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Despite progress, American water supplies are erratically monitored and may contain contaminants with long-term health effects. Millions drink water that violates federal health guidelines.

Radon

Natural radiation appears in drinking water in isolated parts of the country. Arising from underground uranium deposits, it reaches water as radon, which can be inhaled during bathing.

Chemicals

Industrial chemicals such as benzene, trichloroethylene, and gasoline additives can seep into water and cause diseases of the kidney, liver, and brain. Effects on reproductive organs are being studied.

Pesticides

Farmers used 1.25 billion pounds of pesticides and herbicides in 1995. Despite their earthy image, farmers usually side with chemical companies in anti-regulation lobbying.

Microorganisms

Cryptosporidium and other organisms like *cyclospora* and *mycobacteria* have evolved resistance to chlorine, the traditional treatment for disinfecting water.

Lead

Lead was known to be toxic in Roman times but is loosely regulated today. The replacement of municipal pipes will take decades, and many homes may never get new lead-free plumbing.

Industrial Waste

Factories and farmers do not pay to clean up wastes; taxpayers do. Most U.S. water treatment plants do not have technology to remove industrial or agricultural chemicals.

Don't take your drinking water for granted. Here's why you should get it tested and how.

By Mark D. Uehling

How Safe Is Your WATER?

ROBIN SMITH GOT UP HER NERVE. A housewife in Mechanicsburg, Virginia, she got her tap water tested—a step few Americans dare to take. Smith's envelope came back from the laboratory with bad news. "We don't drink our water," she says flatly. "Haven't for three years."

The amount of lead in her water, the lab reported, was more than double the level at which the U.S. Environmental Protection Agency advises people to take corrective measures.

Smith can't afford to replace the pipes in her home, and she realizes that swallowed lead could damage her brain cells and those of her two-year-old twins. So she hauls drinking water by car from the homes of her sister or her mother-in-law, who live nearby. Smith is just one of many Americans who are concerned about the quality of their drinking water. While officials repeatedly boast about the virtues of U.S. water supplies, the public is suspicious. Last year, Americans spent \$2.1 billion on bottled water and \$450 million on

PHOTO-ILLUSTRATION BY MARC TAUSS

Is Bottled Water Better?

THERE ARE SERENE SPRINGS and wells tapped by scrupulous companies that lovingly fill each bottle. But roughly one-quarter of all bottled water comes from the same rivers and lakes as municipal water. The massive quantities sold last year—2.43 billion gallons, or nine gallons for each American—make it unlikely that the stuff in your supermarket recently trickled out of the side of an alpine rock formation far from civilization.

So why bother? Because the best bottlers take additional steps to purify their product. "We don't want to scare anyone into drinking bottled water, but bottled water companies pick up where the EPA and the city treatment leave off," says Jennifer Levine of the International Bottled Water Association.

If tests confirm that your water is contaminated, bottled water can be a good solution. In a few isolated cases, however, government tests have found arsenic, bacteria, and industrial compounds in bottled water. So the only way to be sure that the bottled water you buy is superior to what comes out of your tap is to check the processing method.

Unfortunately, many terms used on bottle labels are not regulated by the FDA. "Pure," "natural," "organic," and "100%" are meaningless, and among the industry's favorite ploys. It would be perfectly legal to sell "glacier" water from a ditch in Gary, Indiana. "Those [words] don't have any meaning," admits Levine. "That's just marketing." Perhaps the biggest loophole is that water that is purified or distilled before bottling need not be labeled with its source. So your bottled water could be coming from the same place as your neighbor's tap water.

Even terms sanctioned by the FDA can seem silly. "Spring" water need not flow out of a spring; it just has to have the same composition as water that does so nearby. "Mineral" water refers to water with less than 250 parts per million of dissolved solids, not the stuff found under a rock in a pristine corner of Alaska.

A few regulated phrases are useful to buyers of bottled water. "Artesian" means well water from contained underground bodies of water, which are more protected from—but not completely immune to—agricultural runoff and industrial contaminants. "Purified" refers to water that has been treated in one of four ways: distilled by boiling, disinfected with ozone, filtered through absorbent carbon, or filtered through a membrane by reverse osmosis. Both purified and artesian water are free of lead. —M.D.U.



home treatment systems. At the heart of those two booming industries looms a question: Is my water safe?

Experts turn the question around, wondering if people who buy bottled water are easily frightened. "It's a lack of information, quite frankly," EPA Administrator Carol Browner told POPULAR SCIENCE. Which is not to say she has a rosy outlook: "I wouldn't take for granted the safety of this nation's drinking water. We still have very serious problems."

The truth about America's drinking water is simultaneously reassuring and disturbing. Our water has never been safer: Experts now worry about quantities of contaminants that could not be measured when the Clean Water Act was passed in 1972. Age-old scourges like cholera, dysentery, and polio—waterborne diseases still ravaging poor countries—are rare here. But new threats, threats specific to the late 20th century, are not being squarely faced by government at any level.

"There is a huge segment of the population in the 20th century in America who can't go to their own taps," laments Brian Cohen, a water expert at the Washington-based Environmental Working Group. "We have not upgraded and invested in our drinking water treatment."

For roughly half of all Americans, tap water comes from lakes and rivers. For another 35 percent, it comes from underground aquifers. The remaining 15 percent of Americans rely on private wells, which are not regulated. But it hardly matters where you get your water, because any source can become tainted. **Even if you buy your water at the store, there's no guarantee that it's safe.** The biggest threats to the nation's water supply include three broad categories of contaminants, none of which are systematically removed by standard sand filtration and chlorine treatment:

- **Industrial and agricultural chemicals.** These have turned up in both well water and lakes. Known to interfere with hormonal systems in wild and laboratory animals, they may cause behavioral disorders, learning disabilities, and reproductive problems in humans.
- **Lead.** Used in plumbing, lead can cause brain damage even at low concentrations. Though lead pipes are no longer sold in the United States, lead is still allowed in new faucets because of lobbying by plumbing manufacturers. Lead monitoring programs are designed with budgets, not health, as the top priority.
- **Biological organisms.** Water treatment plants release 1.2 trillion gallons of raw sewage annually, much of which flows downstream to someone else's water supply. Organisms such as *Giardia* are growing resistant to chlorine disinfection, just as microbes infecting the body are becoming resistant to antibiotics.

"You know how government is. You don't get all the results right away."

EPA figures show that in 1994, 45 million Americans, or about 17 percent of the nation's population, lived in communities that had violated water-related health standards at least once. In 1995, EPA data show, 69 million Americans lived in communities that exceeded the recommended levels for lead, and 12 million people were exposed to water that the EPA says should have been filtered but was not. Roughly 150,000 violations of the Safe Drinking Water Act occur annually, and few penalties are imposed for any of those except in high-profile cases.

And though you might assume someone is checking your water 24 hours a day, in actuality there are no requirements for daily, or even weekly, monitoring for chemicals, lead, or pesticides. Many contaminants are checked once every four years, if at all. Waivers and exemptions to pollution-monitoring requirements are granted readily and legally. Loopholes make it easy for uncertified, untrained water "engineers," especially at smaller utilities, to hide problems. Drawing samples is on the honor system. And there is no single national mandate for water monitoring; each state adopts its own approach. "It's not a national issue," says Carl Reeverts, head of the data branch for the EPA's water programs. "It's a local issue in terms of what your local water system provides."

So how do you know what's in your water? By law, you can ask local water officials, but they may not be willing or able to discuss the subject in plain English. At the 1996 convention of the American Water Works Association, a trade association for water managers, one attendee suggested stating even the most alarming results in ways that

make them seem insignificant. "If you put a lot of zeros to the right of the decimal point, people don't react, even if it's a really high number," he said, noting .0003 milligrams per liter sounds better than 3 parts per billion, a dangerous level for some contaminants.

That kind of talk can make people like Harold Parentini blanch. He got his water, and that of his retirement community, tested after realizing he lives near a garbage dump that doubles as a toxic waste site in Columbus, New Jersey. "You know how government is," the 77-year-old retired pharmacist says with cheerful cynicism. "You don't get all the results right away." So Parentini regularly sends samples away for independent testing. The results indicate that his water is fine, but Parentini is taking no chances: He has installed a filter. [For more on water filters, see "Filters and Other Home Remedies."]

Even when water meets government standards, it may not be safe for everyone to drink. Last year, in a surprising admission of failure, the EPA and the Centers for Disease Control issued a little-publicized directive advising people with severely compromised immune systems to consider boiling their water. The directive, which applies not only to AIDS patients but also to some of the elderly and many cancer patients, could affect 10 percent of the U.S. population, or about 25 million people.



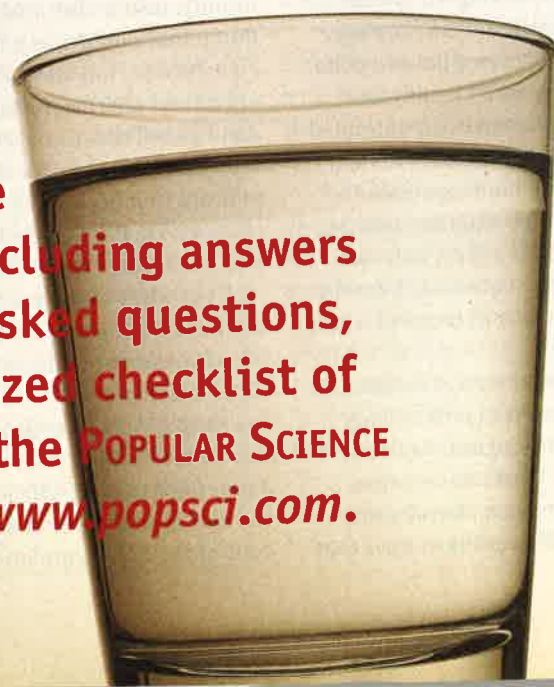
Harold and Mary Parentini of Columbus, New Jersey, have their water tested regularly and use a filter.



After their trees died, Walter and Connie Stachelek of North Wales, Pennsylvania, had their water tested.

"The number could be quite high," agrees Edward F. Rossomando, director of the Waterborne Disease Center at the University of Connecticut Health Center. The main risk is a protozoan, *Cryptosporidium parvum*, which forms cysts that can cause severe intestinal problems. The cysts have evolved to withstand harsh environments and can easily survive a dunking in Clorox, which is far stronger

Yes, you should get your water tested. For more information, including answers to frequently asked questions, and a personalized checklist of concerns, visit the POPULAR SCIENCE home page at www.popsci.com.



"We developed a problem with bacteria. But we were glad that nothing turned up that was more serious."

than the chlorine in most water treatment systems.

According to *The New England Journal of Medicine*, as few as 30 cysts can cause diarrhea in a healthy person and can be fatal to an AIDS patient. In a 1993 outbreak, *Cryptosporidium* killed 100 people in Milwaukee. The water systems of America have no

credible defense against this parasite. "The level of technology is back in Louis Pasteur's time," says Rossomando.

The EPA does not require that engineers check for *Cryptosporidium*, citing the cost and technical difficulty of identifying the parasite. As a result, future outbreaks are likely. "Surface water should be continuously monitored for *Cryptosporidium*," says Thaddeus Graczyk, a microbiologist at Johns Hopkins University. "It should have been started a long time ago."

Other waterborne perils take much longer to cause harm. Chlorine byproducts called trihalomethanes, of which chloroform is the best-known example, take years to cause an estimated 10,000 cases of bladder and colon cancer annually. That's ironic because chlorine generally makes water safer. "If you pour yourself a glass of water and it smells like bleach, you might think of not drinking it," suggests Dr. Robert Morris, an expert on trihalo-

methanes who works as an epidemiologist and family practice physician at the Wisconsin College of Medicine. "We've been too reliant on chlorine as a solution."

Unfortunately, though, some water systems follow the example of Washington, D.C., adding *more* chlorine when bacteria counts rise. In a few states, it's gotten to the point where officials routinely check for cheating on water samples. One analyst in Pennsylvania, Richard Stump, says some samples he processes reek of chlorine—evidence of tampering to produce good results. "We just reject those," says Stump, laboratory director for Suburban Water Testing Laboratories. "Ethically, I cannot process a sample like that."

Stump *could* handle a sample from someone like Janet Tapper of Portland, Oregon. Local authorities did not answer all her questions about water quality after they switched her home to a new water supply—the Tualatin River, which carries farm runoff. "They said they knew there were certain levels of pesticides in there and that they were coming from farmland," she recalls. Uncertain about what might be entering their water supply, Tapper and her husband spent several hundred dollars to install a Multi-Pure filter. "We felt we'd be better safe than sorry," she says. But even Tapper, knowledgeable as she is, did not take a basic step: getting her water tested.

Most experts recommend testing as the first line of defense, especially for common but dangerous contaminants such as lead. Richard Maas, director of the Environmental Quality Institute at the University of North Carolina in Asheville, heads a team that has analyzed water samples from 100,000 American homes. "You've got a one-in-six chance that you are being exposed to neurologically damaging levels of lead in your tap water," warns Maas, who says some researchers believe deficits in intelligence can be correlated with lead levels. "It's about one IQ point, we think for [each] ten parts per billion of lead," says Maas.

Surprisingly, when it comes to lead and many other compounds, the EPA does not have firm rules. Today's patchwork of water laws and regulations includes so many exceptions, exemptions, and loopholes that engineers simply do what their great-grandfathers did: chlorinate. It's all they know. "We've been stagnant for 80 years," says Erik Olson of the Natural Resources Defense Council, a leading voice for clean water. "We have not made any improvements since chlorine and filtration were introduced in the early part of the century."

Politicians back up their engineers. My town, a mayor pleads, can't afford water *that* clean. Such complaints are not likely to disappear even though Congress recently passed legislation to revise the Safe Drinking Water Act.

How to Test the Waters

YOU LIVE IN A CABIN 50 miles from the nearest highway. You have one neighbor—an Amish widow. Should you get your water tested? Yes.

Norman Rockwell's America is dead. Today, even well water can become contaminated—by septic systems or agricultural chemicals, for example. And in urban areas served by the most advanced water treatment systems, thousands of people can still get sick from drinking tap water.

Most industrial and agricultural threats cannot be tasted or smelled, so it makes sense to have your water professionally tested, especially if you have children in your household. Their undeveloped blood-brain barriers make them particularly vulner-

able to lead. Also, the stomachs of toddlers less than four months old absorb nitrates (from fertilizers) that can cause methemoglobinemia, or blue-baby syndrome.

The good news is that once a test is complete and, as is most likely, shows no problem, there is no need to buy bottled water or install a filter. Researchers agree it is wiser to confirm your water is safe than to buy truckloads of Evian on the basis of suspicion. It's cheaper too.

People who have had their water tested speak with relief: They know what's in their water, and take appropriate preventive measures. "We developed a problem with bacteria," concedes Walter Stachelek of North Wales, Pennsylvania, who became worried about his well water when five huge oak trees in his yard died suddenly. "But we were glad that nothing turned up that was more serious." Only a few percent of water samples sent to independent testing labs show serious contamination.

If you do discover problems, have your water retested after taking corrective measures. And if you live in an area that experiences seasonal fluxes in contaminants—from farm runoff, for example—you should draw samples when contaminants are likely to be at peak levels.

To find a lab certified by your state, check the Yellow Pages or the EPA's drinking water hotline at 800-426-4791. To arrange a \$17 test for lead in your water, call the Environmental Quality Institute at 704-251-6800. Suburban Water Testing, at 800-433-6595, offers a wide range of home water tests from \$50 to \$475. National Testing Laboratories, at 800-458-3330, the nation's largest testing firm, offers a screen of basic contaminants for \$94. For more information about drinking water, including answers to frequently asked questions, and a personalized checklist of concerns, visit the POPULAR SCIENCE home page at www.popsci.com.—M.D.U.



Filters and Other Home Remedies

THE TRICKS OF DISREPUTABLE marketers of water filters are limited only by the imagination. One bogus operator sold a copper apparatus that provided no treatment whatsoever but that did come with a rabbit's foot or a copy of the New Testament. Regulators uncovered the scheme and forced him to refund the money. "A number of people didn't want their money back," recalls Ellen Crocker, a U.S. General Accounting Office auditor. "They said it worked just fine."

Even though there is virtually no federal regulation of the filter industry, reliable products do exist. "The critical thing is knowing what your problem is, and what the technology will do," says Joe Harrison, research director of the Water Quality Association, which accredits technicians and contractors. A consumer information package is available from the association at 800-749-0234.

There are three major technologies for water treatment in the home, and little agreement on which is best for a particular pollutant. It's a good idea to seek advice from a professional plumbing contractor before you install a system. Carbon-based units in "granular" or "solid block" configurations can trap chlorine, lead, and petroleum compounds. Reverse osmosis uses a semipermeable membrane that can remove a wide variety of minerals and large manmade molecules. Distillation is boiling, which removes some manmade contaminants. In general, the cheapest pitcher/filters cost \$20; the most expensive basement systems cost \$1,000.

NSF International, a nonprofit trade organization, evaluates filters to see how they measure up to manufacturers' claims. To get a booklet of products that make the grade, call 800-673-6275. Products meeting NSF standards #53 or #58 are the only ones likely to solve bona fide health problems. Respected names include Amway, Brita, Culligan, Everpure, Kinetico, and Pur.

Even NSF certification is no guarantee of long-term reliability. Thanks to complex plumbing, some home treatment systems are prone to clog or break. Other models may work with agonizing slowness, dribbling out a gallon in seven hours. Some systems can't tolerate hot water or are fouled by hard or iron-rich water.

A poorly maintained filter could be worse for your health than drinking tap water. So it's important to follow manufacturer's instructions carefully, or to purchase a maintenance contract from an installer. If you perform the maintenance yourself, you may want to test your water regularly to make sure your filter is working.—M.D.U.

The new law requires utilities to alert newspapers and TV stations to what's in the local water. Meanwhile, federal officials say states are in charge. State officials say Washington has not provided the necessary funds for overseeing the water supply. Blame, like water evaporating and falling back to earth, cycles between different levels of government.

Officials at the local level, of course, are the most vulnerable to citizens' wrath. Some of that blame is misplaced, because local officials have little control over contaminants entering their watersheds from thousands of sources, many of them located in rural areas. In July, the CDC reported that four Indiana women had had miscarriages, some more than once, because of high levels of fertilizer compounds in their drinking water. The chemicals had reached the women's wells. The women no doubt assumed well water would be insulated from whatever is happening to the rest of the country. Yet all water systems are connected by modern life, which spreads thousands of barely understood chemicals across the landscape and into once-impregnable corners of the American heartland.

Which leads us to the Rev. George Ogle. A resident of rural Illinois, he became an activist after learning of the pesticides leaching into his water supply. He and his wife have gone on and off bottled water; the stuff that comes out of their kitchen tap has levels above federal guidelines for atrazine and cyanazine, two toxic

weed killers popular among Midwestern farmers. (Even those guidelines are three to 10 times higher than what is allowed in food.) "At least two-thirds of my life, no one thought about the water," says Ogle. "Nowadays, it's one of the major day-to-day worries." Some Illinois towns, including Danville and Decatur, supply bottled water to residents when pesticide or nitrate levels in city tap water get too high. "Unfortunately," says Ogle, "our society doesn't value itself enough to improve the water supply."

Like the Ogles, many Americans are worried about the quality of their drink-

ing water. But that concern isn't always shared by the people in charge of water systems, says John Cameron, associate director of Citizen Action in Chicago. "These are not public health experts," he says. "They are not experts on oncology. They're water engineers." And at the federal level? "The EPA has been diddling around for some time," he scoffs. "I think we can provide clean drinking water without having every American be their own water utility." Perhaps the biggest irony of all is that much cleaner drinking water might be had for just \$30 per person, according to the EPA. That's a drop in the bucket compared to what worried citizens already spend to bring water home from the grocery store. ♦

