Our Children At Risk

The 5 Worst Environmental Threats To Their Health

Top of Report

CHAPTER 7

DRINKING WATER CONTAMINATION

Introduction

Due to the Safe Drinking Water Act (SDWA), America's drinking water is safer than it has been in decades, and of better quality than that of many other countries. Accordingly, many Americans believe that while people elsewhere may have reason to be concerned about getting sick from contaminated tap water, we are safe. Yet, incidents in the United States -- such as the outbreak of the microorganism *cryptosporidium* in Milwaukee's water supply in 1993 that killed more than one hundred people and sickened over 400,000, and lead and pesticide contamination -- while not affecting most, threaten the tap water of millions of Americans.

In truth, according to Environmental Protection Agency (EPA) data, in 1994 and 1995, 45 million Americans drank water from water systems that fell short of SDWA standards.[1] Adding gravity to the situation, the Centers for Disease Control (CDC) and the EPA advised that people with weakened immune systems should consult with their doctors and consider boiling their drinking water to kill any *cryptosporidium*.[2]

This is just the tip of the iceberg. Some scientists believe that for every outbreak reported in the United States, another ten may be occurring.[3] One such study found that as many as one in three gastrointestinal illnesses -- often chalked up to "stomach flu" -- are caused by drinking water contaminated with microorganisms.[4]

Such microbial-related outbreaks say nothing about the many other hazards borne by our nation's water supply. Researchers have shown that millions of Americans regularly drink tap water that is contaminated with toxic and cancer-causing chemicals such as lead, trihalomethanes (THMs), arsenic, radioactive materials, and pesticides. A 1994 study estimated that some 14.1 million Americans drank water contaminated with the pesticides atrazine, cyanazine, simazine, alachlor, and metolachlor.[5] The manufacturers of these agricultural herbicides have shown that these chemicals may cause cancer, birth defects, and genetic mutations.

To make matters worse, some water utilities have been less than forthcoming with information about their drinking water supplies and the efficacy of their purifying methods. While the primary concern of most water utilities is delivering safe drinking water -- and a large number readily share their water quality data with the public -- many insist on erecting barriers between the public they serve and information about the water they supply.[6]

As a result of the failure of the government and many water systems in the country to protect the drinking water supply, many Americans no longer trust the purity of their tap water, and so pay enormous amounts of money -- nearly $2 billion annually -- for bottled water and home tap water treatment units.[7] Unfortunately, there are few standards guaranteeing the quality of these options. According to one study, as much as one-quarter to one-third of all bottled water sold in the United States originates from water supplied by public water utilities.[8]

Children: The Most Vulnerable Among Us

Unhealthy drinking water affects children in different ways than it does adults. There is cause for special concern for the health of children who drink tap water. Legal standards for most waterborne contaminants generally have been set based on the health effects of pollutants on average adults; consequently, the health

of millions of people -- including infants, children, pregnant women and their fetuses, the elderly, and the chronically ill -may not be protected. To compound matters, infants and children drink more than two and a half times as much water as adults as a proportion of their body weight.[9] An infant living solely on formula consumes about one-seventh of its own weight of water each day, which would correspond to approximately three gallons of water for a 155-pound adult man.[10]

The hazards posed by waterborne lead are especially pernicious. In 1991, the EPA estimated that lead in drinking water harms the health of millions of children, causing more than 560,000 children to exceed the level of concern for blood-lead levels defined by the CDC.[11] (A recent EPA rule regulating lead in drinking water may have reduced this number of children.) Particularly susceptible to waterborne lead poisoning are infants, who are often exposed when their formula is reconstituted with tap water.

This chapter discusses the widespread contamination of the United States' drinking water supplies by microorganisms, pesticides, lead, disinfectant by-products, arsenic, and radioactivity. Citizens need to seek remedies to ensure the health of their families in the face of increasing threats to the nation's water supply. Toward that end this chapter describes scientific research bearing on the health impacts of water contamination on children, suggests measures that concerned parents and others can take and identifies model programs of local solutions that have worked throughout the nation.

HAZARDS OF DRINKING WATER CONTAMINATION

William K. Reilly, Administrator of the EPA under the Bush Administration, classified drinking water contamination among the top four public health risks posed by environmental problems.[12] Some experts estimate that 560,000 people become moderately to severely ill each year from consuming contaminated water.[13] About 10,700 bladder and rectal cancers each year may be associated with THMs and their chemical cousins.[14] That translates into about thirty cancers per day.

Microorganisms

The large number of disease outbreaks throughout the country should come as no surprise, considering how many Americans drink tap water that fails to meet minimum EPA health and treatment standards for infectious microorganisms -- standards which themselves overlook some of the most hazardous pathogens presently infecting our nation's water supply. Waterborne pathogen sources that can cause disease outbreaks include leaking septic tanks; uncontrolled urban runoff contaminated with animal waste; manure in farm, feedlot,[15] and slaughterhouse runoff or direct discharges; and raw or inadequately treated sewage overflows from aging, poorly managed, or inadequately designed sewage conveyance and treatment systems. Drinking water disease outbreaks occur when drinking water wells, surface sources, or post-treatment water in pipes or storage areas of water systems become contaminated with disease-causing microbes that originate from these sources. Since many drinking water watersheds and recharge areas are now under heavy development pressure, this problem is likely to worsen in the absence of political or legal action.

Existing data on contamination are troubling. A 1991 survey of sixty-six surface water plants in fourteen states and one Canadian province revealed that 87 percent of raw water samples contained *cryptosporidium*, and 81 percent contained a similar parasite called *giardia*; overall, the study showed, some 97 percent of the samples contained one of these two disease carriers.[16] Some of these organisms may have been "nonviable," and therefore unable to infect people. In many cases, these organisms cannot be sufficiently controlled with chlorine disinfection.

EPA data show that more than 29 million people drank water served by systems with coliform bacteria higher than the EPA's health standards allow, and that 19.6 million Americans drank water from systems that failed to meet the EPA's basic treatment standards, which indicate inadequate quality, filtration, or disinfection. [17] Another 10.2 million people in the United States were being served water found to contain turbidity[18] -- the cloudiness that often signals microbiological contamination and that can make it impossible to effectively disinfect the water even with heavy doses of chlorine. In Milwaukee, for instance, the only initial sign of a problem was the water's turbidity. Testing for *cryptosporidium*, the deadly parasite that caused the diarrhea and vomiting, did not occur until after people became sick.

In fact, until 1997, EPA regulations failed to require any monitoring of water supplies for *cryptosporidium*. Amendments to SDWA in 1996 require the EPA to regulate *cryptosporidium* levels, starting with large supply systems. As a result, commencing in the summer of 1997, large systems serving over 100,000 started monitoring for *cryptosporidium*, and under a rule scheduled to be issued in 1998, most large systems will have to take preliminary steps to filter out *cryptosporidium*. By the year 2000, the EPA must issue a final rule applicable to all drinking water systems using surface water.

Many water systems in the United States may be more vulnerable than Milwaukee's to contamination by disease-carrying organisms. The Milwaukee water supply is filtered, though apparently the filter suffered from some type of failure. Unfiltered systems or systems with poorly operated and maintained filters may be at even greater risk.

In a limited sampling of fewer than one hundred utilities, NRDC found that more than 45.6 million Americans drank water supplied by systems where the unregulated and potentially deadly contaminant *cryptosporidium* was found in their raw or treated water.[19] Hundreds of chemicals and microbes have been detected in drinking water supplies throughout the country, yet tests are required for just over a hundred of these.[20]

There has been no coordinated effort between government agencies and researchers to document levels of contamination or illness caused by many waterborne microbes, including *cryptosporidium*. The lack of an active waterborne disease surveillance program in the United States means that reports of outbreaks are haphazard. A CDC report found that the waterborne-related illnesses reported each year "probably represent only a small proportion of all illnesses associated with waterborne-disease agents."[21] This report goes on to state that "illnesses occurring after years of exposure to low-level toxins are not detectable," nor are outbreaks of sporadic illnesses resulting from opportunistic pathogens "that may be widespread in chlorinated drinking water systems but that may cause illness with insidious onset and long incubation periods in persons who are immunocompromised."

The CDC tracked 116 waterborne disease outbreaks that killed more than a hundred and sickened more than 450,000 others between 1971 and 1994.[22] Although the majority of those illnesses occurred during one incident in Milwaukee, other significant outbreaks occurred, including one affecting 13,000 people in Georgia. Aside from the Milwaukee incident, where 400,000 people became ill due to *cryptosporidium*, none of these outbreaks of waterborne disease have received significant national attention.

Epidemic outbreaks of waterborne disease -- those in which many people fall ill at once -- are difficult to ignore, say some researchers, whereas endemic levels of waterborne disease -- incidents in which a modest percentage of the population fall ill, or in which the illnesses are chronic and long-term -- may be occurring continually with nobody's knowledge. One CDC expert concluded that thousands of people would have to become afflicted with a waterborne illness in New York City before public officials would be able to recognize it as an outbreak, and even then there would be no guarantee that the disease source would be properly identified.[23]

One study sheds light on the grave situation in which our ignorance places us. Researchers installed sophisticated under-the-sink filters in a number of homes served by a water system meeting all current standards for water treatment, including filtration and disinfection. Then they tracked the number of illnesses in these homes, as well as the illnesses in homes served by the same water system but which lacked the sophisticated filters. What the researchers found was as surprising as it was troubling: significantly higher rates of people who did not have the filters became sick compared with those whose water was filtered. The researchers estimated that "35 percent of the reported [gastrointestinal] illnesses among tap water drinkers were water-related and preventable."[24]

Pesticides

Contamination of water resources is one of the most damaging and widespread environmental effects of agricultural production. Drinking water is vulnerable to pollution by agricultural chemicals, including pesticides, herbicides, fungicides, and fertilizers, as well as their metabolites.

According to a National Academy of Sciences report, the residues of 39 pesticides and their degradation products have been detected in the groundwater of thirty-four states and Canadian provinces.[25] The pesticides most frequently reported included aldicarb and its by-products, which were detected in twenty-four states from California to Maine; EDB was found in twelve states; 1,2-dichloropropane (1,2-D) in seven states;

and dibromochloropropane (DBCP) in five states. Also prominent were alachlor, atrazine and its products, cyanazine, dicamba, dinoseb, metolachlor, metribuzin, simazine, trifluralin, and 2,4-D. The EPA also has found that about one out of ten public water supply wells contains pesticides; the EPA infers from these data that nearly 10,000 community drinking water wells and about 440,000 rural domestic water wells contain pesticides, although most apparently do not exceed the EPA's existing drinking water standards for pesticides.[26]

A recent report published by the Environmental Working Group (EWG) found that about 4.3 million Americans in 245 communities are exposed to levels of carcinogenic herbicides in drinking water that exceed the EPA's benchmark of acceptable cancer risk (one case in a population of a million).[27] Commonly used agricultural herbicides contaminate the tap water of 374 Midwestern towns. Over ten million Americans in the Midwest and Chesapeake Bay region are exposed to carcinogenic herbicides in their drinking water. In addition, mixtures of herbicides were found in tap water: one sample from a suburb of Cincinnati contained ten different herbicides and metabolites, and samples from five other towns in Ohio and Illinois contained six or more herbicides and metabolites.

A 1994 report from EWG also found that drinking water is commonly contaminated with two or more of the five herbicides atrazine, cyanazine, simazine, alachlor, and metolachlor.[28] For example, 61 percent of samples taken at the Kansas City, Missouri, water utility intake contained two or more of these five herbicides, 47 percent of samples collected from four northern Ohio rivers that serve as drinking water sources contained three or more herbicides, and 38 percent of samples from 27 Midwestern drinking water reservoirs were contaminated with four or more of these five herbicides.

Due to the presence of these chemicals in drinking water, more than 3.5 million people in 120 cities and towns face cancer risks more than ten times the federal benchmark for acceptable cancer risk (one case in a population of one million), based on average annual exposure to five common herbicides.[29] People in small rural communities are at particularly high risk; over 400,000 people in 98 rural communities face cancer risks from 10 to 116 times the federal benchmark. In all, some 67 different pesticides and pesticide metabolites have been detected in Midwestern sources of drinking water.[*]

Earlier studies by the U.S. Geological Survey (USGS) had found that 98 to 100 percent of the 150 streams tested in the Mississippi River Basin during 1990 contained herbicides.[30] In 1991, the USGS survey of selected herbicides in eight rivers in the Mississippi River Basin found atrazine in all the samples taken, with concentrations exceeding the federal drinking water standard, or Maximum Contaminant Level (MCL), in 27 percent of the samples. Alachlor was detected in 88 percent of the samples, with levels greater than the MCL 4 percent of the time.[31]

Nitrate appears in groundwater from fertilizer use, natural soil nitrogen, rare geologic nitrogen deposits, manure, sewage, and other organic wastes. Very high concentrations of nitrate in the drinking water can be fatal to infants, particularly in the first three months of life. The primary public health concern related to elevated levels of nitrate in drinking water is the development of a potentially fatal condition called methemoglobinemia, sometimes known as "blue baby syndrome." This condition develops when nitrate is converted to nitrite by bacteria in the gastrointestinal tract. Increasing levels of nitrite decrease the blood's capacity to transport oxygen.[32] Though deaths from methemoglobinemia in the United States are rare, several cases of the disease have been documented in the western Corn Belt.[33]

Lead

The medical community and the U.S. Department of Health and Human Services have determined that lead poisoning is the primary environmental threat to children.[34] The EPA has found that lead in drinking water is one of the leading sources of exposure, typically contributing 20 percent of total lead exposure for an average person.[35] In some cases, a higher percentage comes from drinking water; for example, the EPA found that more than 85 percent of the blood-lead in bottle-fed infants may derive from drinking baby formula made with lead-contaminated water.[36] Indeed, studies by Harvard University doctors at a lead poisoning clinic in Boston found that the primary source of lead in the bloodstreams of about 15 percent of the lead-poisoned infants treated at the clinic was from lead-tainted drinking water used to make the babies' formula.[37] Research shows adverse health effects from lead at ever lower levels of exposure.[38] There is a wide range of serious health problems that can result from lead poisoning; these are discussed in Chapter 3.

Lead can be present in service lines, solder, and faucets. The lead in plumbing leaches into water as it stands in pipes and taps. Boiling does nothing to eliminate lead. Babies have been poisoned when tap water was boiled to make their formula.[39]

Every home may have a different level of lead in its drinking water, and every faucet may deliver a different level of lead. Lead in tap water usually originates between the water main in the street and the household plumbing. Adding lime or other corrosion inhibitors at the treatment plant can sometimes solve the problem because it can reduce acid in water, build a limestone precipitate that coats the pipes, and reduce leaching of lead from lead pipes and solder. The best first step to avoiding exposure to lead in drinking water is to have your household water tested for lead. A good rule of thumb for those who do not know the lead content of their water is to run the water at least 30 to 60 seconds (until temperature changes indicating that water is coming from outside) from each faucet that has not been used for several hours. (Catch this water for plants or dish washing.) Also, never use water from the hot tap for making infant formula or cooking purposes, since the chances for lead contamination increase with the use of hot tap water.

While lead, when present, is a serious health threat, there is a very good chance that you do not have a lead problem. The nation's leading water-lead research program, at the University of North Carolina at Asheville has tested the water from more than 60,000 homes. It found that 83 percent of the homes tested had very low levels of lead. Another 15 percent could solve their problem by running the water briefly before using it.[40] In 1993, *Consumer Reports* announced the results of their nationwide drinking water sampling for lead. Sixty-one percent of the households had no detectable lead (detection limit 2 parts per billion (ppb)).[41]

Trihalomethanes and Other Disinfection By-Products

Disinfection of water supplies has substantially reduced the incidence of many waterborne diseases. But there are risks associated with this process. Trihalomethanes (THMs) and other disinfection by-products (DBPs), which are formed when chlorine or other similar disinfectants are used to purify water that has not been treated to remove organic matter before disinfection, are found at significant levels in the drinking water of 80 to 100 million Americans.[42] Animal studies have long shown that these chemicals are likely to cause cancer in people.[43]

An analysis in *American Journal of Public Health* of more than ten epidemiological studies found that DBPs may be responsible for 10,700 or more rectal and bladder cancers per year.[44] Colorado researchers recently completed another study of human populations exposed to DBPs. That study confirmed the findings of previous studies that exposure to DBPs is significantly associated with bladder cancer.[45]

Another study concluded that analyses of the health effects of exposure to THMs and possibly other DBPs may have substantially underestimated risks due to understatement of exposure.[46] The researchers found that overall lifetime cancer risk associated with exposure to THMs in shower water is underestimated by about 50 percent if the concentration of THMs in cold water is used in a risk assessment. The level of THMs increases substantially when water is heated, but most studies have measured concentrations of THMs in cold water. When steam is inhaled during use of hot water, such as showering, exposure to DBPs is increased, and the risks are higher than generally assumed.

By improving water treatment -- such as physically removing precursors to DBPs -- water systems can control DBPs while reducing microbiological risks. Modern treatment technologies known as "precursor removal," such as granular activated carbon, can be employed without harming the ability of water systems to disinfect their water. However, only a relative handful of U.S. water systems use this technology. In light of strong evidence that DBPs pose serious health risks, the EPA is required to issue rules in late 1998 to reduce THM levels. More stringent requirements are due in 2002.

Arsenic

The most significant non-occupational exposure to arsenic now occurs through the contamination of drinking water. There are numerous studies of populations with exposure to high levels of arsenic through drinking water (at levels above the current EPA standard -- unchanged since 1942 -- of 50 ppb). In humans, skin cancer has long been associated with chronic ingestion of arsenic.[47] Bladder, lung, and other types of cancer

have also been observed at elevated rates in populations exposed to arsenic in tap water.[48] In the United States, more than 50 million people drink tap water containing arsenic, mostly at levels below EPA's current standard of 50 ppb. It has been estimated, however, that 25 million people in this country are exposed to at least 25 ppb of arsenic in their drinking water and that as many as 350,000 people may be exposed to levels greater than the 50 ppb standard.[51]

California state experts found that water containing arsenic at the level of the EPA's current drinking water standard (set in 1942 before arsenic was known to cause cancer) presents a risk of more than one cancer in every one hundred people exposed -- 10,000 times higher risk than the EPA's standard "acceptable" cancer risk of one in one million.[52] This is extremely troubling because 35 million people in the United States drink water every day from their community water systems that contain arsenic at a level of over 1 ppb, which presents a very significant cancer risk.[53]

While numerous studies in other countries have demonstrated arsenic's carcinogenicity at moderate to high doses, a handful of very small studies done on U.S. populations have failed to show a statistically significant increase in the risk of developing skin cancer at low dose exposures. The difficulty of demonstrating adverse health effects may be due to the type of study design and the small populations studied, both of which decrease the statistical power of a study to detect adverse health effects.

Researchers from the University of California recently found increased rates of death from vascular diseases such as arteriosclerosis, aortic aneurysms, and other diseases of the arteries, arterioles, and capillaries among Americans living in areas with relatively higher levels of arsenic in their drinking water.[54] Another study found a link between this widespread drinking water contaminant and diabetes mellitus.[55] According to the study of large populations in Taiwan, people who receive significant levels of arsenic in their drinking water have a six to ten times greater risk of developing diabetes mellitus. The researchers found that there was a dose-response relationship -- that is, the more arsenic in the drinking water, the more likely the person was to be diabetic -- reinforcing the weight of their findings. The researchers concluded that chronic arsenic exposure "may induce diabetes mellitus in humans."

Bottled Water and Home Water Filters

Though Americans try to ensure the safety of their drinking water by paying nearly $2 billion each year for bottled water and home treatment units, the quality of the water they receive may not be any better than tap water.[49] Home treatment units, which can cost hundreds of dollars, are virtually unregulated, and while many companies test their filters voluntarily, others fail to do so. There also is no requirement that home treatment units be independently tested to ensure that they meet their claims and provide safe water.

Hundreds of times more expensive than tap water, bottled water is often no safer. In fact, one study estimated that as much as one-quarter to one-third of all bottled water sold in the United States comes from water supplied by public water utilities.[50] Bottled water is governed by an often less stringent set of regulations set by the Food and Drug Administration (FDA). While the FDA is required to set contaminant standards at the same levels for bottled water as for tap water, these standards in some cases still fall short. The FDA generally requires only one chemical test per year, making it unlikely that some important problems will be detected. The standards also fail to account for decreases in microbiological quality caused by long-term water storage, and the results are often not required to be reported to public health authorities.

Radiation

Radon is an odorless and colorless radioactive gas that generally occurs in drinking water derived from groundwater as a result of the underground decay of naturally-occurring radioactive rock. It is considered to be a known human carcinogen by the National Academy of Sciences and others.[56]

Drinking water contaminated with radon in excess of the EPA's proposed standard of 300 picocuries[*] per liter of water (pCi/L) flows from the taps and showerheads of over 19 million people according to available EPA data.[57] It also is in the water of 81 million people at an average of about 246 pCi/L, posing significant health

risks.[58] As required by the 1996 amendments to the SDWA, the EPA must establish an enforceable standard for radon in tap water by the year 2000.

Radon in drinking water poses significant threats due to inhalation during and after water use.[59] The EPA has also found that the ingestion of radon and its decay products poses significant cancer risks.[60] The EPA has acknowledged that the cancer risks from radon in both air and water are high and that while the airborne risk typically exceeds that arising from water, the cancer risk in water is higher than the cancer risk estimated to result from any other drinking water contaminant.[61]

Special Vulnerability of Children

Regulatory standards for most waterborne contaminants are keyed to the health effects of pollutants on average healthy adults. Consequently, the health of millions of people -- including infants, children, pregnant women and their fetuses, the elderly, and the chronically ill -- may not be protected. Very little research has been conducted to determine the unique susceptibility of vulnerable subgroups in our society, though scientific evidence is mounting to indicate that such people are at greater risk from waterborne contaminants than the average healthy adult. Indeed, the more than one hundred people who died in Milwaukee in 1993 as a result of the *cryptosporidium* outbreak were from vulnerable groups.

Some preliminary research has been conducted recently to point the way, however. Infants, for instance, drink twice as much water per unit of body weight as adults, thereby possibly exposing them to greater waterborne health threats. In a 1993 report, *Pesticides in the Diets of Infants and Children*, the National Academy of Sciences found that "water consumption, both as drinking water and as a food component, is very different between children and adults. Differences in exposure were generally a more important source of differences in risk than were age-related differences in toxicological vulnerability."[62] Water intake is considerably higher for infants than for other age categories because of their high consumption of concentrated juices, infant formula, and cereals that are mixed with water.[63] Little data are available on drinking water and water as a component of food, and it is not adequately considered in most consumption surveys.[64]

One of the areas where a clear disproportionate impact on children has been shown is the case of waterborne lead poisoning. The EPA determined in 1991 that lead in drinking water harms millions of children's health and causes over 560,000 children to exceed the CDC's defined level of concern for blood-lead levels.[65] (Recent EPA rules regulating lead in drinking water may have reduced the number of children at risk.) While adults absorb 10 to 15 percent of the lead entering their gastrointestinal tract, for pregnant women and children this figure can be as high as 50 percent.[66]

Another drinking water contaminant to which children have increased susceptibility is copper. Infants and children up to ten years of age have greater sensitivity due to the presence of normally high concentrations of copper in the liver during early life and the lack of a fully developed physiological mechanism for regulating levels of copper in the body. One study, recognizing this difference, recommended decreasing the federal maximum allowed amount of copper in drinking water in order to adequately protect children.[67]

Children of Color

Many small, rural, or low-income communities and many communities of color do not have access to safe and affordable drinking water supplies. Troubling data have emerged indicating that some water contamination problems may affect certain subsets of the public disproportionately. There are "clear situations where certain [racial and socioeconomic] populations are exposed to higher levels of contaminants in water" than the general population, one study found.[68] This study cited data indicating a higher rate of infectious disease among certain minority populations such as Native Americans, and documented high rates of microbiological contamination of drinking water on Native American reservations. Similarly, there is often very poor drinking water quality in migrant farm workers' camps where waterborne disease has been documented. Along the U.S.-Mexican border area in Texas there is substantial evidence of serious drinking water contamination problems for the predominately Hispanic population, and there is a threefold increase in rates of waterborne disease and hepatitis A in Texas border counties.[69]

What You Can Do

Find out what's in your drinking water. Public water systems generally must test for dozens of contaminants in drinking water, and you have a right to review the results. You might consider doing the following:

- Ask your public water system for copies of any public notices they have issued regarding violations over the past few years.
- Ask your public water system for copies of the monitoring results for both regulated and unregulated contaminants in the water.
- Call your state drinking water program to verify the accuracy of the information your water system provides you and to find information your water supplier will not provide. (Beware, however, for some states tend to downplay problems of local water systems.)
- If your water is contaminated, ask your water utility, state regulators, the EPA, and elected representatives to clean it up.

You may also consider testing your own tap water, at least for lead, which costs from $15 to $35. The EPA Drinking Water Hotline (1-800-426-4791) can help you locate a certified laboratory in your state. The National Testing Laboratories (800-458-3330), the Environmental Health Laboratories (800-332-4345), or Environmental Law Foundation (510-208-4557) can also analyze water for lead.

Determine the source of your drinking water and its possible threats. Your water supplier can tell you the lakes, rivers, and groundwater sources from which your water comes, as well as the location of their water intakes. You may want to visit the intake site from which your water is pumped and look around (including upstream areas) to see whether there are any apparent threats to the water supply. Ask your water supplier for a copy of their watershed or wellhead protection plan; if they don't have one, ask them why they don't. If they do have one, work with local organizations to assure that it is strong and fully implemented.

Help protect your drinking water. There are a variety of local, regional, and nationwide environmental groups trying to reduce water pollution that could use your help. Call any in your area, or the Clean Water Network, a clearinghouse of groups that are working to protect surface area drinking water. Headquartered in Washington, D.C., the Clean Water Network can be reached at 202/289-2395.

Ask elected representatives to fight for a stronger Clean Water Act, and to resist efforts to weaken this critical law. There are battles brewing over the federal and state laws that protect water quality. Urge members of Congress to fight for the health of your family by relying on scientific evidence and common sense when promulgating clean water laws.

Reduce contamination risks at home. There are several things you can do in your home to reduce your exposure to contaminants in drinking water, including the following:

- **Lead.** If you have not tested the water for lead, never use the water that first comes from the tap for baby bottles or for drinking or cooking. If you suspect a lead problem, run your water for at least 30 seconds -- from each faucet unused for several hours -- before drinking the water or using it for cooking. Capture the water for plants or other nonconsumptive uses. Lead levels decline when water is run because the chief sources of lead in drinking water are faucets and the pipes that run between the water main and your tap. When boiling water for reconstituting infant formula, let water boil for one minute to kill microorganisms. Boiling for longer periods of time will concentrate any lead (or nitrate) present. Families with young infants who use well water should have their water tested for nitrates to avoid the possibility of methemoglobinemia.
- **Chlorination by-products, radon, and other volatile compounds.** Inhaling fumes when showering is a common pathway of exposure to the highest levels of many volatile contaminants, those that easily evaporate. To reduce the risks from inhaling such chemicals, reduce your shower time and assure good ventilation in your bathroom.

- **Bottled water.** Though all Americans have a right to safe drinking water, not all tap water is safe. When necessary, bottled water can be a good temporary solution. Unfortunately, bottled water is regulated no more strictly than tap water, and enforcement is minimal, so there is no assurance that bottled water is safer to drink than tap water. If you decide to buy bottled water, you should ask your bottler for testing data showing that the water is uncontaminated. In addition, buying bottled water may do nothing to protect your family from volatile contaminants, since most exposure to these contaminants may come from showering.

- **Home filters.** Home water filters can be another good temporary solution if your tap water is unsafe. It is wise to determine in what way your water is contaminated before investing in one, however. Some filters simply improve the taste and odor of water while doing nothing to remove microbes or toxics. Be sure the filtration capabilities of your filter match the contaminants in your water, and buy only filters certified by an independent testing organization such as NSF International (formerly the National Sanitation Foundation) to remove the contaminants you're concerned about. For example, with potential *cryptosporidium* contamination, look for a filter that is labeled as meeting "NSF Standard #53 for cyst removal." *Consumer Reports* and similar magazines review water filters periodically. Always be sure to maintain the filter properly to assure it does not compound the problem.

Model Programs and Local Solutions

There is a range of instances in which community pressure, business decisions, and government programs have worked to promote feasible, non-polluting alternatives that make economic sense. The job includes not only pressuring local businesses, but regulators as well. Below are some examples.

Facing a citizen suit and government sanctions, managers of the **Robbins Company**, a jewelry manufacturer in Attleboro, Massachusetts, installed a closed-loop production system that eliminates discharge of toxic chemicals in wastewater and saves the medium-sized company $71,000 a year.[70]

Galileo Electro-Optics Corporation, in Sturbridge, Massachusetts, once reported emitting five chemicals in the EPA's Toxic Release Inventory. In 1994, using the Inventory data as a basis for change, the company managed to whittle emissions down to two chemicals. It plans to cut emissions to the point that no reports to the Inventory would be required. These reductions were made without onerous regulation, massive political pressure, or legal action, but simply because the company recognized an opportunity to improve its operations. By doing so, the company cut its costs by $150,000 a year.[71]

In March 1991, **Tinker Air Force Base** outside Oklahoma City negotiated the nation's first Good Neighbor Agreement between a citizens group and a military facility. Agreeing to achieve zero hazardous waste discharges by 1997, Tinker and representatives of Citizens for a Clean Environment developed a method to assure the community's right to know, the right to conduct independent monitoring of air, water, and soil testing, and access to emergency response plans. Most of the reduction came from basic process changes such as switching from solvents to soap and hot or high-pressured water to clean metal parts. While the base has not always lived up to every component of the agreement, the community still retains leverage with the Air Force.[72]

The **Groundwater Foundation** in Lincoln, Nebraska, each year under its Groundwater Guardian program identifies communities protecting their groundwater through efforts such as wellhead protection, conservation, pollution prevention, and education. Among the more than eighty communities cited for their efforts in 1996, several stand out for their work to prevent drinking water contamination. Seventy percent of **Anaheim, California's** drinking water comes from wells. The groundwater is threatened by improper disposal of industrial chlorinated hydrocarbons, used motor oil, and household chemicals. In response, additional used oil collection centers were established, with increased public information about the collection. Efforts to encourage local businesses to switch from chlorinated solvents to aqueous-based or non-chlorinated solvents are underway. Initial activities have included educational materials and workshops. In the future, the city hopes to provide technical assistance to businesses in order to guide substitution to safer solvents.[73]

The **City of Coldwater, Michigan**, obtains all of its drinking water from groundwater. In order to maintain the pristine quality of this water supply, Coldwater has instituted a wellhead protection program and free collection of used oil, oil filters, and antifreeze. In addition, collection sites for batteries have been established, and the chemical fixer used to develop X-rays is recycled to prevent silver from entering wastewater and sludge.[74]

In **Seward County, Nebraska**, all drinking water comes from groundwater aquifers. High levels of nitrates, on occasion exceeding or approaching the federal maximum contaminant level, have been found in drinking water supplies. In response, the community conducted a one-day educational program for farmers, consultants, and others to help reduce farm input costs while reducing water and nitrogen use. County zoning regulations were revised to limit and control development within one thousand feet of a municipal well.[75]

On **Cape Cod, Massachusetts**, the sole source aquifer supplying drinking water for residents was vulnerable due to sandy permeable soils and the shallow depth to the water table. Many efforts were implemented, including used oil collection undertaken in fifteen towns. Elementary teachers received watershed education training, and programs were developed to protect groundwater from leaking fuel tanks and hazardous materials. In addition, a best management practices booklet was developed and distributed to all cranberry growers with specific measures designed to prevent groundwater contamination.[76]

Current Regulatory Framework

America's drinking water is safer than that of many other countries, thanks in part to the Safe Drinking Water Act, signed into law by President Ford in 1974. In 1986, President Reagan signed amendments into the law, substantially strengthening its provisions, and the Act was again revised in 1996 with the signature of President Clinton. The fundamental purpose of the Act is to protect public water supplies from contamination. It establishes a comprehensive national scheme requiring drinking water regulations to be issued by the EPA and enforced by states. If a state fails to adopt and enforce the EPA drinking water rules, the EPA must take over enforcement in that state.

The foundation of the SDWA requires the EPA to establish national drinking water rules, called Maximum Contaminant Levels (MCLs). To set an MCL, the EPA first establishes a Maximum Contaminant Level Goal (MCLG), an unenforceable standard set at the level at which no known or anticipated adverse health effects occur, providing for an adequate margin of safety. The MCL is then established at a level as close to the MCLG as feasible, using the best available technology or treatment techniques (taking costs into consideration) to reduce contaminant levels in water. The EPA issues monitoring and reporting rules that require water systems to test their water for contamination and to report the results of those tests to state or federal authorities. Under the 1996 amendments, research on special risks to children and other vulnerable subpopulations must be conducted and considered in setting new drinking water standards.

Unfortunately, public water systems in every state are violating the SDWA -- in thousands of cases violating it flagrantly -- generally with no threat of legal repercussions. More than 45 million Americans were served drinking water during 1994-95 that did not meet SDWA health standards.[77] Violations of federal tap water standards were reported by 1,583 schools, medical facilities, and day care centers (with their own water systems) providing water to over 700,000 children and adults.[78] Studies have shown that generally, only about one to two percent of violations of the SDWA are subject to formal enforcement actions.[79]

Reforms Needed

The nation's water supplies can be protected and treated so that they will be pure and essentially free of toxins -- in most cases for the price of one soft drink per day per utility customer. The 1996 Safe Drinking Water Act amendments passed the House and Senate with broad, bipartisan support. The new law will have a major positive impact on public health and will substantially improve not only tap water quality, but also public information and involvement in protecting our drinking water. The key improvements in the new law are briefly described:

- A Right to Know provision requires water systems to annually tell their customers by mail and by publication in local newspapers what contaminants, both regulated and unregulated, are in their drinking water, with a plain language explanation.

- Rural Community Protection provisions require states to assure that all water system operators are trained and certified to upgrade dangerous small systems. In addition, the final law allows only tightly controlled state "variances" from EPA health standards for systems serving up to 3,300 people, and the EPA approval of variances for systems serving up to 10,000 people. Additional right to know

provisions, citizen objection petitions, and other strict controls in the final law will offer protective restrictions on the use and terms of these variances.

- Sections addressing health effects research, action on vulnerable populations, and waterborne disease surveillance will require the EPA to conduct important new research into the health effects of drinking water contamination, including the effects on vulnerable people such as children, and to use that research in standard-setting. The EPA and the CDC also must jointly study waterborne disease.

- A provision on radioactive radon reduction will require the EPA to issue, within four years, a standard for this unregulated known human carcinogen, after review of the best available science and feasible treatment technologies. The outdated standard for arsenic must be revised by 2001. States or water systems will have the flexibility to meet less stringent tap water standards if they get the EPA approval of a program to reduce airborne radon that offers an equal or greater impact on reducing overall health risks from radon.

- Sections will require the EPA to issue standards for *cryptosporidium* and disinfection by-products within the next three to five years.

- Public information on water contamination nationwide will be housed in a new publicly accessible EPA computer system and will include data on both regulated and uncontrolled contaminants in water supplies across the country.

- The new law also requires standards for bottled water that are at least as stringent as the EPA's tap water standards to be issued by the Food and Drug Administration. If the FDA fails to issue them, the EPA tap water standards will automatically apply to bottled water.

In an important related move, the EPA spending bill signed into law in late 1996 funded $1.275 billion for improving local water systems for fiscal year 1997. An additional $1 billion per year is authorized for subsequent years. These new amendments and funding should result in greatly improved drinking water quality. However, the next few years will be a critical period for determining whether the implementation of the law is as rigorous and effective as Congress intended. The EPA will likely face concerted pressure from some in industry as well as state and local politicians who will seek to undercut the new statute.

Notes

* When chemicals degrade in the environment, they transform into metabolites that can be as toxic as their parent compounds.

* A picocurie is a measure of radioactivity equivalent to one-trillionth of a curie.

1. Cohen, B. et al., Just Add Water: Violations of Federal Health Standards in Tap Water 1994-1995, Environmental Working Group, Natural Resources Defense Council, Environmental Information Center, May 1996.

2. Centers for Disease Control, "CDC, EPA Issue Drinking Water Guidance for People with Weakened Immune Systems -- Press Advisory," June 1995.

3. Rose, J. et al., "Water-borne Pathogens: Assessing the Health Risks," Health and Environmental Digest, vol. 7, no. 3, June 1993, pp. 1-3.

4. Payment, P. et al., "A Randomized Trial to Evaluate the Risk of Gastrointestinal Disease Due to Consumption of Drinking Water Meeting Current Microbial Standards," American Journal of Public Health, vol. 81, no. 6, June 1991, pp. 703-708.

5. Wiles, R. et al., Tap Water Blues: Herbicides in Drinking Water, Environmental Working Group, 1994, p. 1.

6. Olson, E., You Are What You Drink. Natural Resources Defense Council, June 1995.

7. International Bottled Water Association, "20 Questions About the Bottled Water Industry," undated.

8. Environmental Policy Institute, "Bottled Water: Sparkling Hype at a Premium Price," 1989.

9. Plunkett, L. et al., "Differences Between Adults and Children Affecting Exposure Assessment," Similarities and Differences Between Children and Adults: Implications for Risk Assessment, International Life Sciences Institute, 1992.

10. International Programme on Chemical Safety, Environmental Health Criteria 59: "Principles for Evaluating Health Risks from Chemicals During Infancy and Early Childhood: The Need for a Special Approach," World Health Organization, 1986.

11. EPA, Fact Sheet: National Primary Drinking Water, "National Primary Drinking Water Regulations for Lead and Copper," May 1991.

12. Reilly, W., "Aiming Before We Shoot: The Quiet Revolution in Environmental Policy," U.S. EPA Administrator, speech, September 26, 1990.

13. Morris, R. and R. Levin, "Estimating the Incidence of Waterborne Infectious Disease Related to Drinking Water in the United States," Assessing and Managing Health Risks From Drinking Water Contamination, E. Richard, ed., International Association of Hydrological Sciences, Great Britain, 1995.

14. Morris, R. et al., "Chlorination, Chlorination By-Products, and Cancer: A Meta-Analysis," American Journal of Public Health, vol. 82, no. 7, July, 1992, pp. 955-963.

15. Olson, E. and D. Cameron, The Dirty Little Secret About our Drinking Water, Natural Resources Defense Council, February 1995.

16. LeChevallier, M. et al., "Occurrence of Giardia and Cryptosporidium spp. in Surface Water Supplies," Applied and Environmental Microbiology, vol. 57, no. 9 September 1991, pp. 2610-2616.

17. Olson and Cameron, The Dirty Little Secret.

18. Olson and Cameron, ibid.

19. Olson, You Are What You Drink, June 1995, p. 3.

20. Olson and Cameron, The Dirty Little Secret.

21. CDC, Mortality and Morbidity Weekly Report, vol. 39, no. SS-1, 1990, p. 7.

22. Herwaldt, B. et al., "Waterborne-Disease Outbreaks: 1989-90," Morbidity and Mortality Weekly Report, vol. 40, no. SS-3. W. Levine et al., "Waterborne Disease Outbreaks, 1986-1988," Mortality and Morbidity Weekly Report, vol. 39, no. SS-1, March 1990. A. Moore et al., "Surveillance for Waterborne Disease Outbreaks - United States, 1991-92," Morbidity and Mortality Weekly Report, vol. 42, no. SS-5, November 19, 1993. M. St. Louis, "Water-Related Disease Outbreaks, 1985," Morbidity and Mortality Weekly Report, vol. 37, no. SS-2. M. Kramer et al., "Surveillance for Waterborne-Disease Outbreaks - United States, 1993-1994," Morbidity and Mortality Weekly Report, vol. 45, no. SS-1, April 12, 1996.

23. Presentation of Dr. Dennis Juranek, CDC, at CDC Workshop on Cryptosporidium in Drinking Water, Atlanta, Georgia, September 22, 1994.

24. Payment, "A Randomized Trial to Evaluate the Risk of Gastrointestinal Disease Due to Consumption of Drinking Water Meeting Current Microbial Standards."

25. National Research Council, Pesticides in the Diets of Infants and Children. Washington, D.C.: National Academy Press, 1993, p. 228.

26. U.S. EPA, 1990, National Survey of Pesticides in Drinking Water Wells: Phase I Report.

27. Cohen, B. and R. Wiles, Tough to Swallow: How Pesticide Companies Profit from Poisoning America's Tap Water, Environmental Working Group, August 1997.

28. Wiles et al., Tap Water Blues, 1994, p. 2.

29. Wiles, ibid., p. 2.

30. USGS Press Release, "Spring Sampling Finds Herbicides Throughout the Mississippi River and Tributaries," November 20, 1991.

31. USGS, Distribution of Selected Herbicides and Nitrates in the Mississippi River and Its Major Tributaries: April Through June 1991, Water Resource Investigation Report 91-4163, Denver, 1991, pp. 23-33.

32. Fan, A. and H. Russel, "Summary of Nitrate in Drinking Water: An Evaluation of the Current Standard with Specific References to Methemoglobinemia and Reproductive Effects," Community Toxicology Unit, Hazard Evaluation Section, California Department of Health Services, March 1987, as cited in J. Curtis et al., Harvest of Hope, NRDC, May 1991.

33. Busch D. and M. Meyer, "A Case of Infantile Methemogloninemia in South Dakota," Journal of Environmental Health, vol. 44, May/June 1982, as cited in J. Curtis et al., Harvest of Hope, NRCD.

34. Agency for Toxic Substances and Disease Registry, The Nature and Extent of Lead Poisoning in Children in the United States: A Report to Congress, 1988, p. 2.

35. EPA, Fact Sheet, National Primary Drinking Water Regulations for Lead and copper, attachment p. 3, May 1991.

36. 56 Fed. Reg. 26,470, June 7, 1991.

37. Shannon, M. and J. Graef, "Lead Intoxication in Infancy," Pediatrics, vol. 89, no. 1, January 1992, pp. 87-90. M. Shannon and J. Graef, "Hazard of Lead in Infant Formula," New England Journal of Medicine, vol. 326, no. 2, January 9, 1992, p. 137.

38. ATSDR, The Nature and Extent of Lead Poisoning in Children in the United States.

39. Royce, S. and H. Needleman, Case Studies in Environmental Medicine: Lead Toxicity, ATSDR, 1995.

40. Stapleton, R., Lead Is a Silent Hazard, New York: Walker and Company, 1994.

41. "Is There Lead in Your Water?" Consumer Reports, February 1993, pp. 73-82.

42. National Research Council, Drinking Water and Health. Washington, D.C.: National Academy Press, vol. 7, 1987. NRDC, Trouble on Tap: Arsenic, Radioactive Radon and Trihalomethanes in Our Drinking Water, October 1995.

43. EPA has classified several DBPs as probable human carcinogens. 59 Fed. Reg. 38,668 , July 29, 1994. EPA, National Primary Drinking Water Regulations: Disinfectants and Disinfection By-Products, Proposed Rule.

44. Morris et al., "Chlorination, Chlorination by-Products, and Cancer," 1992.

45. McGeehin, M. et al., "Case-Control Study of Bladder Cancer and Water Disinfection Methods in Colorado," Amer. J. Epidemiol., vol. 138, no. 7, October 1, 1993, pp. 492-501.

46. Weisel, C. and W. Chen, "Exposure to Chlorination By-Products from Hot Water Uses," Risk Analysis, vol. 14, no. 1, February 1994, pp 101-6.

47. Bates M. et al., "Case-Control Study of Bladder Cancer and Arsenic in Drinking Water," Am. J. of Epidemiology, vol. 141, no. 6, 1995, pp. 523-530. U.S. Dept. of Health and Human Services, National Toxicology Program, Seventh Annual Report on Carcinogens, 1994.

48. Bates, M. et al., "Arsenic Ingestion and Internal Cancers: A Review," Am. J. of Epidemiology, vol. 135, March 1992, pp. 462-76. Chiou, H. et al., "Incidence of Internal Cancers and Ingested Inorganic Arsenic: A Seven Year Follow Up Study in Taiwan," Cancer Research 55, March 15, 1995, pp. 1296-1300.

49. International Bottled Water Association, "20 Questions About the Bottled Water Industry."

50. Environmental Policy Institute, "Bottled Water: Sparkling Hype at a Premium Price."

51. Smith, A. et al., "Cancer Risks from Arsenic in Drinking Water," Environmental Health Perspectives, vol. 97, 1992, pp.259-67.

52. Smith, et al, ibid.

53. Smith, et al., ibid.

54. Engel, R. and A. Smith, "Arsenic in Drinking Water and Mortality from Vascular Disease: An Ecologic Analysis in 30 Counties in the United States," Archives of Environmental Health, vol. 49, no. 5, Sept./Oct. 1994, pp. 418-427.

55. Lai, M. et al., "Ingested Inorganic Arsenic and Prevalence of Diabetes Mellitus," Am J. Epidemiol, vol. 139, no. 5, March 1, 1994, pp. 484-92.

56. National Research Council, Health Effects of Exposure to Radon: A Time for Reassessment. Washington, D.C.: National Academy Press, 1994. Agency for Toxic Substance and Disease Registry, Toxicological Profile for Radon, 1990.

57. EPA, Report to the United States Congress on Radon in Drinking Water: Multimedia Risk and Cost Assessment of Radon, March 1994. EPA, Regulatory Reassessment Fact Sheet: Radon, March 1995.

58. EPA, ibid, March 1994. EPA, ibid, March 1995.

59. ATSDR, Toxicological Profile for Radon, 1990.

60. ATSDR, ibid.

61. ATSDR, ibid.

62. National Research Council, Pesticides in the Diets of Infants and Children, p. 4.

63. National Research Council, ibid., p. 194.

64. National Research Council, ibid., p. 196.

65. EPA Fact Sheet, May 1991.

66. National Research Council, Measuring Lead Exposure in Infants, Children and Other Sensitive Populations. Washington, D.C.: National Academy Press, 1993, p. 187.

67. Sidhu, K. et al., "Need to Revise the National Drinking Water Regulation for Copper," Regulatory Toxicology and Pharmacology 22, August 1995, pp. 95-100.

68. Calderon, R. et al., "Health Risks From Contaminated Water: Do Class and Race Matter?" Toxicology and Industrial Health, vol. 9, no. 5, Sept-Oct, 1993, pp. 879-900.

69. Calderon et al., ibid.

70. The Environmental Exchange, What Works-Local Solutions to Toxic Pollution, Washington, D.C., 1993.

71. Cushman, J., "Efficient Pollution Rule Under Attack," New York Times, June 28, 1995.

72. Environmental Exchange, What Works.

73. Groundwater Foundation, 1996 Groundwater Guardian Community Profiles, Water Center/Environmental Programs, University of Nebraska-Lincoln, 1996.

74. Groundwater Foundation, ibid.

75. Groundwater Foundation, ibid.

76. Groundwater Foundation, ibid.

77. Cohen et al., Just Add Water.

78. Cohen et al., ibid.

79. NRDC, Think Before You Drink, 1993. NRDC, Think Before You Drink - Update, July 1994.