

While you or the dealer can normally adjust the level of salt consumption, it's a bit of a balancing act. A high setting will insure that the water stays soft, but will mean more frequent salt refills. A lower setting will save a bit of money but the resin will regenerate less completely.

The tests. We concocted very hard water (about 24 grains per gallon).

Buying advice. It's safe to assume any water softener will do an acceptable job of removing minerals. Our tests showed little difference in performance. If your water use is fairly steady and predictable, a water softener with a simple timer should prove adequate. Look for one whose timer control has 14 pins, rather than 6 or 12. That way you can set the unit to regenerate on the same days each week. For water that varies from week to week, a demand-control model will be more efficient.

Iron removal

Dissolved iron in water, sometimes referred to as ferrous iron or clear iron, can leave brown stains in the bathtub, sink, toilet, dishwasher, and clothes washer. The stains are rust from the dissolved iron oxidizing on contact with air. A water softener may remove moderate levels of ferrous iron, but special-purpose iron treatments are available for water where hardness is not a problem.

An iron remover employs an oxidizing agent, such as air or potassium permanganate, that reacts with dissolved iron and precipitates it out. One common design is a canister about five feet high, rather like a water softener. Inside is a supply of potassium permanganate and a sediment filter that traps the precipitated iron. Periodically the device backflushes the filter, dumping the iron particles down the drain. Iron removers cost anywhere from $400 to $650.

Best at: Removing ferrous iron.

The down side. The device's backwash cycle may make a loud thrumming noise for a few minutes each day.

Buying advice. Costlier models store greater quantities of potassium permanganate and regenerate themselves automatically rather than manually. They're designed for high iron levels: more than 20 parts per million. Aeration devices can also precipitate and reduce iron.