THE EARTH'S BEST DEFENSE

WHAT'S ON TAP?

Grading Drinking Water in U.S. Cities

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The Natural Resources Defense Council is a national nonprofit environmental organization with more than 500,000 members. Since 1970, our lawyers, scientists, and other environmental specialists have been working to protect the world's natural resources and improve the quality of the human environment. NRDC has offices in New York City, Washington, D.C., Los Angeles, and San Francisco. Visit us on the World Wide Web at www.nrdc.org.

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EXECUTIVE SUMMARY

Every day more than 240 million of us in this country turn on our faucets in order to drink, bathe, and cook, using water from public water systems. And as we do, we often take the purity of our tap water for granted. We shouldn't. Before it comes out of our taps, our water usually undergoes a complex treatment process, often including filtration and disinfection. As good as our municipal water infrastructures can be (and they can be very good) they also can fail—sometimes tragically. In 1999, for example, more than 1,000 people fell ill at a county fair in upstate New York after ingesting an extremely virulent strain of *E. coli* bacteria; a three-year-old girl and an elderly man died when their bodies could not fight off the pathogen.[1] This is just one incident; health officials have documented scores of similar waterborne disease outbreaks in towns and cities across the nation during the past decade.

So, just how safe *is* our drinking water? In a careful and independent study, NRDC evaluated the quality of drinking water supplies in 19 of the nation's largest cities. We reviewed tap water quality data, Environmental Protection Agency (EPA) compliance records, and annual "right-to-know reports" (which water systems are required to send to their customers). In addition, we gathered information on pollution sources that may contaminate the lakes, rivers, or underground aquifers that cities use as drinking water sources.

Over the past 15 years, in most cities, drinking water purity has improved slightly. Nevertheless, risks remain. Overall, NRDC found that although many urban dwellers can drink tap water without acute health threats, contaminants pose risks to public health—particularly for pregnant women, infants, children, the elderly, and people with compromised immune systems. In some cities (Fresno is one example), the water is sufficiently contaminated that there may be substantial risks from drinking tap water.

NRDC's research demonstrated that in order to improve water quality and protect public health, we must upgrade treatment and distribution facilities and safeguard source water. Most major U.S. cities still employ the same basic water treatment technologies that have been used since before World War I—techniques that cannot remove many human-made (or human-released) chemicals that modern science, industry, mining, and manufacturing have created.[2] What's more, water supply infrastructure is deteriorating, putting the nation's public health at risk. Finally, source water remains vulnerable to pollution. Credible estimates found that a staggering $500 billion in upgrades and repairs are needed nationwide to ensure the safety of drinking water for years to come.[3] In May 2002, the Congressional Budget Office came to a similar conclusion: from $232–$402 billion in investments will be needed over the next two decades to upgrade and repair the nation's drinking water systems.[4]

The report that follows is a California-only prerelease of NRDC's nationwide study (the full report will be published shortly). NRDC chose to release the California portions of this report early because of the significance of our findings regarding drinking water supplies in Fresno, Los Angeles, San Diego, and San Francisco. The information in this prerelease may be of particular importance to California voters in the upcoming elections as they consider whether to approve Proposition 50, which would authorize $3.4 billion in investments in drinking water system improvements and water protection activities.

FINDINGS AND RECOMMENDATIONS

WATER QUALITY AND RULE COMPLIANCE

City	2001 Grade
Fresno	Poor
Los Angeles	Fair
San Diego	Fair
San Francisco	Poor

NRDC's research revealed that in many cities, drinking water quality is mediocre yet acceptable. A few cities, however, have serious water quality problems that may pose significant health risks to some citizens.

Findings in Four California Cities: From Minor to Major Problems

In general, we noted periodic and unpredictable spikes in contamination in many cities; on occasion, these risks were substantial. The EPA recommends that people with serious immune system problems (such as people on cancer chemotherapy or people with HIV/AIDS) consult with their health care providers about drinking tap water, in order to avoid the risk of infection from contaminated water. Pregnant women and infants may also be at special risk from certain contaminants common in many cities' tap water, like lead and chlorine by-products.

Most cities we reviewed nationally were in compliance with current EPA standards, though there were significant exceptions; some exceeded new standards coming into effect in 2002 or soon thereafter. In California, no confirmed violations of currently enforceable national standards were reported in the four reviewed cities. However:

Fresno water showed repeated problems with nitrates, pesticides, and industrial chemicals. Fresno advised that pregnant women and parents of infants consult with their health care providers about drinking Fresno's tap water.

San Francisco water exceeded the new EPA tap water standard for a family of disinfection by-products called "trihalomethanes" linked to cancer and potentially to birth defects and miscarriage (though the city got an extension to comply until 2004).

Los Angeles water had no violations, but it did have:

- significant levels of disinfection by-products
- substantial concentrations of arsenic (below the new EPA standard—but, according to the National Academy of Sciences, at levels high enough to pose a significant cancer risk)
- elevated levels of radioactive and cancer-causing radon in some wells
- levels of the rocket fuel perchlorate (a thyroid toxin) that measured above the California Action Level and above the EPA's draft safe level
- elevated nitrate levels in some wells

San Diego had:

▸ substantial levels of cancer-causing trihalomethanes, averaging modestly below the new EPA standard but still posing health risks

▸ perchlorate in parts of the system, at levels higher than the state's action level and the draft EPA safe level

▸ other contaminants that, while not at levels high enough to trigger violations, occurred in recent years in excess of EPA health goals and therefore represent potential health concerns—including:

—the carcinogen and reproductive toxin ethylene dibromide (2000 most recent reported data)

—lead (1999 most recent reported data)

Recommendations: Significant Investment Is Needed to Protect Drinking Water

Based upon the research involved in this report, NRDC recommends that cities invest in protecting and improving the quality of tap water.

▸ There is an urgent need for at least $500 billion nationwide in federal, state, and local investment in our neglected city drinking water systems throughout the country.

▸ Billions of dollars in investments are needed for California to:

—improve source water protection through land purchasing, easements, or new standards;

—improve drinking water treatment;

—invest in water conservation measures;

—replace and update pipes and components of water distribution systems;

—modernize drinking water systems.

▸ Congress should enact and fund water infrastructure legislation that at least doubles current federal support for drinking water supplies from the current level of $1.7 billion per year. A portion of this funding should be earmarked for source water protection.

▸ To fund investment, states and local governments should consider raising money through bond issues and other financing mechanisms.

▸ By increasing rates, water systems can collect sufficient funds—with support from state and federal government funding, if needed—to rehabilitate, upgrade, and fully maintain their water supply infrastructure for the long haul.

RIGHT-TO-KNOW REPORTS

Findings: More Candor and Clarity Needed

City	2001 Grade
Fresno	Poor
Los Angeles	Good
San Diego	Fair
San Francisco	Fair

The quality of and honesty in the cities' annual right-to-know reports varied: some were successful tools for consumer education; some, however, appeared to be less than direct.

The Fresno right-to-know reports were troubling. For example, the Fresno reports were particularly circuitous in their discussion of high nitrate levels, as follows:

▶ The 2000 report directed pregnant women to avoid tap water due to high nitrate levels—but the warning was buried on page 5.[5] The 2001 report recommended that women and parents of infants consult with health care providers about city tap water—again, in a recommendation buried on page 5.

▶ In reporting that city wells exceeded drinking water standards for nitrates, the 2000 and 2001 reports buried that critical information in footnotes.

▶ Fresno also placed detailed information on other contaminants found at levels above standards in fine-print footnotes.

▶ Fresno took wells out of service rather than reporting violations.

The Los Angeles right-to-know reports were above average. For example:

▶ Los Angeles candidly revealed tap and source water problems.

▶ The reports were relatively user-friendly.

▶ The reports revealed information about the health effects of contaminants found in the city's water.

▶ The reports included good source water information.

▶ The 2001 reports prominently included a "special notice to immuno-compromised" individuals.

The San Francisco right-to-know reports had problems. For example:

▶ They included overarching, prominent, and unwarranted claims that the city's water is "top quality," ignoring the serious trihalomethane problem and undermining the report's subsequent mandatory (and less prominent) warnings to vulnerable populations.

▶ The city minimized the risks posed by *Cryptosporidium* and *Giardia* and failed to provide an adequate warning for vulnerable populations by neglecting to prominently display warnings to immune-compromised individuals—in spite of the large number of people in the city living with HIV/AIDS. The 2001 report directly violated EPA regulations for right-to-know reports, because it failed to include the explicit, legally required warning to immune-compromised people about the hazards of infection from tap water.[6]

The San Diego right-to-know reports also suffered from deficiencies:

▶ In 1999, San Diego revealed that 10 percent of homes in the city had more than 5 parts per billion (ppb) of lead in their tap water.[7] Contrary to EPA rules, however, the 2000 and 2001 reports failed to follow up on that information and disclose the results of the city's lead and copper monitoring.[8]

Recommendations: A Call for Candor and Clarity

The enormous promise of right-to-know reports has not been achieved. We recommend that water systems change right-to-know report presentation, as follows:

▶ Avoid the use of sweeping and prominent claims of absolute safety for their water.
▶ Prominently place the warnings to especially vulnerable people on the front page of their report, set off in a box or otherwise, to capture these consumers' attention.
▶ Discuss any significant water quality or compliance issues prominently in the first paragraphs of the report, linking the information to the investment needs of the utility.
▶ Candidly discuss the potential health effects of contaminants found in their water—at least those contaminants found at levels in excess of EPA or state health goals, action levels, or health advisories.
▶ Convey as much information as possible about the specific sources in their watershed that are or may be contributing to contamination or that are threatening to contaminate a water supply.
▶ Translate right-to-know reports into any language beyond English that is spoken by more than 10 percent of a population, based upon 2000 Census data.

SOURCE WATER

Findings: Resources Under Siege

City	2001 Rating
Fresno	6
Los Angeles	5 for imported water; 3 for local water
San Diego	5 for imported water; 2 for local water
San Francisco	2

1=least threat; 6=highest threat

City source waters are most frequently contaminated by:
▶ Municipal sewage
▶ Polluted urban runoff from stormwater or snowmelt
▶ Pesticides and fertilizers from agricultural fields
▶ Animal waste from feedlots and farms
▶ Industrial pollution from factories
▶ Hazardous waste sites

Source water protection has often been overlooked by many city water systems for years, and most California cities have done little or nothing to protect source waters. For example, the Fresno water supply relies upon wells that have become seriously contaminated by agricultural and industrial pollution. Nitrate contamination, industrial solvents, pesticides, and a variety of other pollutants have frequently forced Fresno to close down or treat wells or to reduce their use.

The Colorado River provides another striking example of the hazards of unprotected source water. San Diego and Los Angeles rely heavily upon the Colorado River, which threads for hundreds of miles through several states and is threatened by salinity and by a wide array of municipal, industrial, and agricultural sources of pollution. For example, in Nevada, the rocket-fuel producer Kerr-McGee allowed perchlorate to leach into groundwater and to reach the Colorado; this chemical is known to harm the thyroid and may cause cancer. San Diego and Los Angeles are also supplied by the Sacramento-San Joaquin Delta watershed: while of somewhat better quality than the Colorado, this watershed is also threatened with contamination from agriculture and a variety of other pollution sources.

Source water protection is an essential component of drinking water protection. San Francisco's Hetch Hetchy and, to a lesser extent, Alameda water supplies offer fine examples of strong source water protection. The Hetch Hetchy is located in Yosemite National Park and is protected from most human-caused pollution sources, except occasional recreational use of the watershed. The city also has made a major effort to protect the Alameda watershed from contamination.

Recommendations: Protection and Land Acquisition

Cities vary greatly in their efforts to protect water sources. Some cities, like San Francisco, generally have very well protected watersheds. Others, like Fresno, Los Angeles, and San Diego, have serious need for better source water protection.

To ensure the safety of water quality, utilities need to be at the forefront of protection efforts. For example, utilities can urge state or federal lawmakers to craft legislation to acquire interests in land. They can also push for improved controls on pollution from a variety of sources: concentrated animal feeding operations and other agricultural sources, stormwater runoff from cities and suburbs, combined sewers and sanitary sewer overflows, and chemical contamination from industry.

In sum, water utilities and their consumers have a very strong common interest in source water protection. An informed, activated public is a utility's strongest ally in the effort to improve pollution prevention and source water control. By publicly identifying threats to source water and by working with the public and elected officials to address these threats, water utilities will not only help their own customers, but also will make a major contribution to public health and environmental protection.

NOTES

1 "1061 Suspected *E. coli* Cases in New York Outbreak," Infectious Disease News (October 1999), available online at www.infectiousdiseasenews.com/199910/frameset.asp?article=ecoli.asp; CDC. "Public health dispatch: Outbreak of *Escherichiacoli* O157:H7 and *Campylobacter* among attendees of the Washington County Fair, New York," 1999. *MMWR* 1999; 48(36)803.

2 See Brian Cohen and Erik Olson, *Victorian Water Treatment Enters the 21st Century* (Natural Resources Defense Council, 1995).

3 Water Infrastructure Network, Clean Safe Water for the 21st Century (2000) available online at www.amsa-cleanwater.org/advocacy/winreport/winreport2000.pdf.

4 CBO, "Future Investment in Drinking Water and Wastewater Infrastructure," (May 2002), available online at www.cbo.gov/showdoc.cfm?index=3472&sequence=0&from=1.

5 Fresno Water Division, 2000 Water Quality Report.

6 See 40 C.F.R. § 141.154(a): "(a) All reports must prominently display the following language: Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by *Cryptosporidium* and other microbial contaminants are available from the Safe Drinking Water Hotline (800-426-4791)."

7 The City of San Diego, Water Department, Consumer Confidence Report 1999, available online at www.sannet.gov/water/quality/report99.pdf.

8 See 40 C.F.R. §141.153(d)(4)(vi).

CHAPTER 1

BACKGROUND, FINDINGS, RECOMMENDATIONS

Every day more than 240 million of us in this country turn on our faucets in order to drink, bathe, and cook, using water from public water systems. And as we brush teeth, wash hands, fill glasses, and prepare meals, we often take the purity of our tap water for granted. The truth is, we shouldn't. Before it comes out of our taps, our water often undergoes a complex, elaborate, and often antiquated process of treatment, often including filtration, and disinfection designed to protect public health. But as good as our municipal water infrastructures can be (and sometimes they can be very good) they also can fail—sometimes with tragic results.

The experts at the Centers for Disease Control and Prevention (CDC) have recorded hundreds of waterborne disease outbreaks caused by U.S. water supplies in the past 25 years.[1] The worst was in 1993, when more than 400,000 citizens in Milwaukee, Wisconsin, were made violently ill by a tiny parasite in their tap water called *Cryptosporidium*.[2] Several thousand Milwaukeeans were hospitalized, and as many as 100 died.[3] More recently, in 1999, more than 1,000 people at a county fair in upstate New York were stricken by an extremely virulent strain of *E. coli* (the same bacteria that we have come to associate with bad meat). On that occasion, a three-year-old girl and an elderly man died of acute kidney failure when their bodies could not fight off the pathogen.[4]

So, just how safe *is* our drinking water? In a careful and independent study, NRDC evaluated the quality of drinking water supplies in 19 of the nation's largest cities. We reviewed water quality data, Environmental Protection Agency (EPA) compliance records, and annual "right-to-know reports" (which water systems are required to send to customers). In addition, we gathered information on pollution sources that may contaminate the lakes, rivers, or underground aquifers that cities use as drinking water sources.

Overall, we found that over the past 15 years, in most cities, drinking water purity has improved slightly. Nevertheless, risks remain. NRDC found that although most urban dwellers can drink their water without acute health threats, in most cities more needs to be done to improve water quality. Trillions of dollars have been spent to construct, treat, and deliver water to city taps, but there is great need for improvement. Credible estimates found that a staggering $500 billion in upgrades and repairs are needed nationally to ensure the safety of drinking water for years to come.[5] Even the usually conservative Congressional Budget Office (CBO) estimated in May 2002 that $232–$402 billion in investments will be needed over the next two decades to upgrade and repair the nation's drinking water systems.[6]

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BACKGROUND

WATER QUALITY AND COMPLIANCE

The Big City "Water Treatment Train"

Typically, large U.S. cities that tap into surface waters (rivers or lakes) for drinking water supplies use the following treatment steps, which have generally been used since before World War I—some are centuries old:

- *Coagulation.* The first step, after screening any large objects from the water (such as sticks or leaves), is the addition of a coagulant such as alum (aluminum sulfate). The coagulant makes the particles of suspended solids stick together in clumps.
- *Prechlorination.* Some water systems also add chlorine or another oxidant, early in the process, to start disinfection and to oxidize some chemicals in the water to ease their removal later. (As discussed later, this early use of chlorine can substantially increase the levels of chemicals called "chlorination by-products," which are probable human carcinogens, or cancer-causing agents, and may, according to recent studies, cause problems in fetuses exposed to them in the womb.)
- *Sedimentation.* The water is mixed and then allowed to sit in a large basin where the coagulant takes effect, and the mud and solids gradually settle to the bottom. The clarified water is then ready for filtration.
- *Filtration.* Next, the water is run through large filters usually made out of sand or crushed anthracite coal. This filtration process removes many of the smaller particles, including some larger microbiological parasites. Sand and anthracite are not effective for removal of many dissolved organic and inorganic chemicals (such as pesticides, many industrial chemicals, and arsenic).
- *Primary Chemical Disinfection, Usually Using Chlorine.* Chlorine in gaseous form or in a liquid bleach-like form (hypochlorite) is added to kill many bacteria and viruses. Chlorination by-products start to form at this point or earlier (if chlorine was added prior to sedimentation). Some cities are now using "chloramines"—essentially chlorine plus ammonia—as a primary disinfectant because chloramines produce modestly lower levels of undesirable chlorination by-products.
- *Corrosion Inhibiter.* Many cities add a chemical, such as lime or zinc orthophosphate, to inhibit the ability of the water to corrode the city's pipes and house-

hold plumbing. Corrosion inhibiters increase the pH (that is, decrease the acidity) of the water, and often help form a film to coat the inside of the pipes so that the pipes do not corrode as quickly and so that less lead is leached from the pipes and plumbing fixtures.

▶ *Polishing, Fluoride, Secondary Disinfection.* Most cities add fluoride, and virtually all U.S. cities add a second dose of disinfectant, usually chlorine or chloramines. The secondary disinfectant is added to keep the water from becoming recontaminated with bacteria in city and household pipes after the water leaves the water treatment plant. Disinfection by-product levels generally continue to increase as the water travels through the pipes and the chlorine reacts with natural organic matter dissolved in the water.

This treatment train has served most cities fairly well for decades. It has essentially eliminated cholera and typhoid in U.S. cities, and reduced levels of many other bacteria and viruses in our drinking water, saving countless lives. But as discussed below, it leaves many contaminants untouched.

How the Treatment Train Fails

We now know that this pre-World War I–era treatment train does not remove many of the contaminants that are in our water and pose serious public health risks. For example, these antiquated treatments often do little or nothing to remove:

▶ Many inorganic chemicals that are by-products of industry and manufacturing, such as:

- ▶ arsenic
- ▶ cyanide
- ▶ chromium

▶ Many other chemicals, such as:

- ▶ dry cleaning solvents like perchloroethylene ("perc")
- ▶ industrial solvents, such as trichlorethylene (TCE) and dichloroethylene (DCE)
- ▶ pesticides, such as ethylene dibromide (EDB) and atrazine
- ▶ petroleum components, such as benzene, toluene, and xylene

▶ Many waterborne parasites, such as *Cryptosporidium* (*Crypto*), the chlorine-resistant protozoan that sickened 400,000 people and killed as many as 100 in Milwaukee.[7]

The Role of Filtration in Treatment Train Effectiveness

Water engineers have found that adjustments to treatment trains can, in some cases, improve removal of certain contaminants. For example, recent evidence indicated that improved operation of city water filters can reduce the amount of *Cryptosporidium* that gets through them, so the EPA modestly strengthened the rules for cities that filter their water.[8] Similarly, modest operational changes in some types of water treatment plants have been shown to reduce arsenic levels. (Serious arsenic contamination requires installation of new treatment technologies.)[9]

Several of the nation's largest cities have water systems that remain unfiltered. These cities—including New York, Boston, and parts of San Francisco and Seattle—generally get their water from sources that are (or at least were) relatively well protected from housing, development, and industrial pollution. Increasingly, many of these unfiltered water systems are facing serious development pressures in their watersheds (the areas of land that drain into the water source). With increasing development comes greater risk of microbiological and chemical pollution. As a result, either the EPA or state officials have ordered some cities with unfiltered water systems to filter their water or to improve water treatment through use of advanced disinfection technologies (such as ozone or ultraviolet light). Some experts fear that the mandate of additional treatment will result in a weakened resolve on the part of local officials to protect source water—leading to serious degradation of the cities' source water quality and ultimately even worse tap water. Balancing these concerns is a highly controversial exercise.

Clearly, the ideal scenario is to have both strong source water protection and state-of-the-art treatment. However, many cities have neither.

The Unique Problem of Groundwater Wells

A small number of cities—such as Albuquerque and most cities in Florida—rely primarily upon groundwater wells for drinking water supplies. In addition, many cities that depend on surface waters use groundwater wells as reserve sources of water for times of peak demand or in case of an emergency or drought.

Groundwater wells pose their own set of health risks: They are rarely treated (except for chlorination) because they have been presumed to be largely immune to the types of pollution that get into surface water pollution. Of course, we now know that groundwater can and often has been contaminated by people's above-ground activities; Fresno's groundwater wells are a vivid example. Fresno's groundwater has gradually degraded into a complex soup of contaminants ranging from nitrates (from fertilizers or human or animal waste), to pesticides such as the carcinogenic soil fumigant ethylene dibromide (EDB), to industrial chemicals like trichlor-ethylene (TCE), and the dry cleaning solvent perchloroethylene ("perc"). Furthermore, many groundwater wells contain naturally occurring contaminants—including radioactive contaminants like uranium and radon, as well as inorganic contaminants like arsenic. It is critical that those cities that rely on groundwater—either as a primary water source or as a backup—treat their water in order to eliminate these contaminants.

Big City Water Infrastructure: Often Aging and Outdated

The science of drinking water treatment is an old one, but technological advances in recent decades have made delivery of pure, safe, and good-tasting water to city taps a readily achievable goal. Yet most major U.S. cities still employ the same basic technologies that have been used since before World War I.[10] In many cities, the water "infrastructure"—that is, the water collection devices, treatment plants, pumps, water mains, service lines, and other equipment that deliver water to your home—has been in place for decades; quite often, components of these systems (such as the mains) are more than a century old. As the water infrastructure outlives its useful life, it can corrode and deteriorate, and we have witnessed the results: a nationwide epidemic of burst water mains, unreliable pumps and collection equipment, and aging treatment plants that fail to remove important contaminants. With age and increased demands due to population growth, the water infrastructure problems in many cities are growing more serious, and public health is at risk.

Most cities' water supplies are in dire need of repair and upgrading. The problems associated with decay are grave: Old pipes not only leak (many cities lose 20 percent or more of their water to leaks), but they can also burst, causing catastrophic water pressure loss and risking serious contamination of the water supply. When water pressure drops due to pipe breaks or big leaks, bacteria and other contaminants can get into the water. Bacteria can also grow in old or poorly maintained pipes, which may harbor pathogens that can make people sick.

Outdated drinking water treatment plants also cause serious water quality problems. For example, not only do old-fashioned treatment plants allow many contaminants to slip through, but they also *add* contaminants. Traditional chlorine primary disinfection can produce high levels of disinfection by-products when the chlorine reacts with naturally occurring organic matter in the water. These disinfection by-products have been linked to cancer and, in a series of preliminary studies, to miscarriages and birth defects. In addition, older distribution systems often used lead in the service lines (pipes that take water from the water main to homes) or other components of the system.

Who's In Charge?

For the most part, the business of water collection, treatment, and distribution is a government-run operation in this country; in most cities, it is headed by the city itself, or by a public water authority. (A public water authority generally is a government entity, often created under state law, run by a board of directors that was appointed by local or state elected officials.) Some cities purchase their water from large, publicly owned wholesale water authorities; one such example is the Metropolitan Water District of Southern California, which collects, treats, and sells the water used by more than 16 million people.

Private, investor-owned companies represent a relatively small percentage of large city water systems in the United States. However, that may change: The American Water Works Company now serves 15 million people in 27 states and is in the process of being acquired by a German investor-owned corporation, RWE AG.[11,12] In many European nations, including France and the United Kingdom, several huge, multinational private water companies own virtually all the water systems. Atlanta has privatized its water system's operation and maintenance, and New Orleans is in the process of doing so.

Who Sets and Enforces the Rules?

Public Water Systems

The Safe Drinking Water Act (SDWA), originally enacted by Congress in 1974 and signed into law by President Gerald Ford, vests the EPA with the responsibility for regulating the quality of drinking water served by "public water systems" (PWSs).[13] A PWS is defined to include any water system that serves water to more than 25 people (or 15 service connections), no matter who owns it, so PWSs run the gamut from small trailer parks to the nation's biggest cities.

Maximum Contaminant Level Goals

Under the SDWA, which was substantially amended in 1986 and again in 1996, the EPA must set "Maximum Contaminant Level Goals" (MCLGs). The aim of these goals is to limit contaminants in drinking water to levels that will have no adverse effect on human health (with a margin of safety).[14] The EPA usually sets the MCLG for cancer-causing agents at zero because no level of these contaminants is believed to be fully safe. The MCLGs are not directly enforceable.

Maximum Contaminant Levels

Once the EPA sets an MCLG for a given contaminant, it then establishes a "Maximum Contaminant Level" (MCL), which is an enforceable maximum allowable level of a contaminant in tap water. The MCL is supposed to be as close to the MCLG health goal as is feasible for large water systems.[15] In a change to the law enacted in 1996 (and opposed by many environmentalists), Congress added a provision that allows the EPA to adopt a weaker MCL than is feasible if the EPA administrator determines that the costs of the feasible standard are not justified by its benefits.[16] The EPA has now used this authority on several occasions—first for uranium and most recently for arsenic. In the case of arsenic, the EPA established a weaker standard (10 parts per billion, or ppb) than was feasible (3 ppb). Thus, it is extremely important to realize that MCLs often are not fully protective of public health. They are set as a result of a political, economic, and technical balancing act, in which the EPA often sets standards that allow significant health risks—sometimes allowing as high as a 1 in 300 cancer risk (in the case of the recent arsenic standard). So while MCLs are sometimes referred to as "health standards," in fact only MCLGs are based exclusively upon health standards.

Monitoring and Reporting Requirements

When the EPA sets an MCL, the agency also imposes monitoring and reporting requirements on PWSs; these vary depending on the contaminant. For example, PWSs must frequently monitor for a common contaminant such as coliform bacteria; a water system may have to test only once a year—or once every three years or even less frequently—for other contaminants. Water systems are often required to test for radioactive contaminants like radium or beta emitters only every three years. States are also authorized to waive testing entirely when they find that a contaminant is very unlikely to be found (e.g., dioxin, for which many states do not require systems to test).

Treatment Techniques

In cases in which a contaminant cannot reliably be measured in drinking water, the EPA is authorized to issue a "treatment technique" (TT) instead of an MCL.[17] A TT requires water systems to use a certain type of water treatment to get rid of the contaminant of concern. There are just a few TTs. One requires water systems that use surface water to filter their water with sand or similar media to remove waterborne parasites, or to demonstrate that they are entitled to avoid filtration because their source water is extremely high quality and very well protected from possible pollution sources.[18]

Another TT applies to lead and copper. The "Lead and Copper Rule" requires water systems to test their water for these contaminants, and to treat to make their water less corrosive (to reduce lead leaching). If the corrosion control does not work and lead levels remain high, the water system must eventually remove lead service lines that contribute to the lead problem.[19]

Primacy: Responsibility for Enforcing Standards

Once the EPA has established MCLs and TTs, states are given the opportunity to take "primary enforcement responsibility," or "primacy," for that standard.[20] If, within a prescribed period, a state fails to show to the EPA's satisfaction that it has adopted the rule and will enforce it, the EPA itself must enforce that rule in that state. To date, all states except Wyoming have obtained primacy for current drinking water standards.

Testing and Audits

Water is generally tested by the water system itself. Typically, a large water system has an in-house laboratory that tests for bacteria and other contaminants. (For example, major cities are required to test for coliform bacteria more than 100 times per month.) Some cities and most smaller water systems take samples of their water and send them to a state-approved laboratory for analysis. This testing and reporting of the results typically is done on the "honor system"—that is, the state and the EPA trust the water systems to take representative samples of their water and to send them to the lab following EPA protocols for ensuring the integrity of samples.

Occasionally, state or EPA spot-checks and reviews have uncovered falsified results, where the system operator was making up reported values, for example, or microwaving samples to kill bacteria.[21] In general, states lack the resources to conduct detailed audits of the accuracy and integrity of most samples and reports provided to them; thus the EPA and states rely upon self-policing.

Violations

Each year, states report more than 100,000 violations of EPA standards to the EPA.[22] While most of these violations are failures to test or to report test results (posing potential risks if contamination problems are being overlooked, intentionally or not), more than 16,000 of these are EPA standard (MCL or TT) violations. According to EPA data audits, this figure seriously underestimates the actual number of violations of all types, since states fail to report most violations.

If a water system is reported to be in violation of EPA standards, states are supposed to be the first line of enforcement. If a state fails to take enforcement action, the EPA is required under the SDWA to formally notify the state and PWS of the violation; the EPA must then initiate enforcement action itself.[23] However, with the vast majority of violations (well over 90 percent)—even those known and reported to the EPA—no enforcement action is taken by the EPA or by states.[24]

Apparently most very large city water systems have not reported serious MCL or TT violations.[25] This may be attributable simply to underreporting of violations, but NRDC's review of the records found few such cases. (We acknowledge, however, that such violations may exist but may not have been detected.) There are some cases in which large cities have violated MCLs or TTs and in which the EPA or a state has taken enforcement action. For example, several cities have been sued for violating the Surface Water Treatment Rule; other cities have been subject to enforcement actions for violating other EPA rules—Phoenix, for example, which settled an EPA enforcement case for allegedly violating monitoring, reporting, and other rules repeatedly for $350,000.

RIGHT-TO-KNOW REPORTS

For nearly the past 30 years, concerned citizens have been working through policy avenues to assert their right to know whether their drinking water is safe. The movement began in 1974, when the SDWA included a requirement that a PWS must issue a public notice to all of its customers when it violates an EPA regulation.[26] A serious violation that poses an immediate health threat (such as a serious bacteria-contamination problem) is subject to virtually immediate public notice. However, a 1992 General Accounting Office (GAO) study and other information revealed that these public notices were not being issued. [27] In the rare cases when public notices were issued, they often appeared only in small print in the "legal notices" section of newspapers.[28]

As a result, citizen organizations urged Congress to overhaul the public notice provision of the SWDA; furthermore, citizens pushed Congress to adopt a right-to-know provision in the SDWA that would enable citizens to be notified by PWSs about what was in their drinking water. During Senate-floor debate on the 1996 SDWA Amendments, Senator Barbara Boxer (D-CA) offered a revolutionary amendment requiring annual right-to-know reports to be sent directly to each water customer; these would summarize what contaminants were in tap water and provide other pertinent drinking water related information. Boxer's amendment was opposed by many water utilities, by most municipalities and states, and by the Democratic and Republican leadership of the Environment and Public Works Committee—and it was ultimately defeated on the Senate floor. But in the House of Representatives, Representatives Henry Waxman (D-CA) and Jim Saxton (R-NJ) urged the adoption of an amendment much like Boxer's. They successfully persuaded the other House Energy and Commerce Committee negotiators for the legislation to include the provision in the final House bill, which was ultimately signed into law.[29]

In 1998, after extensive regulatory negotiations with the water industry, states, and environmental, public health, and other groups, the EPA issued regulations implementing right-to-know requirements.[30] The final rules, carefully crafted in extensive detail in the negotiations (in which NRDC was an active participant), represented a middle ground. They did require specific information on, among other things, what contaminants were found in tap water, what the water source was for the system, and any known pollution sources responsible for detected contaminants, as well as details on any violations during the past year. Under the SDWA and the EPA's rules, the water system is responsible for sending the report to all water system customers and for making a good-faith effort (defined in the rules) to get the report into the hands of apartment dwellers and others who do not receive water bills.

The reports are intended to be direct and understandable. The rules specifically provide that while systems can add nonrequired information, that information must be "consistent with, and not detract . . . from the purpose of the report."[31] Tables cannot be cluttered with irrelevant information on contaminants not detected, or presented with fractional decimal numbers that are hard to interpret.

THREATS TO SOURCE WATER

Drinking water comes from either groundwater sources (underground formations of rock, saturated soil, or glacial deposits called aquifers that are usually porous and hold water) or from surface water sources, such as streams, rivers, or lakes. Groundwater and surface waters have their own particular sets of pollution sources.

Major pollutants of city source waters include:

- *Municipal sewage.* Some cities have combined sewer systems, which convey stormwater runoff along with sanitary sewage and industrial waste. Runoff from particularly heavy storms can result in "combined sewer overflow" (CSO), which occurs when the volume of rain or snow is greater than the capacity of the stormwater management system. In such events, sewage can make its way into drinking water supplies.
- *Polluted runoff.* When rainwater or snowmelt runs off roads, farmland, lawns, and construction, logging, or mining sites, for example, it picks up pollutants such as oil, animal waste, lawn pesticides and fertilizers, and other contaminants, which can end up in drinking water supplies.
- *Pesticides and fertilizers.* Chemicals applied to farmland or by homeowners, golf courses, and commercial establishments can leach into the groundwater, contaminating supplies.
- *Animal waste.* Animal waste from big animal feedlots, manure piles, and land application of manure can leach into groundwater, contaminating supplies.
- *Industrial pollution.* By-products from the manufacturing process can leach into groundwater, contaminating supplies.
- *Hazardous waste.* Hazardous waste sites contain chemicals than can leach into groundwater or wash into surface water, contaminating supplies.

The health effects related to these contaminants are detailed in Chapter 2. In sum, many some of the most common water quality contaminants are:

Microbiological Contaminants
▶ coliform bacteria
▶ the pathogen *Cryptosporidium* in source waters
▶ other pathogens, indicated by turbidity or cloudiness of water

Inorganic Contaminants
▶ arsenic
▶ lead
▶ nitrates (from fertilizers or human or animal waste), which can poison infants
▶ perchlorate (a currently unregulated toxin from rocket fuel and explosives which is found in millions of peoples' tap water)

Organic Contaminants
▶ atrazine, a toxic and possibly cancer-causing pesticide (number-one pesticide, used on corn)
▶ trihalomethanes (by-products of the use of chlorine disinfection)
▶ haloacetic acids (also disinfection by-products)
▶ dibromochloropropane (DBCP), a pesticide
▶ ethlyene dibromide (EDB), also a pesticide

Radioactive Contaminants
▶ radon
▶ alpha radiation
▶ beta radiation
▶ uranium

FINDINGS

NRDC's research revealed that in many cities, drinking water quality is mediocre yet acceptable. A few cities, however, have serious water quality problems that may pose significant health risks to some citizens. In general, we noted periodic and unpredictable spikes in contamination in many cities; on occasion, these risks were substantial. The EPA recommends that people with serious immune system problems (such as people on cancer chemotherapy or people with HIV/AIDS) consult with their health care providers about drinking tap water, in order to avoid the risk of infection from contaminated water. Pregnant women and infants may also be at special risk from certain contaminants common in many cities' tap water, like lead and chlorine by-products.

WATER QUALITY AND RULE COMPLIANCE: FROM MINOR TO MAJOR PROBLEMS

Most cities we reviewed nationally were in compliance with current EPA standards, though there were significant exceptions; some exceeded new standards coming into effect in 2002 or soon thereafter. In California, no confirmed violations of currently enforceable national standards were reported in the four reviewed cities. However:

Fresno water showed repeated problems with nitrates, pesticides, and industrial chemicals, though the city insisted that every time a well was confirmed to violate the standards, it was removed from service. Fresno advised that pregnant women and parents of infants consult with their health care providers about whether to drink Fresno's tap water.

Los Angeles water had no violations, but it did have:
▸ significant levels of disinfection by-products (though somewhat lower than San Francisco's)
▸ substantial concentrations of arsenic (below the new EPA standard—but, according to the National Academy of Sciences, at levels high enough to pose significant cancer risk)
▸ elevated levels of radioactive and cancer-causing radon in some of its wells (levels were above the EPA's proposed MCL but below the weaker, proposed so-called alternate MCL that will be available via waiver)
▸ levels of the rocket fuel (and thyroid toxin) perchlorate that measured above the California action level and above the EPA's draft safe level
▸ elevated nitrate levels in some wells

San Diego water had:
▸ substantial levels of cancer-causing trihalomethanes, averaging modestly below the new EPA standard but still posing health risks
▸ perchlorate in parts of the system, at levels higher than the state's action level and the draft EPA safe level
▸ the carcinogen and reproductive toxin ethylene dibromide, lead, and three cancer-causing radioactive contaminants (though not at levels high enough to trigger violations, these contaminants pose a potential health concern, since they occured in excess of EPA health goals)

San Francisco water exceeded the new EPA tap water standard for a family of disinfection by-products called "trihalomethanes." (The standard was issued in 1998 and became enforceable in January 2002.) San Francisco requested, and got, an extension until 2004 of the compliance deadline for that standard from the EPA; the city says it will meet the standard in 2003.

RIGHT-TO-KNOW REPORTS: A CALL FOR CANDOR AND CLARITY

The quality of and honesty in the cities' annual right-to-know reports varied. Some were successful tools for consumer education. Some, however, appeared to be less than direct.

The Fresno right-to-know reports were troubling. For example, the Fresno reports were particularly circuitous in their discussion of high nitrate levels, as follows:
▸ The report for 2000 directed pregnant women to avoid tap water due to high nitrate levels—but the warning was buried on page 5.[32] The 2001 report recommended that

pregnant women and parents of infants consult with health care providers about city tap water safety—but this recommendation, again, was buried on page 5 of the report. In that report, the front page included this prominent claim: "Fresno Water Division Ranked #1."

▶ In reporting that city wells exceeded drinking water standards for nitrate; 1,1-DCE; cis-1,2-DCE; DBCP; EDB; and TCE, the 2000 and 2001 reports buried that critical information in footnotes printed so small as to be nearly unreadable.

▶ The tables in the reports stated that Fresno did not violate any enforceable standards. In fact, for each of the contaminants discussed above, for some period of time Fresno residents apparently drank water exceeding the EPA health standards for some period of time. But because Fresno took the wells out of service later or averaged the high levels with lower levels detected later, Fresno claims there was no violation. This reading of the rules is questionable—particularly in the case of nitrate, an acute toxin for which averaging is not allowed.

The Los Angeles right-to-know reports were above average. For example:

▶ Los Angeles candidly revealed tap and source water problems.

▶ The reports were relatively user-friendly.

▶ The reports revealed information about the health effects of contaminants found in the city's water.

▶ The reports included good source water information.

▶ The 2001 reports prominently included a "special notice to immuno-compromised" individuals.

The San Francisco reports also had problems. For example:

▶ They included overarching, prominent, and unwarranted claims that the city's water is "top quality," ignoring the serious trihalomethane problem and undermining the report's subsequent mandatory (and less prominent) warnings to vulnerable populations. The prominent safety claims may have deterred many readers from reading through the full report and reaching these warnings.

▶ San Francisco also minimized the risks posed by *Cryptosporidium* and *Giardia* and failed to provide an adequate warning for vulnerable populations by neglecting to display prominently warnings to immune-compromised individuals. Despite the large number of people in the city living with HIV/AIDS, the 2001 report notes only that these parasites pose special risks to "some people"; it does not even mention the special threats to immune-compromised people or people living with HIV/AIDS. The 2001 report directly violates the EPA regulations for right-to-know reports, because it fails to include the explicit, legally required warning to immune-compromised people about the hazards of infection from tap water.[33] (The 2000 report, however, did include this information.)

The San Diego reports also suffered from some deficiencies:

▶ In 1999, San Diego revealed that 10 percent of homes in the city had more than 5 ppb lead in their tap water.[34] Contrary to EPA rules, however, the 2000 and 2001 reports both failed to follow up on that information and disclose the results of the city's lead and copper monitoring.[35] The city should have followed up with information on lead in the two subsequent years, as parents of infants and young children deserve to be told about lead levels.

▸ The San Diego reports failed to disclose the levels of several regulated contaminants found in the city's water, such as arsenic, barium, chromium, copper, and selenium. While these contaminants were found at levels below EPA standards, some may be of health interest to consumers; furthermore, the EPA's regulations clearly require that citizens be informed of any findings of regulated contaminants (everything noted is regulated).[36]

SOURCE WATER UNDER SIEGE

Source water protection is key to strong drinking water protection. Typically, water experts seek what they call "multiple barriers to contamination":

- ▸ strong protection against pollution of the source water
- ▸ effective drinking water treatment at the water treatment plant
- ▸ effective and safe management of the distribution system

Unfortunately, source water protection has often been overlooked by many city water systems for years.

In California, San Francisco's system, however, is a notable exception to this rule. San Francisco's Hetch Hetchy and, to a lesser extent, Alameda water supplies have strong source water protections in place. The Hetch Hetchy is located in Yosemite National Park and is protected from most human-caused pollution sources, except occasional recreational use of the watershed. The city also has made a major effort to protect the Alameda watershed from contamination.

However, many other California cities have done little or nothing to protect source waters; the case of the Colorado River provides a striking example. San Diego and Los Angeles rely heavily upon the Colorado, which threads for hundreds of miles through several states and is threatened by salinity and by a wide array of municipal, industrial, and agricultural sources of pollution. The perchlorate problem from the Kerr-McGee plant in Nevada, which produced rocket fuel for many years, is but one source of contamination. Other sources of salinity, pesticides, industrial chemicals, and other contaminants include polluted runoff from urbanizing areas, farms, and old mining sites such as the vast uranium mill tailings piles in Moab, Utah, which are leaking radioactive and other contaminants into the Colorado River. San Diego and Los Angeles are also supplied by the Sacramento–San Joaquin Bay Delta watershed. While of somewhat better quality than the Colorado, this watershed is also threatened with contamination from agriculture and a variety of other potential pollution sources.

The Fresno water supply, relying upon wells that have often become seriously contaminated by agricultural and industrial pollution, is poorly protected. Nitrate contamination, industrial solvents, pesticides, and a variety of other pollutants have frequently forced Fresno to close down wells or to reduce their use. This is an ongoing and increasingly serious problem.

RECOMMENDATIONS

WHAT ABOUT BOTTLED WATER?

Bottled water is big business. People who have decided to stop drinking tap water and are instead “voting with their bottles” of water are spending more than $4 billion a year. The trend is troubling: the right to drink healthy water should not be related to one’s economic status. Furthermore, bottled water is not a panacea; testing shows that some bottled waters may contain many of the same pollutants that tap water does. In fact, at least 25 percent of the bottled water sold in the United States is derived from tap water—some of which is subject to additional treatment, some not. As NRDC showed in a 1999 study entitled *Bottled Water: Pure Drink or Pure Hype?* bottled water is not necessarily any purer or safer than tap water. For that study, NRDC hired independent, certified labs to test more than 1,000 bottles of water, including 103 of the most popular brands. Some bottled water contained arsenic, trihalomethanes, bacteria, and a variety of other contaminants. While most of the bottled water was of good quality, about one-third of the bottled waters NRDC tested contained significant contamination (that is, levels of a chemical or bacterial contaminant exceeding those allowed under state or industry standards or guidelines) in at least one test. What’s more, bottled water is certainly far more expensive than tap water: NRDC found that bottled water costs from 240 to more than 10,000 times more per gallon than tap water.

Moreover, NRDC found that the regulatory and government oversight program for bottled water is far weaker than the tap water regulatory program. In fact, the Food and Drug Administration (FDA), which has jurisdiction over bottled water, has rules for bottled water that are in many ways weaker than the EPA rules that apply to city tap water. The FDA interprets its rules as exempting from all federal regulation many brands of bottled water (water that is bottled and sold in a single state, which in some states is the majority of bottled water). Furthermore, the FDA has exempted carbonated water, seltzer water, and many other waters from the specific bottled water contamination standards that do exist, applying only vague general sanitation rules that set no specific contamination limits.

The FDA also told NRDC that it had the equivalent of less than one staff person dedicated to developing and issuing bottled water rules, and the equivalent of less than one staff person dedicated to assuring compliance with these rules. State bottled water programs also are, in most cases (with the exception of California and a couple of other states), virtually paper tigers, with the equivalent of less than one person’s time dedicated to overseeing this industry.

Drinking tap water is only one part of the equation. People who drink bottled water exclusively are still exposed to tap water contaminants, which are absorbed through the skin, inhaled, or ingested while showering, bathing, cooking, or washing dishes or clothes. For example, one primary way we ingest trihalomethanes and radon in tap water is not from drinking water but from inhaling air into which these contaminants evaporated—for example, while showering.[37] A study by University of Maine investigators found that a person whose home has high levels of radon in the water inhales huge amounts of radioactivity simply by taking a shower.[38] Similarly, trihalomethanes and other volatile organic chemicals have been shown to volatilize in the shower and be absorbed by the lungs when breathing.[39]

While bottled water of independently confirmed high quality may be a temporary solution to known tap water contamination problems or for vulnerable people, the long-term solution to our drinking water woes is to ensure tap water safety. Bottled water is far more expensive, per household, than the reasonable cost of upgrading and maintaining drinking water systems.

WHAT ABOUT HOME WATER FILTERS?

Many people turn to home water filters to remove contaminants from tap water—either under the sink or on the faucet (called point-of-use filters) or whole-house filters, which are installed where the water comes into the household (called point-of-entry devices). This may make sense for pregnant women, for those especially vulnerable to water contamination and for those whose tap water problems are exceptionally serious. People who choose to use such filters should take the following steps:

- Consult your right-to-know report to identify which contaminants are in your tap water in order to buy a filter that removes those particular contaminants.
- If you have a young child at home or if you are pregnant, test your home water for lead or make sure your filter removes lead. (Some faucets release lead, so even an under-the-counter filter may not fix the problem.) To find a state-certified lab to test household water, consumers can check the state's website list of labs at www.dhs.ca.gov/ps/ls/elap/Elapindex.htm.
- Remember that many contaminants are absorbed through the skin or can be inhaled, so a point-of-use device on your sink will not solve the problem for contaminants that you breathe or absorb when you shower or bathe. Some point-of-use devices do filter water at the showerhead, however.
- Insist on a filter that has been independently certified to remove the specific types of contaminants that you are worried about. For example, NSF International (www.nsf.org) has standards for filters and certifies them.
- Make sure that you maintain your filter *at least* as frequently as is recommended by the manufacturer. Better yet, buy a contract to have it regularly checked and maintained by a certified professional. Improperly maintained filters can make water contamination problems worse. For example, potentially pathogenic bacteria can build up on some poorly maintained filters, and "breakthrough" can occur if the filter media are not changed or regenerated often enough, allowing high concentrations of captured contaminants to suddenly break through into the drinking water.

As we concluded with respect to bottled water, home water filters can fulfill important needs for pregnant women and vulnerable people or can serve as temporary solutions to known tap water problems. Nonetheless, the long-term solution is to ensure that tap water is safe for everyone to drink.

RECOMMENDATIONS FOR PEOPLE WITH WEAKENED IMMUNE SYSTEMS

People who are immuno-compromised should consult with their health care providers about drinking tap water. The Centers for Disease Control (CDC) recommends that people with severely compromised immune systems not drink tap water.

The CDC has offered detailed recommendations specifically to people with HIV/AIDS, but they are equally applicable to anyone who is seriously immuno-compromised:[40]

> *You may wish to avoid drinking tap water. Because public water quality and treatment varies in the United States, you should check with your local health department and water utility to see if they have made any recommendations for HIV-infected persons about drinking local tap water. There are three extra measures you may wish to take to ensure that your drinking water is safe: boil your water, filter your water with certain home filters, or drink certain types of bottled water. Processed bubbly drinks in cans or bottles are probably safe also. If you choose to take these extra measures, take them all the time, not just at home. If your local public health office warns you to boil your water, don't drink tap water unless you make it safe. Here are some extra measures you may wish to take to make sure your water is safe:*
>
> **1. Boiling water:** *Boiling is the best extra measure you may wish to take to be sure that your water is free of* Cryptosporidium *and any other germs. You yourself can see that the water was boiled and that it was stored safely. Bring your water to a rolling boil and let it boil for one (1) minute. After your boiled water cools, put it in a clean bottle or pitcher with a lid and store it in your refrigerator. Use the water as you normally would. Ice made from contaminated water can also contain* Cryptosporidium*. To be safe, make your ice from boiled water. Water bottles and ice trays should be cleaned with soap and water before you use them. Do not touch the inside of your water bottles or ice trays. If you can, clean your water bottles and ice trays yourself.*
>
> **2. Filtering tap water:** *There are many different kinds of home water filters, but not all of them remove* Cryptosporidium*. If you want to know if a particular filter will remove* Cryptosporidium*, call NSF at 1-800-673-8010. NSF is an independent testing group. If you want a list of filters that remove* Cryptosporidium*, call, write, or fax NSF and ask for their "Standard 53 Cyst Filters" list. You can reach NSF at www.nsf.org.*

WATER QUALITY AND COMPLIANCE

Based upon the research involved in this report, NRDC recommends that cities invest in protecting and improving the quality of tap water. In every city we reviewed—

even cities with the best water—major investments must be made. We have reached the following conclusions about the need for improvements in city tap water, right-to-know reports, and policy:

▶ There is an urgent need for at least $500 billion in federal, state, and local investment in our neglected city drinking water systems. City water treatment plants are often outdated and in need of repair and upgrades. Pipes are aging, leaking, failing (sometimes catastrophically), and permitting contamination.
▶ California needs to make significant investments into water infrastructure. Billions of dollars must be invested in order to:
—improve the protection of drinking water sources, such as purchasing land or easements or adopting standards to protect watersheds or areas above aquifers draining into California water supplies;
—improve drinking water treatment;
—invest in water conservation measures;
—replace and update pipes and components of water distribution systems;
—modernize drinking water systems.
▶ Congress should enact and fund water infrastructure legislation that at least doubles federal support for drinking water supplies, from the current $1.7 billion per year. A portion of this funding should be earmarked for source water protection.
▶ States and local governments should consider raising needed funds through bond issues and other financing mechanisms to invest in water systems.
▶ Water systems should plan ahead and should collect sufficient funds from their ratepayers—with support from state and federal government funding, if needed—to rehabilitate, upgrade, and fully maintain their water-supply infrastructure for the long haul. Continuing to defer maintenance and upgrades threatens water quality and public health, and in the long run will prove many times more costly than regular, planned infrastructure investment.

RIGHT-TO-KNOW REPORTS

The enormous promise of right-to-know reports has not been fully achieved. We recommend that water systems change right-to-know report presentation, as follows:

▶ **Avoid the use of sweeping and prominent claims of absolute safety** for their water. These unqualified claims are not only misleading, they are likely to discourage consumers from reading the whole report. This is a particular concern for vulnerable people such as pregnant women, young children at risk from lead, and people with compromised immune systems.
▶ **Prominently place the warnings to especially vulnerable people on the front page of their report, set off in a box or otherwise, to capture these consumers' attention.** Too many utilities bury these mandatory warnings in the back of their reports, embedded in large blocks of uninviting text.
▶ **Discuss any significant water quality or compliance issues prominently in the first paragraphs of the report, linking the information to the investment needs of**

the utility. This candid, honest approach will persuade consumers that the utility is being forthright and will help build consumer support for raising the funds to address the problems.

- **Candidly discuss the potential health effects of contaminants found in their water—at least those contaminants found at levels in excess of EPA or state health goals, action levels, or health advisories.** Citizens deserve the straight facts about the potential health effects of contaminants found in their drinking water. Unbiased, complete information will fulfill citizens' right to know, and will encourage citizens to work with their utility to fix the problem. Utilities that explain that their water rates must rise to fund improvements in health protection will face a far more receptive public audience than systems that pretend there is no problem.
- **Convey as much information as possible about the specific pollution sources in their watershed that are or may be contributing to contamination or that are threatening to contaminate a water supply.** Not only do citizens have a right to know who is polluting or threatening their water supply, they can also be extremely helpful to the utility in its efforts to get the polluters to clean up their acts.
- **Utilities should translate their right-to-know reports into any language beyond English that is spoken by more than 10 percent of a population, based upon 2000 Census data.** Utilities have a responsibility to make sure that their customers understand the reports, so if significant portions of their customers do not speak English, the report should be translated.

SOURCE WATER PROTECTION

The lengths to which utilities go to protect water sources varies widely from city to city. Some cities, like San Francisco, generally have very well protected watersheds. Others, like Fresno, Los Angeles, and San Diego, have serious need for better source water protection. The argument that source water protection is beyond a utility's control is simply not valid; for example, Los Angeles or San Diego may contend that they can do little about pollution sources in Nevada, but that claim is untrue. Water utilities can aggressively pursue polluters of their water supply through both political and legal means.

For example, the Kerr-McGee plant in Nevada, which is the source of perchlorate in Los Angeles's and San Diego's water, could be sued to force cleanup or treatment of the cities' water supplies. Similarly, the cities could work with CALFED, Metropolitan Water District, and others, with public support, to bring pressure on polluters to protect and clean up source water.

In order to ensure the safety of drinking water sources, utilities should be at the forefront of protection efforts. For example, utilities can urge state or federal lawmakers to craft legislation to acquire interests in land. They can also push for improved controls on pollution from a variety of sources: concentrated animal feeding operations and other agricultural sources, stormwater runoff from cities and suburbs, combined sewers and sanitary sewer overflows, and chemical contamination from industry.

In sum, water utilities and their consumers have a very strong common interest in sourcewater protection. An informed, activated public is a utility's strongest ally in the effort to improve pollution prevention and source water control. By publicly identifying threats to source water and by working with the public and elected officials to address these threats, water utilities will not only help their own customers but will also make a major contribution to public health and environmental protection.

NOTES

1 See, e.g., Rachel S. Barwick, M.S., Deborah A. Levy, Gunther F. Craun, Michael J. Beach, Rebecca L. Calderon, "Surveillance for Waterborne-Disease Outbreaks—United States, 1997–1998," *MMWR*, May 26, 2000, 49(SS04): 1-35; Deborah A. Levy, Michelle S. Bens, Gunther F. Craun, Rebecca L. Calderon, Barbara L. Herwaldt, "Surveillance for Waterborne-Disease Outbreaks—United States, 1995–1996," *MMWR*, December 11, 1998, 47(SS-5): 1-34; Michael H. Kramer, Barbara L. Herwaldt, Gunther F. Craun, Rebecca L. Calderon, Dennis D. Juranek, "Surveillance for Waterborne-Disease Outbreaks—United States, 1993–1994," *MMWR*, 45(SS-1)1-33, April 12, 1996, 45(SS-1): 1-33; Erik D. Olson and Diane Cameron, *The Dirty Little Secret About Our Drinking Water: New Data Show Over 100 Drinking Water Disease Outbreaks from 1986-1994, and Strong Evidence of More Widespread Problems* (NRDC, February 1995).

2 W. R. MacKenzie, et. al., "A Massive Outbreak in Milwaukee of *Cryptosporidium* Infection Transmitted Through the Public Water Supply," *New England Journal of Medicine*, 1994, 331: 161–167. The precise number of people killed by the Milwaukee outbreak is not known with certainty. A count by the *Milwaukee Journal* put the number at over 100, while the "official" state and local health department count was "a minimum of 50 deaths." See Marilyn Marchione, "Deaths continued after crypto outbreak: State report attributes a minimum of 50 deaths from '93 to '95." *The Milwaukee Journal Sentinel*, May 27, 1996.

3 Ibid.

4 "1061 Suspected *E. coli* Cases in New York Outbreak," *Infectious Disease News* (October 1999), available online at www.infectiousdiseasenews.com/199910/frameset.asp?article=ecoli.asp; Centers for Disease Control and Prevention, "Public health dispatch: Outbreak of *Escherichia coli* O157:H7 and *Campylobacter* among attendees of the Washington County Fair—New York," *MMWR*, 1999, 48(36): 803.

5 Water Infrastructure Network, *Clean Safe Water for the 21st Century* (2000) available online at www.amsa-cleanwater.org/advocacy/winreport/winreport2000.pdf.

6 Congressional Budget Office, "Future Investment in Drinking Water and Wastewater Infrastructure," May 2002, available online at www.cbo.gov/showdoc.cfm?index=3472&sequence=0&from=1.

7 See note 2.

8 See, e.g., EPA, "Interim Enhanced Surface Water Treatment Rule," 63 Fed. Reg. 69477 (December 16, 1998), which requires large water systems (serving over 10,000 people) to upgrade their water filter operations to improve removal of *Crypto*.

9 See EPA, "Final National Primary Drinking Water Regulation for Arsenic," 66 Fed. Reg. 6976 (January 22, 2001).

10 See Brian Cohen and Erik Olson, *Victorian Water Treatment Enters the 21st Century* (NRDC, 1995).

11 "About American Water Works Company" available online at www.illinoisamerican.com/aboutus/about.html.

12 See "RWE Announces Acquisition of American Water Works," January 17, 2002, available online at www.waternunc.com/gb/rwe_ag_01.htm.

13 42 U.S.C. §300f et seq. ; PWS definition at id. §300f(4).

14 Ibid. § 300g-1(b)(4)(A).

15 Ibid. § 300g-1(b)(4)(B)-(D).

16 Ibid. § 300g-1(b)(6).

17 Ibid. § 300g-1(b)(7).

18 See EPA, "Surface Water Treatment Rule," codified at 40 C.F.R. §§ 141.70-141.75, described in EPA Fact Sheet on Drinking Water Contaminants online at www.epa.gov/safewater/source/therule.html#Surface.

19 See 40 C.F.R. § 141.80-141.91, described in EPA Fact Sheet on Drinking Water Contaminants online at www.epa.gov/safewater/source/therule.html#Surface.

20 42 U.S.C. § 300g-2.

21 See, e.g., EPA Inspector General, Audit Report of Region I's Enforcement of the Safe Drinking Water Act," Audit E1HWCS3-01-0023-2100291 (1993), and Erik Olson, *Think Before You Drink* (NRDC, 1993).

22 EPA, *Providing Safe Drinking Water in America: 1998 National Public Water Systems Compliance Report* (2000).

23 42 U.S.C. § 300g-3(a).

24 See note 22.

25 Ibid., and see city-by-city text of this report.

26 42 U.S.C. § 300g-2(c)(1)-(3).

27 GAO, *Drinking Water: Consumers Often Not Well-Informed of Potentially Serious Violations* (1992); Erik Olson, *Think Before You Drink* (NRDC, 1993).

28 Ibid.

29 42 U.S.C. § 300g-2(c)(4).

30 40 C.F.R. § 141.151 et seq.

31 Ibid. § 141.153(h)(5).

32 Fresno Water Division, 2000 Water Quality Report.

33 See 40 C.F.R. § 141.154(a): "(a) All reports must prominently display the following language: Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by *Cryptosporidium* and other microbial contaminants are available from the Safe Drinking Water Hotline (800-426-4791)."

34 The City of San Diego, Water Department, Consumer Confidence Report 1999, available online at www.sannet.gov/water/quality/report99.pdf.

35 See 40 C.F.R. § 141.153(d)(4)(vi).

36 See 40 C.F.R. § 141.153(d)(4).

37 G. H. Shimokura, D. A. Savitz, E. Symanski, "Assessment of water use for estimating exposure to tap water contaminants." *Environ. Health Perspectives* February 1998; 106(2): 55-9; N. I. Maxwell, D. E. Burmaster, D. Ozonoff, "Trihalomethanes and maximum contaminant levels: the significance of inhalation and dermal exposures to chloroform in household water." *Regul. Toxicol. Pharmacol.*, December 1991; 14(3): 297–312; J. B. Andelman, "Inhalation exposure in the home to volatile organic contaminants of drinking water." *Sci. Total Environ.*, December 1985, 47: 443–60.

38 G. Bernhardt; C. T. Hess, *Acute exposure from radon-222 and aerosols in drinking water*. Written communication (1995). Unpublished master's thesis. University of Maine.

39 See note 37. Also EPA 600/R-00/096, *Volatilization Rates From Water To Indoor Air Phase II*, October 2000.

40 CDC, "Cryptosporidiosis: A Guide for People with HIV/AIDS," available online at www.cdc.gov/ncidod/diseases/crypto/hivaids.htm.

CHAPTER 2

HEALTH CONCERNS FOR COMMON TAP WATER CONTAMINANTS

WHAT'S ON TAP?

Grading Drinking Water in U.S. Cities

EARLY RELEASE CALIFORNIA EDITION

October 2002

NRDC's review of city tap water quality revealed that there are several contaminants that occur with surprising regularity—such as chlorination by-products, lead, and total coliform bacteria. Other contaminants, such as industrial chemicals, may occur less frequently but still pose major health concerns. This chapter summarizes the health concerns for and sources of many of the most common tap water contaminants.

MICROBIOLOGICAL CONTAMINANTS

CRYPTOSPORIDIUM

National Standard: Treatment Technique (TT)

National Health Goal (MCLG): 0 (zero)—there is no known fully safe level of *Cryptosporidium*

Cryptosporidium (*Crypto*) is a microbial, waterborne protozoan. It has long been known to be a parasite in humans and animals, including cattle, and is shed in feces after reproducing by the millions in the host's intestines.[1] *Crypto* forms a particularly robust, hard-shelled cyst that can withstand temperature extremes and even survive a dousing with pure chlorine bleach.

Crypto's health effects include severe diarrhea for up to two weeks in otherwise healthy people, nausea, abdominal cramps, and fever. Currently, no antibiotics or other medical treatments are available to kill *Crypto*.[2]

Crypto poses significant public health concerns, especially to individuals whose immune systems are weakened, including people living with HIV/AIDS, the frail elderly, young children, chemotherapy patients, and organ transplant patients.[3] Indeed, individuals who are immuno-compromised can and do die from *Crypto* infection.

In 1993, high levels of *Crypto* got through the filters and treatment process at a water treatment plant in Milwaukee, Wisconsin. The plant was filtered and used chlorine disinfection and was apparently in full compliance with all EPA rules then in place. More than 400,000 people in Milwaukee became sick, several thousand of whom were hospitalized, and approximately 100 of whom eventually died. The outbreak was the largest documented waterborne disease occurrence in U.S. history, but it is not the only such experience on record.[4] Many more waterborne *Crypto* outbreaks have occurred in the United States, England, and elsewhere in the world.[5]

Tests of healthy adult human volunteers found that even a single *Crypto* cyst carries a risk of infection. The more cysts in a glass of drinking water, the higher the risk that people will become infected.[6] Because a single cyst may cause infection, the EPA has established a Maximum Contaminant Level Goal (MCLG, or health goal) for *Crypto* of zero.[7]

Occurrence and Treatment

Crypto is found in most surface water supplies in the United States; surveys have found it in more than 80 percent of the U.S. surface waters tested.[8] However, *Crypto* is difficult to detect in water, and testing methods available cannot identify with certainty whether the *Crypto* that is detected is "viable"—that is, that it can actually make people ill.[9] In addition, the current testing methods are especially poor at detecting the kind of low-level *Crypto* concentrations that might be expected in finished, or treated, drinking water. Therefore, experts say it is incorrect to assume that *Crypto* is not present in treated drinking water simply because it has not been detected.[10]

Chlorine disinfection of drinking water is ineffective in killing *Crypto*. Indeed, only very finely tuned filtration or state-of-the-art disinfection using ozone or intense ultraviolet light will kill *Crypto* once it is in water supplies.[11] Of course, the best approach is to prevent *Crypto* from getting into drinking water sources in the first place, and that requires the adoption of strong source water protection programs. However, even Seattle, San Francisco, and other cities with such strong source water protection—including the use of completely undeveloped watersheds—find *Crypto* at low levels in their source water, possibly from wildlife, or from humans using the watershed for recreation. Low levels of *Crypto* from protected watersheds pose far lower risks than high levels such as those found downstream from concentrated animal feeding operations or other major pollution sources. Nevertheless, they still pose a risk if not dealt with through treatment.

However, if filtration is operating properly and is optimized, it will reduce *Crypto* levels. The EPA has adopted an "Interim Enhanced Surface Water Treatment Rule" for cities serving more than 10,000 people that filter surface water. The rules went into effect in January 2002, and they require water filtration plants to optimize the way they operate filters and to keep turbidity levels down, a measurement of filter efficiency (see turbidity section below).[12]

Recommendations for People with Weakened Immune Systems

If you are immuno-compromised, or are concerned about the possibility that *Crypto* may be in your water, you should consult with your health-care provider about finding a safe source of drinking water. The Centers for Disease Control and

Prevention (CDC) recommends that people with severely compromised immune systems may wish to avoid drinking tap water.

The CDC has offered detailed recommendations specifically to people with HIV/AIDS, but they are equally applicable to anyone who is seriously immuno-compromised. Those recommendations are quoted in full on page 16.

TOTAL COLIFORM BACTERIA

National Standard (MCL): 5% in highest month
National Health Goal (MCLG): 0%—there is no known, fully safe level of coliform bacteria

Total coliform bacteria is a broad class of bacteria, many of which live in the intestines of humans and animals. It is a microbial contaminant whose presence is a potential indicator that disease-causing organisms may be in tap water. While most coliform bacteria are themselves harmless, their presence is a sign that the water may contain fecal pathogens, including non-coliform pathogens such as other forms of bacteria, viruses, or protozoa. Exposure to disease-carrying pathogens potentially indicated by the presence of coliform bacteria may cause infection, resulting in diarrhea, cramps, nausea, jaundice, headaches, and fatigue.[13]

Some coliform bacteria, such as *Escherichia coli* 0157:H7 (*E. coli*), are dangerously infectious organisms that can cause serious infections in exposed people. It was this type of coliform that caused the infamous "Jack in the Box" hamburger poisoning incidents in which four children were killed and 700 sickened.[14] In an *E. coli* disease outbreak in 1989 caused by contamination in the Cabool, Missouri, drinking water supply, four people died while 243 were sickened—but the incident generated virtually no publicity.[15] More recently, two people died, including a three-year-old girl, at least 65 were hospitalized, and an estimated 1,061 were confirmed to have become ill as a result of the same strain of *E. coli*, when drinking water was contaminated at a county fair in upstate New York in 1999.[16] Again, the incident generated some publicity, but hardly the nationwide attention caused by the hamburger incidents.

People with weak immune systems, including some infants, frail elderly people, organ transplant or cancer chemotherapy patients, and people living with HIV/AIDS, are at special risk from the pathogens whose presence may be indicated by total coliform.[17] In some cases, immuno-compromised people can die from consuming water containing dangerous bacteria.[18]

Occurrence, Treatment, and the Total Coliform Rule

The EPA says that "the presence of coliform bacteria in tap water suggests that the treatment system is not working properly or that there is a problem in the pipes."[19] The EPA therefore has adopted the "Total Coliform Rule" (TCR), which set the health goal for total coliform at zero. The EPA found that "since there have been waterborne disease outbreaks in which researchers have found very low levels of coliform, any level indicates some health risk."[20]

To avoid or eliminate microbial contamination, water systems may need to repair their disinfection or filtration processes, flush or upgrade pipes from treatment plants to customers (their distribution system), and adopt source water protection programs to prevent contamination.

The EPA's TCR says that when water system tests reveal that more than 5 percent of monthly samples contain coliforms system operators are required to report that violation to their state and the public.[21]

If a water system finds that any sample contains total coliform, the TCR requires it to collect "repeat samples" within 24 hours.[22] When a sample tests positive for total coliforms, it must also be analyzed for fecal coliforms and *E. coli*.[23] If fecal coliform or *E. coli* are found, the incident is deemed an "acute violation," triggering a requirement that the system rapidly notify the state and the public, because such a violation "represents a direct health risk," according to the EPA.[24]

Big city water systems are required to test for coliform far more often than small systems. Water suppliers serving fewer than 1,000 people may test once a month or less frequently, but systems with 50,000 customers must test 60 times per month, and those with 2.5 million customers must test at least 420 times per month.[25]

Recommendations for People with Weakened Immune Systems

Total coliform violations are a common trigger for "boil water" orders issued in the United States. When total coliform levels are repeatedly high in a public water system, it is an indication that the system may pose serious risks, particularly to people with immune system problems. The recommendations made by CDC regarding immuno-compromised people taking action to avoid *Crypto* are equally applicable to water that has a high risk of *E. coli* or other pathogen contamination that may be indicated by "boil water" alerts or total coliform violations.

TURBIDITY (CLOUDINESS)

National Standards (TT) (in Nephelometric Turbidity Units, or NTU)

Filtered water:	0.5 NTU, 95% of the time (through 2001)
	0.3 NTU, 95% of the time (as of 2002)
	1 NTU 100% of the time (as of 2002)
Unfiltered water:	5 NTU maximum, 100% of the time

Turbidity is a measure of the cloudiness of water, often the result of suspended mud or organic matter, and sometimes an indication that the water is contaminated with *Cryptosporidium* or other pathogens. In addition, turbidity can interfere with disinfection of the water, because it can impede the effectiveness of chlorine or other chemical disinfectants. Thus, according to the EPA, "higher turbidity levels are often associated with higher levels of disease-causing microorganisms such as viruses, parasites and some bacteria. These organisms can cause symptoms such as nausea, cramps, diarrhea, and associated headaches."[26]

Indeed, it was a spike in the level of turbidity at a Milwaukee treatment plant that indicated the city had a serious problem with its drinking water just before the 1993 *Crypto* outbreak that sickened 400,000 and killed approximately 100 people.[27] It is important, therefore, to remember that disease-carrying organisms that may be present during turbidity spikes can pose special, even mortal, threats to people with weakened immune systems.

Treatment and Regulation

From 1989 until 2002, the EPA had a lax standard for turbidity in filtered drinking water, allowing up to 5 Nephelometric Turbidity Units (NTU) as a maximum, and requiring only that water systems maintain 0.5 NTU 95 percent of the time (most cities take samples every hour or every few hours).[28] The laxity of this old standard was made all too clear by the Milwaukee outbreak. According to some investigators, although Milwaukee had a spike in turbidity, it reportedly did not violate the EPA standard during the outbreak.[29]

In 1998, after an extensive set of regulatory negotiations among the EPA, the water industry, NRDC, health groups, and others, the EPA issued the Interim Enhanced Surface Water Treatment Rule, establishing a new turbidity standard for large filtered water systems serving more than 10,000 people. Under the new rules, which went into effect in 2002, large filtered systems can never exceed 1 NTU (down from the previous maximum of 5), and must achieve a limit of 0.3 NTU or less in at least 95 percent of its samples. A rule to reduce *Crypto* and turbidity problems in smaller filtered systems was agreed to by regulatory negotiators in 2000, and in NRDC's view was legally required to have already been issued, but the Bush administration has failed even to publish the proposal in the Federal Register.[30] Because the rules for unfiltered surface water systems have not been updated, unfiltered systems need only meet the old and outdated 5 NTU maximum limit, the Milwaukee experience notwithstanding.

Recommendations for People with Weakened Immune Systems

Like coliform violations, turbidity violations often trigger "boil water" orders. When turbidity levels are repeatedly high in a public water system, it is an indication that the system's filters are not being well operated or maintained, or, if the system is unfiltered, that its source water is not as well protected as it should be. Whichever is the case, the circumstance may pose serious risks, particularly to people with immune system problems. The recommendations made by CDC regarding immuno-compromised people taking action to avoid *Crypto* are equally applicable to water that has a high risk of significant turbidity spikes and violations.

INORGANIC CONTAMINANTS

ARSENIC

National Standard for Arsenic (MCL): 10 ppb (average) (enforceable in 2006) (50 ppb standard is effective until 2006)

National Health Goal for Arsenic (MCLG): 0 ppb—there is no known, fully safe level of arsenic

Arsenic is toxic to humans and causes cancer, and for this reason, no amount of arsenic is considered fully safe. Many scientific studies, including no fewer than seven reviews of the problem by the National Academy of Sciences (NAS), have determined that arsenic in drinking water is known to cause cancer of the bladder, skin, and lungs; likely causes other cancers; and is responsible for a variety of other serious health ailments. The NAS reviews culminated in the important recent reports *Arsenic in Drinking Water* (issued in 1999) and *Arsenic in Drinking Water: 2001 Update*, which counter the long-standing water utility and industry arguments that arsenic in tap water poses no significant threat.[31,32]

The NAS found in its 2001 report that a person who drinks two liters of water a day containing 10 parts per billion arsenic—the new EPA standard—has a lifetime total fatal cancer risk greater than 1 in 333. That risk level is more than 30 times higher than the EPA traditionally allows in tap water.[33] NAS's risk estimates were more than 10 times higher than the estimates the EPA used to justify its new January 2001 standard (see below). This 2001 NAS report's staggering findings likely would have been major news across the nation, but they were released on September 11, 2001.[34]

Arsenic in drinking water supplies comes from mining, industrial processes, past use of arsenic-containing pesticides, and natural leaching or erosion from rock. Recent studies indicate that heavy pumping of groundwater can actually increase arsenic levels in some cases, perhaps because the pumping allows oxygen to reach the arsenic source, permitting oxidization and mobilization of the poison.

Treatment and Regulations

Arsenic can readily be removed from drinking water with off-the-shelf treatment technology, including activated alumina and membrane treatment.[35] According to the EPA, the cost of using current, easily available treatment for arsenic is less than $2 per household per month for city water customers.[36] A working group of the National Drinking Water Advisory Council, appointed by the Bush administration in 2001 to review these EPA estimates (in light of industry allegations that the EPA had grossly underestimated arsenic treatment costs), found the EPA's estimates "credible," and noted that newer technologies, such as granular ferric hydroxide and other cutting-edge treatments may bring even these already quite affordable costs of treatment down.[37]

For 60 years, since the Public Health Service issued a 50-parts-per-billion arsenic guideline in 1942, which the EPA adopted in 1975 as a tap water standard, the United States has used this extremely lax standard, and it remains applicable today.[38] After the EPA missed at least three statutory deadlines to update the standard, and after NRDC sued the EPA to get the agency to move forward with issuing a new arsenic rule, the Clinton administration finally adopted the new arsenic standard (a Maximum Contaminant Level) of 10 parts per billion in January 2001.[39] That standard becomes effective in 2006.

Upon taking office, the Bush administration suspended the EPA's new arsenic standard, responding to pleas from the mining industry and utilities, and arguing that the EPA had overestimated arsenic's risks and underestimated the rule's costs.

A public outcry ensued, and the National Academy of Sciences issued a study, at the Bush administration's request, finding that the EPA had actually underestimated cancer risks by about 10-fold.[40] The NAS's finding should have led to a standard lower than the 10 parts per billion, but the Bush administration moved hurriedly to ratify the Clinton administration standard instead. Even at a level of 3 parts per billion, the standard that NRDC and many public health and medical groups support because it is the lowest level the EPA has called feasible to achieve using existing treatment technology, the NAS found that arsenic poses a cancer risk of about 1 in 1,000[41]—10 times higher than the EPA traditionally allows for any single tap water contaminant and a significant concern to human health.

CHROMIUM

National Standard (MCL): 100 ppb (average)
National Health Goal (MCLG): 100 ppb

Chromium is a naturally occurring metal used in industrial processes, including metal-plating for chrome bumpers, and in making stainless steel, paint, rubber, and wood preservatives.[42] Health effects from human exposure to chromium range from skin irritation to damage to kidney, liver, and nerve tissues. A heated debate has taken shape recently over whether states and the EPA should adopt a separate standard for Chromium VI (hexavalent chromium), a form of chromium known to cause cancer when inhaled. The EPA has refused so far to consider it as a carcinogen when it is consumed in tap water.[43] The EPA has found that chromium can be removed from drinking water through coagulation/filtration, ion exchange, reverse osmosis, and lime softening.[44]

CYANIDE

National Standard (MCL): 200 ppb (average)
National Health Goal (MCLG): 200 ppb

A well-known poison, cyanide is a nitrogen-carbon compound.[45] The EPA says short-term exposure to cyanide at levels above the standard can cause rapid breathing, tremors, and other neurological effects, and long-term exposure can cause weight loss, thyroid effects, and nerve damage.[46] Cyanide is used in various forms in mining, steel and metal manufacturing, and to make resin, nylon, and other synthetic fibers.[47] Also, chlorination treatment of some waste water can create cyanide, according to the EPA.[48] Cyanide can be removed from drinking water with reverse osmosis membranes, and ion exchange. In some cases chlorine will assist in its removal.

LEAD

National Standard (TT): 15 ppb (action level, at 90th percentile—see below)
National Health Goal (MCLG): 0 ppb—there is no known, fully safe level of lead

Lead is a major environmental threat, and is often referred to as the number-one environmental health threat to children in the United States. No amount of it is considered safe.[49] Infants, young children, and pregnant women's fetuses are particularly susceptible to the adverse health effects of lead. Lead poisoning can cause permanent brain damage in serious cases, and in less severe cases can cause children to suffer from decreased intelligence and problems with growth, development, and behavior. Lead can also increase blood pressure, harm kidney function, adversely affect the nervous system, and damage red blood cells.[50]

One way lead enters drinking water supplies is from the corrosion of water utility pipes in the distribution system—the system of pipes through which water reaches consumers' homes from the water utility, including water mains and their connectors, service lines (between the main and the home), goosenecks (which connect service lines to the main), and water meters. Lead can also leach from pipes or faucets in homes, schools, and businesses.

Treatment and Regulation

The easiest way for cities to reduce lead levels in tap water is to treat their water using "corrosion control." This approach involves adjusting the water's pH upwards—that is, making it less acidic—by adding a chemical such as lime, and thereby decreasing the likelihood of lead leaching from pipes. Many water utilities also add an orthophosphate, such as zinc orthophosphate, that forms a thin coating on the inside of utility and household pipes, thus reducing corrosion.

The EPA's lead and copper rule requires city water systems to reduce lead levels at the tap by optimizing corrosion control for their water, which reduces its ability to corrode pipes and therefore to leach lead into tap water. The EPA has also adopted an action level standard for lead that is different than the standard for most other contaminants.[51] Water utilities are required to take many samples of lead in tap water, including some samples at identified "high risk" homes—those that are likely to have high lead because they are old and have lead plumbing components, or in the case of homes built after 1982, because they have lead-soldered copper pipes likely to be heavy lead leachers.[52] The actual number of required samples is determined by system size; a large city generally must take at least 100 samples. If the amount of lead detected in the samples exceeds 15 parts per billion (ppb) at the 90th percentile—which is to say that 10 percent or more of taps tested have 15 ppb or more of lead—then the amount is said to exceed the "action level." A water system that exceeds the action level is not necessarily in violation, but additional measures are required, such as chemical treatment to reduce the water's ability to corrode pipes and thus its ability to leach lead from pipes. If such chemical treatment does not work, the water system must then replace lead portions of its distribution system, including lead service lines and goosenecks owned by the water system, if they are still contributing to the lead problem.

In addition, Congress amended the Safe Drinking Water Act to ban high-lead solder (over 0.2 percent lead) and high-lead plumbing (over 8 percent lead), but this plumbing can still contribute significantly to lead contamination of tap water.[53] An NSF standard for lead in plumbing, adopted by most states, is supposed to help on this front, but testing by NRDC and others has found lead leaching at high levels from faucets and water meters since Congress amended the SDWA. NRDC sued the faucet and water-meter manufacturers under a stricter California law (Proposition 65) and agreed to a settlement to phase out lead from faucets and water meters.

NITRATE

National Standard (MCL): 10 ppm (two-sample average within 24 hours)
National Health Goal (MCLG): 10 ppm

Nitrates are the product of fertilizers and human or animal waste. Infants who drink water containing excessive nitrates for even a short period of time can develop "blue baby syndrome," in which nitrate poisoning prevents their blood from holding oxygen.[54] Shortness of breath, nausea, vomiting, diarrhea, lethargy, loss of consciousness, and even death can result from infants' exposure to high levels of nitrates in water.[55] Pregnant women are also particularly vulnerable to high nitrate levels in drinking water, again because it can affect the ability of their blood to carry oxygen.[56]

The medical literature continues to report deaths and serious illnesses of infants fed formula made with nitrate-contaminated water.[57] In addition, recent literature suggests that pregnant women who drink nitrate-contaminated water can have miscarriages possibly caused by the contaminant.[58] Moreover, a comprehensive study conducted by the California Birth Defects Monitoring Program discovered an association between nitrate exposure and increased risk of neural tube defects.[59] The study found that pregnant women whose drinking water contained nitrates above the regulatory standard faced a four-fold increase in the risk of anencephaly—absence of the brain—in their developing fetus.

In addition to these short-term effects, several chronic effects of elevated nitrate levels have also been observed. According to the EPA, drinking water containing nitrates at levels above the Maximum Contaminant Level (MCL) for a prolonged period has "the potential to cause...diuresis, increased starchy deposits and hemorrhaging of the spleen."[60] In addition, indications are that breakdown products of nitrates called N-nitrosamines, and compounds that form when nitrates react with pesticides with which they commonly co-occur (the nation's most used pesticide, the corn herbicide atrazine, among them) may cause cancer.[61]

A separate chapter discusses the widespread nitrate contamination problems in California. Elevated levels of nitrates in water generally result from agricultural runoff from dairy and cattle farms or concentrated animal feeding operations, and from fields heavily fertilized with inorganic nitrogen fertilizer or over-fertilized with manure.[62] High levels of nitrate contamination also can come from septic tanks and sewage.[63]

Treatment and Standard

The EPA set the MCLG and MCL for nitrate at 10 parts per million. Because it is an acute toxin, no long-term averaging is allowed; one confirmation sample, taken within 24 hours of a sample showing a level over 10 parts per million, is allowed.

The EPA's nitrate standard remains controversial. Many European and other nations have adopted a standard allowing less than half the nitrates the EPA permits.[64] While a National Academy of Sciences review conducted in 1995 concluded that the EPA's 10-parts-per-million health goal and standard were protective of health,[65] that conclusion may not be justified in light of emerging evidence of nitrates' possible reproductive and other toxicity, and nitrosamines' potential cancer risks.[66] Clearly, the current EPA nitrate MCL and MCLG leave virtually no margin of safety, since blue baby syndrome has been observed in infants who drink water containing nitrates at 12 parts per million or possibly lower concentrations.[67]

PERCHLORATE

National Standard (MCL): None Established
National Draft Safe Level (Drinking Water Equivalent Level):[68] 1 ppb
California Action Level (health-based advisory level): 4 ppb

Perchlorate is an inorganic contaminant that harms the thyroid and may cause cancer.[69] It usually comes from rocket fuel spills or leaks at military facilities. Perchlorate contaminates the tap water of much of Southern California (including Los Angeles and San Diego) via the Metropolitan Water District's Colorado River Aqueduct. It also is in the water of Phoenix, Las Vegas, and many other cities and towns reliant upon the Colorado River for their water. The source of the Colorado's contamination is reportedly a Kerr-McGee site in Henderson, Nevada, where perchlorate was manufactured and whose waste leaks into the Colorado River.[70] Perchlorate also contaminated wells in the San Fernando Valley, the San Gabriel Valley, the Inland Empire region of Southern California, and the Rancho Cordova area of Sacramento County (the perchlorate here was likely from local sources), and water sources for many other towns and cities across the nation, where it has been manufactured or used at military bases or in commercial applications. In addition to its heavy use in rocket fuel, perchlorate is also used, in far lower quantities, in a variety of products and applications, including electronic tubes, automobile air bags, leather tanning, and fireworks.[71]

According to the EPA, perchlorate

> *disrupts how the thyroid functions. In adults, the thyroid helps to regulate metabolism. In children, the thyroid plays a major role in proper development in addition to metabolism. Impairment of thyroid function in expectant mothers may impact the fetus and newborn and result in effects including changes in behavior, delayed development, and decreased learning capability. Changes in thyroid hormone levels may also result in thyroid gland tumors. [The EPA finds that] perchlorate's disruption of iodide uptake is the key event leading to changes in development or tumor formation.*[72]

In early 2002, the EPA proposed a "reference dose," (a level the EPA says is safe), and with that as a basis, estimated that the "drinking water equivalent level" (DWEL)— essentially the highest safe dose in tap water—should be 1 part per billion. California dropped its action level shortly thereafter to 4 parts per billion. Many public health and environmental groups believe both figures are too high, and that the EPA should immediately establish a new standard at less than 1 part per billion.

The EPA appears reluctant to establish a permanent standard of any sort, however. It now maintains that it does not yet know enough to warrant establishing a standard, and will continue studying the problem.[73,74] In the meantime, as many as 12 million Americans (or more) have perchlorate in their tap water, a circumstance that the EPA's own draft risk assessment acknowledges is an unacceptable risk.

THALLIUM

National Standard (MCL): 2 ppb (average)
National Health Goal (MCLG): 0.5 ppb

Thallium is a trace metal often associated with copper, gold, zinc, and cadmium, and is found in rock and in ores containing these other commercially used metals.[75] Thallium is used principally in electronic research equipment.[76] The EPA reports that thallium pollution sources include gaseous emissions from cement factories, coal-burning power plants, and metal sewers.[77] The chief source of thallium in water is ore processing—the metal leaches out during processing.[78] High exposure to thallium for a short period can cause gastrointestinal irritation and nerve damage.[79] Of even greater concern are the long-term effects of exposure over time, even at lower levels (but still above the EPA standard): changes in blood chemistry; damage to the liver, kidney, intestines, and testicles; and hair loss.[80] Thallium can be removed from tap water with activated alumina, ion exchange, or reverse osmosis.

ORGANIC CONTAMINANTS

ATRAZINE

National Standard (MCL): 3 ppb (average)
National Health Goal (MCLG): 3 ppb

Atrazine is among the most widely used pesticides in this country, used to protect corn and other crops from broadleaf and grassy weeds.[81] Atrazine enters source waters through agricultural runoff, and also volatilizes, or evaporates, and is then redeposited with rain.[82] It is among the most commonly detected pesticides in drinking water, particularly during spring runoff season throughout most of the Mississippi River basin and virtually anywhere else that corn is grown.[83] Atrazine is an animal carcinogen.[84] The EPA recently reversed its previous judgment of atrazine's hazards and downgraded it from a "probable" to a "possible" carcinogen in humans, but new evidence collected about its link to prostate cancer in workers and its ability to harm the reproductive system as an "endocrine disrupter" have called the EPA's actions into question.[85]

According to the EPA, short-term human exposure to atrazine may cause congestion of the heart, lungs, and kidneys; low blood pressure; muscle spasms; weight loss; and damage to the adrenal glands.[86] Over the long term, the EPA reports, atrazine may cause weight loss, cardiovascular damage, retinal and some muscle degeneration, and possibly cancer.[87] In addition, as noted above, atrazine is a known endocrine disrupter,[88] meaning that it interferes with the body's hormonal development, and may cause cancer of the mammary gland.

The EPA determined in 2002 that the chemical cousin "triazine pesticides"—atrazine, simazine, and propazine, and several of their degradates—all share a "common mechanism of toxicity," which is to say that they all poison the body in the same way.[89] However, the EPA has yet to take action to reduce allowable tap water or other exposure levels to these chemicals in combination.

Atrazine can be removed from tap water through the use of granular activated carbon, powdered activated carbon, or reverse osmosis.

DIBROMOCHLOROPROPANE (DBCP)

National Standard (MCL): 200 ppt (average)

National Health Goal (MCLG): 0—there is no known fully safe level of DBCP

DBCP is a banned pesticide still detected in some cities' tap water, including in Fresno, California. The enforceable standard is an average of 200 parts per trillion. DBCP has been shown to cause cancer, kidney and liver damage, and atrophy of the testes leading to sterility.[90] It can be removed from water with granular activated carbon, reverse osmosis, and certain other treatments.

CIS-1,2-DICHLOROETHYLENE

National Standard (MCL): 70 ppb (average)

National Health Goal (MCLG): 70 ppb

California Standard: 6 ppb (average)

Cis-1,2-Dichloroethylene is a volatile organic chemical that reaches drinking water supplies as discharge from industrial chemical factories. It is linked with liver and nervous system problems.[91] The federal maximum contaminant level (MCL) and health goal for the chemical are both 70 parts per billion, with averaging allowed. A stricter standard is applied by the state of California: 6 parts per billion.

DICHLOROMETHANE

National Standard (MCL): 5 ppb (average)

National Health Goal (MCLG): 0—there is no known fully safe level of DCM

Dichloromethane (DCM) is an industrial chemical used as a paint remover, solvent, and cleaning agent; as a fumigant for strawberries and grains; and to extract substances from food.[92] It is sometimes discharged by the pharmaceutical and chemical industries.[93] The EPA has found that exposure to dichloromethane over a relatively short term at levels exceeding the EPA's standard potentially causes damage to the nervous system and to blood.[94] Over the longterm, the EPA says, dichloromethane has the potential to cause liver damage and cancer.[95] DCM can be removed from drinking water by granular activated carbon in combination with packed tower aeration or by reverse osmosis.

2,2-DICHLOROPROPANE (2,2-DCP)

National Standard (MCL): none

National Health Goal (MCLG): none

2,2-Dichloropropane (2,2-DCP) is a volatile organic chemical that evaporates at room temperature and is found in a few drinking water supplies, most of which are reliant on groundwater sources. It was once used as a soil fumigant by the farming industry. Although its isomer 1,2-dichloropropane is linked to liver problems and cancer, NRDC has been unable to find specific studies on the health effects of low-level exposure to the chemical.

DI-(2-ETHYLHEXYL)PHTHALATE ("DEHP" OR "PHTHALATE")

National Standard (MCL): 6 ppb (average)

National Health Goal (MCLG): 0—there is no known fully safe level of DEHP

Di-(2-Ethylhexyl)Phthalate (DEHP) is a plasticizing agent used widely in the chemical and rubber industries. It is also contained in many plastics.[96] The EPA has listed it as a probable human carcinogen, but it also causes damage to the liver and testes. As a result, the agency set a health goal of zero for DEHP.[97] DEHP can be removed from drinking water with granular activated carbon or reverse osmosis.

ETHYLENE DIBROMIDE (EDB)

National Standard (MCL): 50 ppt (average)

National Health Goal (MCLG): 0—there is no known fully safe level of EDB

Ethylene Dibromide (EDB) is used as an additive in gasoline, as a pesticide, in waterproofing preparations, and as a solvent in resins, gums, and waxes.[98] The EPA has found EDB to "potentially cause the following health effects when people are exposed to it at levels above the MCL for relatively short periods of time: damage to the liver, stomach, and adrenal glands, along with significant reproductive system toxicity, particularly the testes."[99] The EPA also says that "EDB has the potential to cause the following effects from a lifetime exposure at levels above the MCL: damage to the respiratory system, nervous system, liver, heart, and kidneys; cancer."[100] It can be removed from water with granular activated carbon or reverse osmosis.

HALOACETIC ACIDS/TOTAL TRIHALOMETHANES (TTHMS)

Haloacetic Acids National Standard (MCL): 60 ppb (average) (effective 2002; no previous standard)

Haloacetic Acids National Health Goal (MCLG): 0 [a] ppb—no known fully safe level of haloacetic acids

TTHMs National Standard (MCL): 80 ppb (average) (effective 2002)
100 ppb (average) (effective through 2001)

TTHMs National Health Goal (MCLG): 0 ppb[b]—no known fully safe level of trihalomethanes

Total trihalomethanes (TTHMs) and Haloacetic Acids (HAAs) are volatile organic contaminants often referred to as "disinfection by-products" or DBPs. TTHMs and HAAs are chemical contaminants that result when chlorine used to disinfect drinking

a As discussed in this section, although the EPA does not have an MCLG for HAAs, some dichloracetic acid has a health goal of zero, and since water systems generally report only the combined HAA level, and since it is essentially chemically impossible to create one HAA in tap water without some level of the others, we list the health goal for HAAs as zero.

b As discussed in this section, and is true of HAAs, although the EPA does not have an MCLG for TTHMs, two TTHMs have health goals of zero, and since water systems generally report only the combined TTHM level, and since it is essentially chemically impossible to create one trihalomethane in tap water without some level of the others, we list the health goal for TTHMs as zero.

water interacts with organic matter in the water. TTHMs consist of a sum of the levels of four closely related chemicals—chloroform, dibromochloromethane, bromoform, and bromodichloromethane—which occur together at varying ratios when water is chlorinated. HAAs regulated by the EPA include five related chemicals: monochloroacetic acid, dichloroacetic acid, trichloracetic acid, monobromoacetic acid, and dibromoacetic acid.

TTHMs are used as an indicator of a complex soup of other potentially risky DBPs or "chlorination by-products." More than a dozen epidemiological studies of people who drank water containing chlorination by-products have linked the chemicals to bladder cancer, and several studies indicate likely links to colorectal, pancreatic, and other cancers.[101] National Cancer Institute epidemiologists found links to brain cancer recently,[102] and a link to childhood leukemia has been noted in a recent Canadian epidemiological study.[103] The EPA has classified some individual TTHMs as probable human carcinogens.

Recent studies have also found that some pregnant women exposed to DBPs in tap water may have a higher risk of problems with their babies, even after relatively brief periods of exposure to spikes of the chemicals. The most significant concerns raised by studies of pregnant women have been about findings of associations between elevated levels of chlorination by-products (including TTHMs) and low birth weight, preterm delivery, spontaneous abortions (miscarriages), stillbirths, and birth defects (central nervous system, major cardiac, oral cleft, respiratory, and neural tube defects).[104] For example, one study in California found a significant association between women who drank more than six glasses of water a day containing more than 75 parts per billion TTHMs, and miscarriages by those women.[105] Lab studies on animals and studies of pregnant women exposed to chlorination by-products have also found an association between TTHMs and low birth weight.[106]

The evidence that chlorination by-products cause miscarriages, birth defects, low birth weight, or other reproductive problems is not conclusive but raises major concerns worthy of preventative action to reduce or eliminate exposure to these chemicals. As one recent scientific review concluded, several studies have "shown associations for DBPs and other outcomes such as spontaneous abortions, stillbirth and birth defects, and although the evidence for these associations is weaker, it is gaining weight."[107]

Treatment and Standards

Two TTHMs (bromoform and bromodichloromethane) and dichloroacetic acid have health goals of zero because of cancer risks. In addition, the EPA promulgated and then withdrew after a court decision a zero health goal for chloroform. It has not yet issued a new goal for chloroform. Since water systems generally report only the combined TTHM level, and since it is essentially chemically impossible to create one trihalomethane or one haloacetic acid in tap water without some level of the others, NRDC lists the health goal for TTHMs and HAAs as zero.

In 1979, the EPA announced an "interim" tap water standard for TTHMs of 100 parts per billion that allows systems to test across their distribution systems every quarter, averaging the levels across time and across the distribution system, and that exempts systems serving fewer than 10,000 people.[108] After complaints that the interim standard was too lax, the EPA said it would promptly review it.

After many years of debate, and a 1994 agreement in a regulatory negotiation among the EPA, the water industry, NRDC, other health and consumer groups, states, and others, the EPA agreed to issue a "Stage 1 DBP Rule" that would strengthen the standard to 80 parts per billion, and to set a 60 parts per billion standard for HAAs.[109] The EPA published the final rule embodying that agreement in 1998. The EPA also agreed in the regulatory negotiations to propose a reduction to 40 parts per billion TTHMs and 30 parts per billion HAAs, as a "Stage 2 DBP Rule," which was to be finished by May 2002.[110]

Following a subsequent regulatory negotiation among most of the same parties the EPA agreed to rework how the standards would be measured, putting much more emphasis on reducing peak TTHM and HAA levels, due to concerns about reproductive hazards, but left the actual MCL numbers in place.[111] The new standard would have the effect of substantially reducing the highest peaks in DBPs, and would also, the technical experts agreed, substantially reduce the average levels of DBPs in those systems, smoothing out their peak levels.[112] The EPA has missed the deadline for issuing that new standard, and in fact has not even published the proposal in *The Federal Register*.

HEXACHLOROCYCLOPENTADIENE (HEX)

National Standard (MCL): 50 ppb (average)
National Health Goal (MCLG): 50 ppb

Hexachlorocyclopentadiene (HEX) is an industrial chemical used to make other chemicals, including pesticides, flame retardants, resins, dyes, pharmaceuticals, and plastics.[113] According to the EPA, short-term exposure to high levels of HEX causes gastrointestinal distress, and liver, kidney and heart damage. Prolonged exposure, again according to the EPA, has the potential to cause long-term damage to the stomach and kidneys.[114] HEX can be removed from tap water with granular activated carbon combined with packed tower aeration or by reverse osmosis.

METHYL TERTIARY-BUTYL ETHER (MTBE)

National Standard (MCL): none
National Health Goal (MCLG): none
EPA Health Advisory: 20–40 ppb (based on taste and odor concerns; the EPA says safe health level is higher)

MTBE is a fuel additive, commonly used in the United States to reduce carbon monoxide and ozone levels caused by auto emissions.[115] Because of its widespread use, reports of MTBE detections in the nation's ground and surface water supplies are increasing.[116] MTBE gets into water supplies from leaking underground or above ground storage tanks, spills, pipeline leaks, refineries, inefficient boat and other watercraft engines, runoff from streets, and even atmospheric deposition.[117]

For several years running, the EPA has maintained that it "is currently studying the implications of setting a drinking water standard for MTBE."[118] But it has yet to make a commitment to issue a standard, and has not promised to make a decision on a standard at any specific date. The EPA says that concentrations in the range of 20 to 40 micrograms per liter (or parts per billion, ppb) are the most people can tolerate because of the very bad gasoline-like taste and odor of the water.[119] The health effects of these low levels are uncertain, according to the agency, since the limited testing of the chemical has shown that the taste and odor threshold "is about 20,000 to 100,000 (or more) times lower than the range of exposure levels in which cancer or non-cancer effects were observed in animal tests."[120]

PENTACHLOROPHENOL (PENTA)

National Standard (MCL): 1 ppb (average)
National Health Goal (MCLG): 0—there is no known fully safe level of Penta

Pentachlorophenol (Penta) is a widely used preservative, used on telephone poles, railroad ties, and other wood.[121] Because it is a probable carcinogen, the health goal for Penta is zero.[122] The EPA reports that short-term exposure to high levels may cause central nervous system problems, while long-term exposure has the potential to cause reproductive problems and damage to liver and kidneys, in addition to cancer.[123] Penta can be removed from tap water with granular activated carbon or reverse osmosis.

SIMAZINE

National Standard (MCL): 4 ppb (average)
National Health Goal (MCLG): 4 ppb

A chemical cousin of atrazine, simazine is widely used in agriculture as a pre-emergence herbicide for control of broad-leaved and grassy weeds.[124] Its major use is on corn, where it is often combined with atrazine.[125] It is also used on a variety of deep-rooted crops, including artichokes, asparagus, berries, broad beans, and citrus, and on noncrop areas such as farm ponds and fish hatcheries.[126] The EPA says that high levels of simazine exposure over a short term can cause weight loss and changes in blood, and that prolonged exposure to elevated levels above the MCL has the potential to cause tremors; damage to the testes, kidneys, liver, and thyroid; gene mutations; and cancer.[127] The EPA determined in 2002 that the chemical cousin "triazine pesticides"—simazine, atrazine, and propazine, as well as several of their degradates—all share a "common mechanism of toxicity," which is to say that they all poison the body the same way.[128] The EPA has yet to take action to reduce the allowable levels of simazine in tap water or elsewhere. Simazine can be removed from tap water with granular activated carbon or reverse osmosis.

TETRACHLOROETHYLENE (ALSO CALLED PERCHLOROETHYLENE, PCE, OR PERC)

National Standard (MCL): 5 ppb (average)
National Health Goal (MCLG): 0—there is no known fully safe level of perc

Tetrachloroethylene is used in dry cleaning and industrial metal cleaning or finishing.[129] It enters the water system via spills or releases from dry cleaners or industrial users, waste dumps, leaching from vinyl liners in some types of pipelines used for water distribution, and in some cases during chlorination water treatment.[130] Prolonged consumption of water contaminated by perc can cause liver problems, and may cause cancer.[131]

TOLUENE

National Standard (MCL): 1 ppm (1000 ppb) (average)
National Health Goal (MCLG): 1 ppm (1000 ppb)

Toluene is a volatile organic chemical with a sweet odor.[132] A component of gasoline and other petroleum fuels, it is used to produce benzene and urethane, as well as in solvents and thinners, and is released in wastewaters or by spills on land during the storage, transport and disposal of fuels and oils.[133] According to the EPA's Toxic Chemical Release Inventory, toluene releases to land and water totaled more than 4 million pounds from 1987 to 1993, primarily from petroleum refining.[134] Short-term exposure to toluene at high doses can cause minor nervous system disorders such as fatigue, nausea, weakness, confusion.[135] Longer-term exposure to lower levels (but over the MCL) can cause more pronounced nervous disorders such as spasms, tremors, liver and kidney damage, and impairment of speech, hearing, vision, memory, and coordination.[136]

TRIHALOMETHANES: SEE HALOACETIC ACIDS, ABOVE

TRICHLOROETHYLENE (TCE)

National Standard (MCL): 5 ppb (average)
National Health Goal (MCLG): 0—there is no known fully safe level of TCE

Trichloroethylene (TCE) is a colorless liquid used as a solvent to remove grease from metal parts. It is present in many underground water sources and surface waters as a result of the manufacture, use, and disposal of TCE at industrial facilities across the nation.[137] TCE is a likely carcinogen, and people exposed to high levels of trichloroethylene in their drinking water may experience harmful effects to their nervous system, liver and lung damage, abnormal heartbeat, coma, and possibly death.[138]

VINYL CHLORIDE

National Standard (MCL): 2 ppb (average)
National Health Goal (MCLG): 0—there is no known fully safe level of vinyl chloride

Vinyl chloride is used in the manufacture of cars, electrical wire insulation and cables, piping, industrial and household equipment, and medical supplies, and is also heavily used by the rubber, paper, and glass industries.[139] The EPA has found that relatively short-term exposure to vinyl chloride at levels above the current standard of 2 parts per billion potentially causes damage to the nervous system. Long-term exposure, again according to the EPA, can cause cancer and liver and nervous system damage.[140] Vinyl chloride can be removed from drinking water with granular activated carbon in combination with packed tower aeration, or by reverse osmosis.

RADIOACTIVE CONTAMINANTS

RADON

National Standard (MCL) (proposed): 300 pCi/L (alternate MCL of 4,000 pCi/L, where approved multimedia mitigation program is in place) (averages)

National Health Goal (MCLG) (proposed): 0—there is no known fully safe level of radon

Radon is a radioactive gas known to cause lung cancer. No amount of it is considered fully safe in tap water; indeed, a single particle of radon can cause cancer.[141] Radon results from the natural radioactive breakdown of uranium in the ground. Communities that depend on groundwater can often encounter radon gas in their drinking water, and in the United States, more than 81 million people's drinking water comes from groundwater. The EPA estimates that radon in drinking water causes approximately 168 deaths from lung and stomach cancers[142] each year—89 percent from lung cancer caused by breathing radon released to the indoor air from water, and 11 percent from stomach cancer caused by consuming water that contains radon. In fact, radon is the second leading cause of lung cancer deaths in the United States, after smoking, causing what the National Academy of Sciences has estimated is a total of 20,000 lung cancer deaths per year. Most of these lung cancers are due to radon seepage from soil into basements and through floor slabs,[143] underscoring the importance of radon-testing for basements. But radon in tap water is a threat as well.

At the EPA's proposed 300 picocuries-per-liter (pCi/L) maximum contaminant level (MCL), the lifetime risk of contracting fatal cancer is about 1 in 5,000—twice what the EPA traditionally says is the highest allowable cancer risk for any drinking water contaminant.[144] At 4,000 pCi/L, an "alternate" MCL that the EPA proposes to apply to some communities' water, the fatal cancer risk is about 1 in 370—a cancer risk that is 27 times higher than what the EPA usually says is acceptable in tap water.

Radon is easily removed from tap water through simple aeration of the water—bubbling air through water in a "packed tower." The EPA's estimated cost per household for customers living in a big city for this simple but life-preserving step: $9.50 per year.[145]

Some water industry representatives argue that since more people die from basement seepage of radon, worries about radon in tap water are misplaced. Congress relied on this argument in establishing a new radon provision in the 1996 Safe Drinking Water Act Amendments. That provision requires the EPA to set a new radon MCL, using the usual standard-setting approach, by August 2001. However, acceding to the industry argument that basement seepage is worse than tap water radon, Congress also adopted a provision in the 1996 law that allows the EPA to set an "alternate," weaker MCL applicable in cities or entire states that adopt a "multimedia mitigation program" (MMM) designed to reduce exposure to radon from seepage into basements or across building slabs.

In November 2000, the EPA proposed a radon rule that included a 300 pCi/L MCL, and an "alternate" MCL of 4,000 pCi/L. But more than a year after the August 2001 deadline, the EPA still has not issued a final radon rule.

NRDC is concerned that even at 300 pCi/L in tap water, the NAS and the EPA both agree that the cancer risks are larger than what the EPA traditionally allows. It is true that radon also seeps into some people's basements, and that more people die from that source than from radon in tap water. That is no argument for compounding the problem by permitting unacceptable levels of radon in tap water, particularly when fixing the tap water problem is readily within the capacities of water utilities (unlike basement radon), at a modest cost.

ALPHA RADIATION

National Standard (MCL): 15 pCi/L (average)
National Health Goal (MCLG): 0—there is no known fully safe level of alpha radiation

Alpha particle radiation causes cancer.[146] It generally results from the decay of radioactive minerals in underground rocks, and is sometimes a by-product of the mining or nuclear industries. The best available treatment for alpha emitters other than radon or uranium is reverse osmosis membrane filtration (RO).[147] The RO membrane removes virtually all contaminants, including *Crypto* and other microbes, most industrial or agricultural synthetic chemicals, radioactive contaminants, and even most inorganic contaminants, including arsenic. The resulting water is almost entirely pure.

BETA RADIATION

National Standard (MCL): 50 pCi/L (average)
National Health Goal (MCLG): 0—there is no known fully safe level of beta radiation

Beta particle and photon emitter radiation causes cancer.[148] It generally results from the decay of radioactive minerals in underground rocks, and is sometimes a by-product of nuclear testing or the nuclear industry. The best available technologies for removing beta radiation or photon emitters is ion exchange or reverse osmosis (RO). As noted above, RO removes virtually all other contaminants as well.

TRITIUM

National Standard (MCL): 20,000 pCi/L (average)
National Health Goal (MCLG): 0—there is no known fully safe level of beta radiation

Tritium is a radioactive form of hydrogen that causes cancer. A beta particle emitter, no level of exposure to it is considered safe. The EPA says tritium,

> *forms in the upper atmosphere through interactions between cosmic rays (nuclear particles coming from outer space) and the gases composing the atmosphere. Tritium can be deposited from the atmosphere onto surface waters via rain or snow and can accumulate in ground water via seepage. Tritium is also formed from human activities. . . . Natural tritium tends not to occur at levels of concern, but contamination from human activities can result in relatively high levels. The man-made radionuclides, which are primarily beta and photon emitters, are produced by any of a number of activities that involve the use of concentrated radioactive materials.*

> *These radioactive materials are used in various ways in the production of electricity, nuclear weapons, nuclear medicines used in therapy and diagnosis, and various commercial products (such as televisions or smoke detectors), as well as in various academic and government research activities. Release of man-made radionuclides to the environment, which may include drinking water sources, are primarily the result of improper waste storage, leaks, or transportation accidents.*[149]

URANIUM

National Standard (MCL): 30 micrograms/liter (which EPA assumes to be equivalent to 30 pCi/L)

National Health Goal (MCLG): 0—there is no known fully safe level of uranium

California Standard: 20 pCi/L

Uranium is radioactive and causes cancer when ingested.[150] In addition, the EPA has determined that uranium also causes serious kidney damage at levels above the MCL. Uranium is released from minerals in the ground, often as the result of mining or as a by-product of the nuclear industry.

The EPA acknowledges that uranium poses a cancer risk at levels below its established MCL of 30 pCi/L, but the agency argues that the benefits of reducing uranium contamination of water are outweighed by the costs. That, at least, was the conclusion of the EPA's cost-benefit analysis, in which it calculated costs to all U.S. water systems, including small systems where per-customer costs can be considerably higher than for larger systems. The cancer risk at 30 pCi/L is about one in 10,000, the highest cancer risk the EPA usually allows in drinking water, and about 100 times higher than the one-in-one-million risk the EPA allows for carcinogens under the Superfund or pesticide programs.[151] California does not rely on the EPA's cost-benefit analysis, and so has set a standard of 20 pCi/L, about one-third lower than the EPA's MCL.

NOTES

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3 See CDC, "Parasitic Disease Information: Cryptosporidiosis." Available online at www.cdc.gov/ncidod/dpd/parasites/cryptosporidiosis/factsht_cryptosporidiosis.htm. See also, CDC, "Cryptosporidiosis: A Guide for People with HIV/AIDS," available online at www.cdc.gov/ncidod/diseases/crypto/hivaids.htm.

4 W. R. MacKenzie, et al., "A Massive Outbreak in Milwaukee of *Cryptosporidium* Infection Transmitted Through the Public Water Supply." *New England Journal of Medicine*, 1994, 331: 161–167. The precise number of people killed by the Milwaukee outbreak is not known with certainty. A count by the *Milwaukee Journal* put the number at over 100, while the "official" state and local health department count was "a minimum of 50 deaths." See Marilyn Marchione, "Deaths continued after *Crypto* outbreak: State report attributes a minimum of 50 deaths from '93 to '95." *The Milwaukee Journal Sentinel*, May 27, 1996.

5 See MacKenzie et al. supra; Erik Olson, *The Dirty Little Secret About Our Drinking Water: New Data Show Over 100 Known Drinking Water Disease Outbreaks in the U.S. From 1986-1994, and Strong Evidence of More Widespread, Undetected Problems*." (NRDC, 1995)

6 H. L. Dupont, C. L. Chappell, C. R. Sterling, P. C. Okhuysen, J. B. Rose, W. Jakubowski (1995). "The infectivity of *Cryptosporidium parvum* in healthy volunteers." *New England Journal of Medicine* 332(13): 855–859. "Human Cryptosporidiosis in Immunocompetent and Immunodeficient Persons: Studies of an Outbreak and Experimental Transmission," *New England Journal of Medicine* 308(21): 1252–1257.

7 EPA, "National Primary Drinking Water Regulations: Interim Enhanced Surface Water Treatment Rule," 63 Fed. Reg. 69477-69521 (December 16, 1998).

8 See EPA, "National Primary Drinking Water Regulation: Long Term 2 Enhanced Surface Water Treatment Rule, Draft," page 75 Table III-5, available online at www.epa.gov/safewater/lt2/lt2_preamble.pdf; M. W. LeChevallier and W. D. Norton, "*Giardia* and *Cryptosporidium* in Raw and Finished Water," *Journal AWWA*, 1995, 87: 54–68.

9 Ibid.

10 See, e.g., EPA, "National Primary Drinking Water Regulation: Long Term 2 Enhanced Surface Water Treatment Rule, Draft," page 73 ("it is expected that *Cryptosporidium* oocysts were present in many more samples and were not detected due to poor recovery rates and low volumes analyzed. The observed data do not account for the ICR Method's low recovery efficiencies. Adjusting for recovery would increase the estimated occurrence several-fold.") available online at www.epa.gov/safewater/lt2/lt2_preamble.pdf.

11 Ibid.

12 EPA, "National Primary Drinking Water Regulations: Interim Enhanced Surface Water Treatment Rule," 63 Fed. Reg. 69477-69521 (December 16, 1998).

13 The information on health effects of coliform is derived from EPA, "Total Coliform Rule," 54 Fed.Reg. 27544-27568, June 29, 1989; EPA, "Total Coliform Rule, available online at www.epa.gov/safewater/source/therule.html#Total, and EPA, "Total Coliform Rule: A Quick Reference Guide," available online at *Total Coliform Rule: A Quick Reference Guide* PDF file (816-F-01-035, September 2001).

14 "*E. coli* Death Toll Rises," available online at abcnews.go.com/sections/us/DailyNews/ecoli990911.html.

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18 Ibid.

19 EPA, "Total Coliform Rule," available online at www.epa.gov/safewater/source/therule.html#Total.

20 Ibid.

21 40 C.F.R. 141.21 & 141.63.

22 Ibid.

23 See note 19.

24 Ibid.

25 40 C.F.R. 141.21.

26 EPA, Fact Sheet: National Primary Drinking Water Regulations (2002), available online at www.epa.gov/safewater/mcl.html.

27 See W. R. MacKenzie, et al., "A Massive Outbreak in Milwaukee of *Cryptosporidium* Infection Transmitted Through the Public Water Supply," *New England Journal of Medicine*, 1994, 331:161–167. As noted above, a precise number of people killed by the Milwaukee outbreak is not known with certainty, but the *Milwaukee Journal* put the number at over 100, while the "official" state and local health department count was "a minimum of 50 deaths." See Marilyn Marchione, "Deaths continued after Crypto outbreak: State report attributes a minimum of 50 deaths from '93 to '95." *The Milwaukee Journal Sentinel*, May 27, 1996.

28 EPA, "National Primary Drinking Water Regulations: Interim Enhanced Surface Water Treatment Rule," 63 Fed. Reg. 69477-69521 (December 16, 1998).

29 See W. R. MacKenzie, et al., "A Massive Outbreak in Milwaukee of *Cryptosporidium* Infection Transmitted Through the Public Water Supply," *New England Journal of Medicine*, 1994, 331:161–167.

30 See EPA, "National Primary Drinking Water Regulation: Long Term 2 Enhanced Surface Water Treatment Rule, Draft," page 75 Table III-5, available online at www.epa.gov/safewater/lt2/lt2_preamble.pdf.

31 Available online at www.nap.edu/catalog/6444.html.

32 National Academy of Sciences, National Research Council, Arsenic in Drinking Water: 2001 Update (National Academy Press, 2001), available online at www.nap.edu/catalog/10194.html.

33 Total cancer risk figures are taken from the National Academy of Sciences' report *Arsenic in Drinking Water: 2001 Update* (2001); for a plain-English explanation of the Academy's arsenic cancer risk figures, see NAS's September 11, 2002, press release, available online at www4.nationalacademies.org/news.nsf/isbn/0309076293?OpenDocument. EPA's maximum acceptable cancer risk is 1 in 10,000.

34 See NAS's 9/11/2002 press release, available online at www4.nationalacademies.org/news.nsf/isbn/0309076293?OpenDocument.

35 EPA, National Primary Drinking Water Regulation for Arsenic, 66 Fed. Reg. 6976, at 6981 (January 22, 2001).

36 Ibid, at 7011, Table III.E-2.

37 See Report of the Arsenic Cost Working Group to the National Drinking Water Advisory Council, August 14, 2001, available online at www.epa.gov/safewater/ars/ndwac-arsenic-report.pdf.

38 For a review of the history of the arsenic standard and the health effects of arsenic, see Paul Mushak, et al. *Arsenic and Old Laws* (NRDC, 2000).

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40 National Academy of Sciences, National Research Council, *Arsenic in Drinking Water: 2001 Update* (National Academy Press, 2001), available online at www.nap.edu/catalog/10194.html.

41 Ibid.; see also NAS's September 11, 2002, press release, available online at www4.nationalacademies.org/news.nsf/isbn/0309076293?OpenDocument.

42 EPA, Consumer Fact Sheet: Chromium, available online at www.epa.gov/safewater/dwh/c-ioc/chromium.html.

43 See EPA, "National Primary Drinking Water Regulations; Announcement of the Results of EPA's Review of Existing Drinking Water Standards and Request for Public Comment; Proposed Rule," 67 Fed. Reg. 19030, at 19057-58 (April 17, 2002).

44 See note 42.

45 EPA, Consumer Fact Sheet: Cyanide, available online at www.epa.gov/safewater/dwh/c-ioc/cyanide.html.

46 Ibid.

47 Ibid.

48 Ibid.

49 See EPA, Consumer Fact Sheets on Lead, www.epa.gov/safewater/Pubs/lead1.html and www.epa.gov/safewater/standard/lead&co1.html, and IRIS summary for lead online at www.epa.gov/iris/subst/0277.htm.

50 Ibid.

51 40 C.F.R. §141.80-141.91.

52 Ibid.; for a review of the sampling and monitoring requirements as amended by the "lead and copper rule minor revisions," see EPA, "Lead and Copper Rule Minor Revisions: Fact Sheet for Public Water Systems Serving More than 50,000 Persons," available online at www.epa.gov/safewater/lcrmr/largefs.pdf.

53 SDWA § 1417.

54 The information regarding the health effects of nitrate are derived from National Academy of Sciences, National Research Council, *Nitrate and Nitrite in Drinking Water,* 1995, available online at www.nap.edu/catalog/9038.html), and EPA, Nitrates, (Fact sheet)(available online at www.epa.gov/safewater/dwh/c-ioc/nitrates.html).

55 Ibid.

56 Ibid.

57 See, e.g. L. Knobeloch, B. Salna, A. Hogan, J. Postle, H. Anderson, "Blue babies and nitrate-contaminated well water." *Environmental Health Perspectives,* July 2000, 108(7): 675-8.

58 "Spontaneous abortions possibly related to ingestion of nitrate-contaminated well water—LaGrange, Indiana, 1991–1994." *MMWR,* 1996, 45(26): 569-572.

59 L. A. Croen, K. Todoroff, G. M. Shaw. "Maternal exposure to nitrate from drinking water and diet and risk for neural tube defects," *American Journal of Epidemiology,* 2001, 153(4).

60 EPA, Nitrates, (Fact sheet)(available online at www.epa.gov/safewater/dwh/c-ioc/nitrates.html.

61 See L. Knobeloch, B. Salna, A. Hogan, J. Postle, H. Anderson, "Blue babies and nitrate-contaminated well water." *Environmental Health Perspectives,* July 2000, 108(7): 675–8; see also EWG, *Pouring it On: Nitrate Contamination of Drinking Water* (1995), available online at www.ewg.org/reports/Nitrate/NitrateHealth.html.

62 Ibid; see also EPA, Nitrates, (Fact sheet), (available online at www.epa.gov/safewater/dwh/c-ioc/nitrates.html.

63 Ibid.

64 For a list of stricter standards overseas, see EWG, *Pouring It On: Nitrate Contamination of Drinking Water* (1995), available online at www.ewg.org/reports/Nitrate/NitrateHealth.html.

65 National Academy of Sciences, National Research Council, *Nitrate and Nitrite in Drinking Water* (1995), available online at www.nap.edu/catalog/9038.html.

66 See note 62 (noting emerging evidence that nitrate exposure may pose miscarriage and reproductive risks, cancer risks, thyroid risks, and diabetes risks, and that even exposure as low as 12 ppm has been linked to blue baby syndrome); EWG, *Pouring it On: Nitrate Contamination of Drinking Water* (1995), available online at www.ewg.org/reports/Nitrate/NitrateHealth.html (noting evidence of chronic risks not considered by NAS).

67 Ibid.

68 A DWEL is the presumed level of perchlorate that one would need to consume in tap water to reach the Reference Dose—the maximum safe level. See EPA, "Perchlorate," Fact Sheet, available online at www.epa.gov/safewater/ccl/perchlor/perchlo.html.

69 Ibid.; see also California Office of Environmental Health Assessment, Draft Public Health Goal for Perchlorate in Drinking Water (March 2002), available online at www.oehha.org/water/phg/pdf/PHGperchlorate372002.pdf.

70 MWD is well aware that this Henderson facility is the source of this perchlorate. See MWD, "In the News: Perchlorate." Available online at www.mwdh2o.com/mwdh2o/pages/yourwater/ccr02/ccr03.html; MWD Press Release, "Water Officials Report Significant Progress in Perchlorate Removal," April 17, 2002. This release puts an unduly optimistic face on the problem, since MWD is well aware that the cleanup of the facility remains problematic and partially unsuccessful. See also Environmental Working Group, *Rocket Science* (2001), available online at www.ewg.org/reports/rocketscience.

71 See California Department of Health Services, "Perchlorate in Califrona Drinking Water," available online at www.dhs.cahwnet.gov/ps/ddwem/chemicals/perchl/perchlindex.htm; see also EWG, *Rocket Science* (2001),.available online at www.ewg.org/reports/rocketscience/.

72 EPA, "Perchlorate," Fact Sheet, available online at www.epa.gov/safewater/ccl/perchlor/perchlo.html.

73 See EPA, "Perchlorate," Fact Sheet (2002) (perchlorate was listed on the contaminant candidate list in 1998 and study is continuing), available online at www.epa.gov/safewater/ccl/perchlor/perchlo.html; see also EPA, "Announcement of Preliminary Regulatory Determinations for Priority Contaminants on the Drinking Water Contaminant Candidate List," 67 Fed. Reg. 38222 (June 3, 2002) (no regulatory determination made for perchlorate), available online at www.epa.gov/ogwdw/ccl/pdf/prelimreg_fr.pdf.

74 See note 72.

75 EPA, "Consumer Fact Sheet: Thallium" available online at www.epa.gov/safewater/dwh/c-ioc/thallium.html.

76 Ibid.

77 Ibid.

78 Ibid.

79 Ibid.

80 Ibid.

81 EPA, "Consumer Fact Sheet: Atrazine," available online at www.epa.gov/safewater/dwh/c-soc/atrazine.html.

82 USGS data, cited in NRDC, *Atrazine: An Unacceptable Risk to America's Children & Environment* (June 2002).

83 Ibid.

84 Ibid.; see also note 82.

85 Syngenta's prostate cancer data and other atrazine data are summarized in NRDC, *Atrazine: An Unacceptable Risk to America's Children & Environment* (June 2002).

86 See note 81.

87 Ibid.

88 See NRDC, *Atrazine: An Unacceptable Risk to America's Children & Environment*, (June 2002).

89 EPA, "Common Mechanism of Action Determination for the Triazines," summary available online at www.epa.gov/pesticides/cumulative/triazines/newdocket.htm.

90 Health effects and other general information on DBCP derived from EPA, Consumer Fact Sheet on Dibromochloropropane, available online at www.epa.gov/safewater/dwh/c-soc/dibromoc.html.

91 EPA, "Consumer Fact Sheet on 1,2-Dichlorethylene," available online at www.epa.gov/safewater/dwh/c-voc/12-dich2.html.

92 Information derived from EPA, "Consumer Fact Sheet on Dichloromethane," available online at www.epa.gov/safewater/dwh/c-voc/dichloro.html.

93 Philadelphia Water Department, "Drinking Water Quality 2001," available online at www.phillywater.org/wqr2001/wqr2001.htm. Last visited September 15, 2002. Published April 2002.

94 Information derived from EPA, "Consumer Fact Sheet on: Dichloromethane," available online at www.epa.gov/safewater/dwh/c-voc/dichloro.html.

95 Ibid.

96 EPA, "Consumer Fact Sheet on DEHP," www.epa.gov/safewater/dwh/c-soc/phthalat.html.

97 Ibid.

98 EPA, "Consumer Fact Sheet on Ethylene Dibromide," available online at www.epa.gov/safewater/dwh/c-soc/ethylene.html.

99 Ibid.

109 Ibid.

101 See, e.g., K. P. Cantor, C. F. Lynch, M. E. Hildesheim, M. Dosemeci, J. Lubin, M. Alavanja, G. Craun. "Drinking water source and chlorination by-products. I. Risk of bladder cancer," *Epidemiology* January 1998, 9(1): 21–28; M. E. Hildesheim, K. P. Cantor, C. F. Lynch, M. Dosemeci, J. Lubin, M. Alavanja, G. Craun. "Drinking water source and chlorination by-products. II. Risk of colon and rectal cancers," *Epidemiology* January 1998, 9(1) 29–35; W. D. King, L. D. Marrett, C. G. Woolcott, "Case-control study of colon and rectal cancers and chlorination by-products in treated water," *Cancer Epidemiol. Biomarkers Prev.* August 2000, 9(8): 813-8; C. B. Jsselmuiden, C. Gaydos, B. Feighner, W. L. Novakoski, D. Serwadda, L. H. Caris, D. Vlahov, G. W. Comstock, "Cancer of the pancreas and drinking water: a population-based case-control study in Washington County, Maryland," *Am. J. Epidemiol.,* October 1, 1992, 136(7): 836–42. For a review of this issue, see Erik Olson, et al., *Trouble on Tap* (NRDC, 1995); Erik Olson, et al., *Bottled Water: Pure Drink or Pure Hype?* (NRDC, 1999), available online at www.nrdc.org/water/drinking/bw/bwinx.asp; and EPA, draft Preamble for Stage 2 Disinfection By-products Regulation, available online at www.epa.gov/safewater/mdbp/st2dis-preamble.pdf.

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103 C. Infante-Rivard, E. Olson, L. Jacques, P. Ayotte, "Drinking water contaminants and childhood leukemia," *Epidemiology,* January 2001, 12(1): 13-9.

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107 Ibid.

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109 EPA, National Primary Drinking Water Regulations: Disinfectants and Disinfection By-products, 63 Fed. Reg. 69389 (December 16, 1998).

110 Ibid.

111 EPA, draft Preamble for Stage 2 Disinfection By-products Regulation, available online at www.epa.gov/safewater/mdbp/st2dis-preamble.pdf.

112 Ibid.

113 EPA, "Consumer Fact Sheet on: Hexachlorocyclopentadiene," available online at www.epa.gov/safewater/dwh/c-soc/hexachl2.html.

114 Ibid.

115 EPA, "MTBE in Drinking Water," available online at www.epa.gov/safewater/mtbe.html.

116 Ibid.

117 Ibid.

118 Ibid.

119 EPA, "Fact Sheet: Drinking Water Advisory: Consumer Acceptability Advice and Health Effects Analysis on Methyl Tertiary-Butyl Ether (MtBE)," available online at www.epa.gov/waterscience/drinking/mtbefact.pdf.

120 Ibid.

121 EPA, Consumer Fact Sheet: Pentachloropehenol, available online at www.epa.gov/safewater/dwh/c-soc/pentachl.html; see also EPA, Technical Fact Sheet on Pentachlorophenol, available online at www.epa.gov/safewater/dwh/t-soc/pentachl.html.

122 Ibid.

123 Ibid.

124 EPA, Consumer Fact Sheet on Simazine, available online at www.epa.gov/safewater/dwh/c-soc/simazine.html.

125 Ibid.

126 Ibid.

127 Ibid.

128 EPA, Common Mechanism of Action Determination for the Triazines, summary available online at www.epa.gov/pesticides/cumulative/triazines/newdocket.htm.

129 EPA, Consumer Fact Sheet on Tetrachloroethylene, available online at www.epa.gov/safewater/dwh/c-voc/tetrachl.html.

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132 EPA, Consumer Fact Sheet on Toluene, available online at www.epa.gov/safewater/dwh/c-voc/toluene.html.

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142 Ibid.

143 NAS, *Risk Assessment of Radon in Drinking Water, supra.*

144 EPA, "Proposed National Primary Drinking Water Regulation: Radon," 64 Fed. Reg. 59245, at 59270 Table VII.1 (November 2, 1999).

145 EPA, "Proposed National Primary Drinking Water Regulation: Radon," 64 Fed. Reg. 59245, at 59328 Table XIII.11 (November 2, 1999).

146 See EPA Fact Sheets on radionuclides for information on health effects and sources: www.epa.gov/safewater/hfacts.html#Radioactive; and www.epa.gov/safewater/rads/technicalfacts.html.

147 EPA, "National Primary Drinking Water Regulation: Radionuclides," 65 Fed. Reg. 76707, at 76722 (December 7, 2000).

148 See note 159.

149 EPA, "Implementation Guidance for the Radionuclides Rule," at page IV-8 (draft, January 2002), available online at www.epa.gov/safewater/rads/fullradsimpguide.pdf.

150 Health effects information is derived from EPA's final rule issued in December 2000, 65 Fed. Reg. 76708 (December 7, 2000), available online at www.epa.gov/safewater/rads/radfr.pdf.

151 EPA, Final Radionuclides National Primary Drinking Water Regulation, 65 Fed. Reg, 76708, page 76715 (December 7, 2000).

CHAPTER 3

Grading Methodology

In developing a grading system for drinking water quality and right-to-know reports, NRDC worked closely with the Steering Committee of the Campaign for Safe and Affordable Drinking Water, an alliance of more than 300 public health, environmental, medical, consumer, and other groups. Once NRDC had evaluated the water systems and assigned an initial round of grades, it sent draft reports on each city out for peer review. Based on comments from that review, NRDC fine-tuned its grading system.

DRINKING WATER QUALITY GRADES

NRDC chose public water systems in four of California's largest cities and assigned each system a water quality and compliance grade. (A forthcoming report will examine the water in 15 additional cities around the nation.) A California water system that was in compliance with national health standards (that is, enforceable Maximum Contaminant Levels and substantive Treatment Technique requirements) under NRDC's grading system earned a grade of "Fair." If, in addition to complying with these standards, the utility met additional criteria, it earned a higher grade. Specifically:

1. If the utility does not exceed any current, proposed, or final (but not yet enforceable) drinking water standards (that is, Maximum Contaminant Levels or Treatment Techniques); does not exceed any action levels for lead and copper; and if all of the utility's detected contaminants whose health goals are zero are found at less than 25 percent of the national standards, then that utility may earn an "Excellent."

2. If the utility does not exceed any current, proposed, or final but not yet enforceable drinking water standards (that is, Maximum Contaminant Levels or Treatment Techniques); does not exceed any action levels for lead and copper; and all contaminants are substantially below, but above 25 percent of, the national standard, then that utility may earn a "Good." For example, a city may be in compliance with all current and proposed standards, but have levels of a cancer-causing contaminant like trihalomethanes (some of which have a health goal of zero because any exposure poses a cancer risk) at under half of the EPA standard. Such a water system would get a "Good."

3. If the utility is in compliance with national standards, but violates a proposed standard, or violates an action level, then it earns a "Fair." For example, a system that is technically in compliance with all current EPA standards, but has a problem with lead that causes it to exceed the EPA action level would get a "Fair."

If a utility did not meet the core criteria, it earned a grade lower than "Fair." Specifically:

4. If a utility violates a final (but not yet enforceable) standard or has a combination of more than one violation of an action level or a proposed standard, but does not violate a currently enforceable standard, it receives a "Poor." In addition, if a system is found to violate a substantive requirement of a treatment technique that presents a potential risk but not an imminent health threat, it can get no better than a "Poor." Thus, if a system violated the new but not yet enforceable arsenic standard, and also exceeded the EPA action level for lead, it would get a "Poor."

5. If a utility violates a current national standard, then it receives a "Failing" grade. Thus, for example, a system that violates the EPA treatment standard for turbidity (cloudiness of the water that indicates possible pathogen contamination) and is forced to tell its customers to boil their water would get a "Failing" grade.

One important caveat to this structure: If a utility's contamination levels are low enough that they do not violate a national standard, but high enough that they exceed a level that the EPA has deemed fully safe (through its health goal or Maximum Contaminant Level Goal), the utility can be downgraded, even though it is technically in compliance. Thus, NRDC's standards for judging drinking water quality may differ from those of the EPA, state officials, and water utilities. Utilities may complain that they should be graded with an "Excellent" simply for being in compliance. NRDC disagrees.

NRDC believes that a water system in technical compliance with current enforceable drinking water standards and action levels deserves some credit, but that to demonstrate more than mediocre performance and water quality, a system must go beyond the legal minimum. It must provide excellent water that does not pose health risks to its consumers, whether or not the system is technically in violation. Many EPA standards allow unnecessary health risks because they are old and have not been updated, or because, in issuing the standards the EPA has weighed compliance costs too heavily, in NRDC's view, and has allowed the public to be placed at an unnecessary risk.

The final methodology is summarized in the table on page 48.

RIGHT-TO-KNOW REPORT CITIZENSHIP GRADE

Public water utilities are required to produce annual right-to-know reports (also called consumer confidence reports or water quality reports) under the Safe Drinking Water Act Amendments of 1996. The purpose of the right -to-know reports is to inform Americans about the quality of their drinking water and the health risks to which they may be exposed from drinking it. The reports are also intended to

TABLE 1
Water Quality and Compliance Grading System

Grade	Requirements Needed to Receive Grade
Excellent	
Excellent drinking water	No violation of current national standards; no exceedence of action levels; no violations of proposed or final (but not yet enforceable) national standards; all detected contaminants whose national health goals are zero are found at less than 25 percent of the national health standard.
Good	
Generally high-quality drinking water	No violation of current national standards; no exceedence of action levels; no violation of proposed or final (but not yet enforceable) national standards; all detected contaminants whose national goals are zero are found at substantially less than the national standard, but over 25 percent of that standard.
Fair	
Drinking water quality and compliance is satisfactory overall but there are some problems	No violations of current national standards; one violation of a proposed national standard that is not yet final, or one exceedence of an action level.
Poor	
Drinking water quality or compliance with standards has serious problems and barely passes	Violations of a combination of more than one action level or proposed standard; a violation of new (but not yet legally enforceable standard; or other serious and repeated water quality or compliance problems (such as frequent well closures due to serious contamination).
Failing	
Drinking water quality or compliance with standards is of high concern	A violation of a currently enforceable national standard.

Note: National Standard means the EPA's maximum contaminant level (MCL) or substantive enforceable treatment requirements of an EPA treatment technique (TT).

provide information on the threats to source water, and on known polluters of that source water, as well as information on how citizens can get involved in protecting their drinking water.

The EPA issued regulations providing guidelines for the minimum amount of information that must be included in the reports. The first round of reports was released in October 1999 (summarizing 1998 data), and since then reports have been required to be issued for each year no later than July 1 of the following year. Each report summarizes data on water quality for the previous calendar year. This study is based on 2000 and 2001 right-to-know reports, released in mid-2001 and mid-2002, respectively.

In this study, each water utility received a right-to-know report citizenship rating. The criteria for this rating are:

1. Form and readability, including compliance with EPA rules regarding format.

2. Content, particularly disclosure of health risks, including compliance with EPA rules regarding content, and EPA recommendations regarding disclosure of pollution sources.

TABLE 2
NRDC's Grading System For Right-To-Know Reports

Grade	
Excellent Excellent right-to-know report	Report complies with all EPA right-to-know rules, includes significant information about unregulated contaminants and health effects of all contaminants found at levels above EPA's health goals, and lists and maps major specific sources of pollution of its source water
Good Generally high-quality right-to-know report	Report complies with all EPA rules, and includes at least two of the following: (a) significant information about unregulated contaminants, (b) health effects of at least some contaminants found at levels above the EPA's health goals, or (c) lists and maps major specific sources of pollution of its source water. Other significant nonrequired information (such as full translation of report for non-English speakers, plus other special efforts to educate consumers) can also earn a "Good."
Fair Right-to-know report is satisfactory overall	Report basically complies with EPA rules, but does not go significantly beyond those minimum requirements.
Poor Report has serious problems and barely passes	Report is not in full compliance with EPA rules, but does not contain major violations of EPA right-to-know rules and does not appear to seriously mislead consumers.
Failing Report is of high concern	Report has major flaws that substantially violate EPA rules, or that affirmatively mislead consumers.

3. Translation of the right-to-know report when more than 10 percent of the population is non-English speaking.

As with the drinking water compliance and water quality grades, NRDC believes that, while mere compliance with the EPA's regulations is commendable and deserves some credit, water systems should go beyond the minimum requirements to fully educate and be honest with their consumers. NRDC's grading system, summarized above, reflects that view.

A report that complies with all EPA rules, includes information about the health effects of all contaminants found at levels above the EPA's health goals, as well as any other unregulated contaminants found, and lists or maps major specific sources of pollution of its source water, earns an "Excellent." A report that complies with EPA rules, but does not go significantly beyond those minimum requirements, earns a "Fair." A report that is not in compliance with EPA rules, but does not appear to mislead consumers intentionally, gets a "Poor." A system with major flaws in its report, that substantially violates EPA rules, or that affirmatively misleads consumers, gets a "Failing" grade.

THREATS TO SOURCE WATER GRADE

NRDC used a variety of information sources to evaluate the threats to source water quality, including EPA databases, water system source water assessments, independent organizations' studies of source water threats, and the EPA's Index of Watershed Indicators (IWI) database.

The IWI is a useful tool for determining threats to drinking water sources, and NRDC researchers used its basic grading system to establish numeric grades for threats to source water. The IWI database is a general compilation of indicators, or measures, of the health of water resources in the United States. Measuring watershed health is helpful to gaining a better understanding of how drinking water resources are affected by pollution and other factors. The index is composed of condition and vulnerability indicators. The EPA compiled and analyzed data for each indicator in order to determine an overall index score for the relevant watershed.

NRDC generally uses the IWI database score for its Threats to Source Water rating, unless more detailed and up-to-date data were available. In addition, NRDC downgrades that score if a known source of contamination has historically threatened or currently threatens a city's source water for drinking water.

The overall index scores range from 1 (few or no problems) to 6 (serious problems). The IWI data is dated from 1990–1998, depending on the indicator. As this report was going to press, the EPA removed the readily accessible public version of the IWI from its website, claiming that it was outdated. However, there is no more recent national database available; IWI remains the most comprehensive national database on watershed threats. NRDC's investigation focused on three indicators: (1) Sources of Drinking Water; (2) Agricultural Runoff Potential; and (3) Urban Runoff Potential. In addition, if other significant information about threats to source water was available, NRDC took that information into account in issuing the final grade.

CHAPTER 4

Agriculture, Dairies, and Septic Systems Degrade Drinking Water in California

According to the California Department of Water Resources, three-fourths of the impaired groundwater in California has been contaminated by salinity, pesticides, and nitrates, primarily from agricultural practices.[1] Of these contaminants, nitrates have caused the closure of more public drinking water wells than any other.[2] Elevated nitrate levels in California's water generally result from agricultural and dairy runoff, erosion of natural deposits, and leaching from septic tanks and sewage.

Although nitrates have no taste or smell, they are toxic to infants and developing fetuses, and degrade drinking water sources for more than 10 million Californians. Because of loopholes and exemptions under state and federal clean-water laws, agricultural, dairy, and septic system sources are not adequately regulated for discharges of these chemicals to surface or groundwater. California regulators are now contemplating the state's first ever controls for these leading pollution sources.

EVEN SHORT-TERM EXPOSURE IS TOXIC

As discussed in Chapter 2, even very short-term exposure to nitrates can pose a serious risk to infants, causing what is known as methemoglobinemia, or "blue baby syndrome."[3] Nitrates affect the ability of the blood to carry oxygen. Infants exposed to nitrates in drinking water can suffer shortness of breath, poor appetite, vomiting, diarrhea, lethargy, dusky skin coloring, loss of consciousness, and even death when exposed to high levels of nitrates. Because nitrates effectively deprive the infant's brain of sufficient oxygen, babies may also suffer chronic or subtle impairment of neurologic function, even at exposure levels that do not cause dramatic, acute symptoms. Studies have also indicated that nitrates may be transformed in the stomach to more hazardous substances (nitrosamines) that may cause cancer.

Of particular interest to Californians is a recent comprehensive study conducted by the California Birth Defects Monitoring Program, which discovered an association between nitrate exposure and increased risk of neural tube defects.[4] The study found that pregnant women whose drinking water contained nitrates above the regulatory

NITRATE STANDARDS

"Nitrates" as discussed in this section include nitrate, nitrate and nitrite (expressed as total nitrogen), and nitrite. Each is regulated separately as a contaminant in groundwater.[5] The standards for each are:

Nitrate (as NO_3)	45.0 mg/l
Nitrate as nitrogen	10.0 mg/L
Nitrate + Nitrite (sum as nitrogen)	10.0 mg/L
Nitrite (as nitrogen)	1.0 mg?l

standard faced a 400 percent increase in the risk of anencephaly—the absence of the brain in the developing fetus.

LEADING SOURCES: AGRICULTURE, DAIRIES, AND SEPTIC SYSTEMS

Agriculture can contribute to nitrogen contamination in several ways. Commercial fertilizers and other forms of animal waste contain high levels of nitrates. Although the former are used to stimulate plant growth and the latter is regarded as a waste product to be disposed of, in agricultural settings the two generally reach the same resting place—directly on the ground—which allows the nitrates to leach into the soil and down to the water. Thus, two of the primary ways in which agriculture contributes to nitrogen contamination are (1) through the direct application of commercial fertilizers, and (2) through the generation, and improper disposal, of the vast quantities of animal waste associated with concentrated animal feeding operations (CAFOs), also known as factory farms.[6] Some nitrogen is absorbed by plants as part of the natural growth process, but massive agricultural operations often use, in the case of crop production, and generate, in the case of livestock operations, more nitrogen than plants can use.[7]

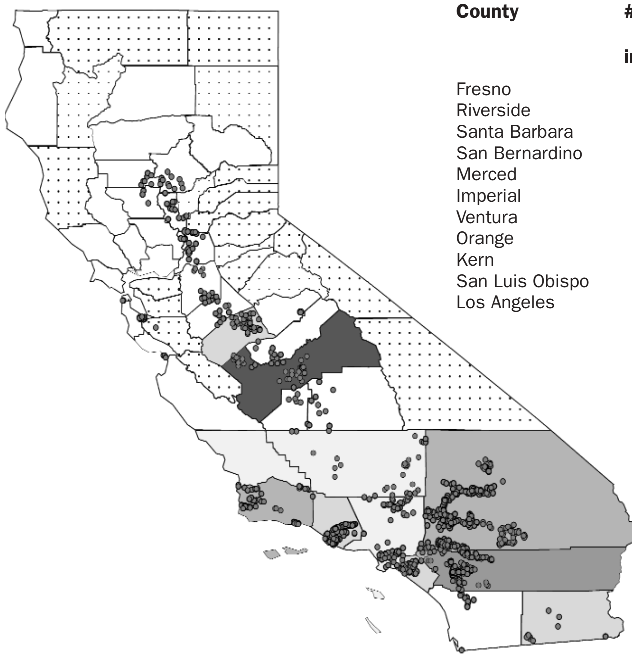
Dairies, in particular, tend to produce huge quantities of nitrogenous waste because of their high concentration of cows. One dairy cow is estimated to produce about 144 pounds of nitrogen waste per year.[8] Operations with 7,000 or more animal units generate a volume of manure equivalent to the waste produced by a city of 45,000 people.[9]

Septic systems are the other significant cause of nitrate contamination. In many areas, particularly those experiencing rapid urbanization (such as Ventura County or northern Los Angeles County), nitrogen reaches groundwater through poorly designed or constructed sewage systems and unsuitable site conditions.[10]

WIDESPREAD NITRATE CONTAMINATION IN CALIFORNIA GROUNDWATER

As a result of factory farming, septic systems, and the widespread use of chemical fertilizers, nitrate contamination of groundwater in California is common. By 1994, nitrate levels at more than double the acceptable limit resulted in the closures of more

FIGURE 1
Nitrogen in California Groundwater



County	# of samples analyzed in the 1990s	Percent of samples > 10 mg/L of nitrate & nitrite (as N)
Fresno	113	38%
Riverside	841	23%
Santa Barbara	359	16%
San Bernardino	1852	15%
Merced	68	13%
Imperial	102	12%
Ventura	172	10%
Orange	51	10%
Kern	74	4%
San Luis Obispo	87	1%
Los Angeles	496	1%

The state and federal maximum allowable concentration limit for nitrate plus nitrite (measured as nitrogen) in drinking water is 10 mg/L. NRDC reviewed 10 years of groundwater quality data (1990 to 2000) from the U.S. Geological Survey (USGS) for 38 of California's 58 counties and calculated the number of samples that exceeded that threshold. For any county in which USGS analyzed more than 50 samples over that 10 year period, this map shows the percent of those samples that exceeded the 10 mg/L limit. The USGS did not sample randomly throughout the state, and the samples were not designed to be representative of entire counties. However, it is the most comprehensive data available.

Source: Data from U.S. Geological Survey (1990—2000); compiled by NRDC.

than 800 wells in Southern California and 130 wells in the San Joaquin Valley.[11] Although they have not been as significant a problem in other areas, nitrates are also among the primary pollutants in public water supply wells in the San Gabriel and San Fernando Valley basins.[12] Wells in the San Martin area, along the central coast, also exceed the nitrate limit,[13] and fertilizers and sewage spills have contributed to high nitrate levels in groundwater that percolates into Lake Tahoe.[14] The summaries of four large California cities in this report illustrate that these problems are not limited to a few geographic regions, and that nitrates can be a serious problem even for large cities (see below).

A 1983 study by the U.S. Geological Survey (USGS) found nitrate levels in excess of the 10-milligrams-per-liter standard (as nitrogen) in three areas of the Sacramento Valley.[15] Although the study noted that most of the contamination was in shallow aquifers, implying that wells could be drilled deep enough to bypass the contaminated sections, nitrates are highly mobile and are not likely to remain restricted to one area of the aquifer for long. Even confining layers, which may slow the migration of nitrates, will not prevent their movement completely.[16] This point was driven home recently when MTBE was found to have made its way from shallow groundwater to a deep aquifer in Orange County.[17] Furthermore, if pumpers are forced to drill deeper wells to avoid the accumulation of nitrates, they may encounter other problems. For example, the deeper the well in the Central Valley, the greater the concentration of dissolved solids one is likely to encounter.[18]

The map in Figure 1 reflects the levels of nitrate and nitrite (as nitrogen) in the groundwater in several California counties, based on U.S. Geological Survey (USGS) data for the period 1990–2000.[19] Only counties with significant data are represented in Figure 1. The others are either blank (in the case of insufficient data)[20] or spotted (if data had not been requested for those counties). The shading indicates the percentage of those samples that exceeded the 10-milligram-per-liter MCL for nitrate plus nitrite (as nitrogen). The divisions in this map were created electronically, based on natural breaking points.[21] The data show substantial numbers of samples in which nitrogen was above the MCL throughout the Central Valley and in the non-coastal areas of Southern California. This is consistent with other reports that nitrates are especially problematic in the San Joaquin and Salinas Valleys, and in the Chino Basin of Southern California.[22]

DEGRADED DRINKING WATER FOR MILLIONS OF CALIFORNIANS

Given the widespread detections of nitrates in groundwater, it should be no surprise that the contaminant is frequently detected in drinking water. NRDC analyzed millions of water quality monitoring test results submitted to the California Department of Health Services (CDHS) by California drinking water providers for samples taken from 1997 through 2001. During this period, nitrates, including nitrite, were detected above regulatory standards in the drinking water supplies serving more than 11.2 million Californians; the drinking water of 8.5 million Californians was subjected to five or more exceedences.[23] Unfortunately, the California Department of Health Service's drinking water monitoring database does not indicate how much of this water was distributed to consumers at unsafe levels.

Larger drinking water systems typically dilute contaminated sources with cleaner water, distributing "finished" water that complies with drinking water standards. But even large systems drawing from sources contaminated with nitrates may pass water containing unsafe levels of contaminants to consumers. The city of Fresno, for example, which serves nearly 500,000 people, evidently distributed to consumers water exceeding the nitrate standard twice in 2000. According to NRDC's analysis of drinking water data, the city reported 250 exceedences for nitrate in its drinking water sources from 1997 through 2001. Smaller drinking water systems that lack a separate source of clean water with which to blend nitrate-contaminated sources typically have no choice but to pass contaminated water along to consumers. Nitrates may also be removed through treatment systems using reverse osmosis or ion exchange, processes that are typically unaffordable for small- and medium-sized drinking water providers.

The results of NRDC's analysis of CDHS's drinking water data are summarized in Table 3 and Table 4. Table 3 ranks the water providers reporting the greatest number of exceedences of the federal/state standard for nitrate (45 mg/L as NO_3) for the period from 1997 through 2001. Note that the percentage of all nitrate samples that exceed the standard varies greatly. Table 4 lists all California drinking water providers that reported five or more nitrate exceedences from 1997 through 2001.

STATE REGULATORS CONSIDER NEW CONTROLS FOR AGRICULTURAL AND DAIRY DISCHARGES

Farm runoff and irrigated return flows are exempted from the federal Clean Water Act. In California's Central Valley, remaining dairies and irrigated agriculture have also been exempt from the Porter Cologne Water Quality Control Act, the state's own clean water law. These exemptions, promulgated by state regulators in the early 1980s, have left rivers, streams, and groundwater resources with little if any protection from surface water discharges and groundwater infiltration from dairies and agriculture.

The good news is that the state legislature passed SB 390 in 1999 to force the reconsideration of all waivers under the state clean water law. SB 390 causes all such

TABLE 3
California Drinking Water Providers Reporting the Greatest Number of Nitrate Exceedences (1997–2001)[24]
(In many cases, water exceeding standards is diluted or treated before distribution to consumers.[25])

Rank	County	Water Provider	Exceedences of Nitrate Standard (45mg/l)	Percent of All Samples Which Exceed Standard	Population Served
1	Los Angeles	Pomona City Water Dept.	787	40.8%	131,723
2	Los Angeles	Crescenta Valley CWD	722	55.9%	31,000
3	San Bernardino	Cucamonga CWD	691	22.5%	128,000
4	Riverside	City of Corona	559	57.9%	104,000
5	San Bernardino	California Institution for Men	489	36.7%	814
6	Stanislaus	City of Modesto, DE Grayson	384	47.4%	921
7	Riverside	Rubidoux Community SD	321	37.2%	22,800
8	Orange	City of Tustin	319	70.9%	52,100
9	Los Angeles	La Verne City WD	308	48.9%	34,009
10	Los Angeles	SCWC-San Dimas	295	19.9%	51,282
11	Fresno	City of Fresno	250	8.4%	390,350
12	Los Angeles	Cal. American Water Co.-San Marino	236	14.4%	47,656
13	Riverside	California Rehabilitation Center—Norco	236	11.5%	4,842
14	San Bernardino	Hi Desert WD	213	15.7%	28,000
15	San Luis Obispo	Grover Beach Water Department	196	63.4%	12,720
16	San Bernardino	Monte Vista CWD	167	37.5%	38,001
17	Riverside	Jurupa Community SD	164	21.2%	35,000
18	Riverside	City of Norco	156	16.7%	24,704
19	Los Angeles	Burbank City Water Dept.	152	20.9%	105,332
20	Los Angeles	Suburban Water Systems-San Jose	150	12.9%	110,602

Source: NRDC's analysis of drinking water quality data compiled by the California Department of Health Services, July 2002

TABLE 4
California Drinking Water Providers Reporting Five or More Nitrate Exceedences (1997-2001)[26]
(In many cases, water exceeding standards is diluted or treated before distribution to consumers[27])

County	Water Provider	Exceedences of Nitrate Standard (45mg/l)	Percent of All Which Exceed Standard	Population Served
Alameda	California Water Service—Livermore	97	23.8%	53,540
Fresno	City of Fresno	250	8.4%	390,350
Fresno	City of Orange Cove	5	20.0%	7,750
Kern	Arvin Labor Center Water System	7	87.5%	665
Kern	Bear Creek Production Co—Wasco	8	50.0%	750
Kern	Bear Valley CSD	6	4.0%	5,300
Kern	Burger King/Scarborough Management	19	42.2%	100
Kern	Capello, Inc.	17	77.3%	503
Kern	East Niles CSD	5	4.9%	24,049
Kern	Farmer John Egg Ranch #2	8	88.9%	30
Kern	Flying J Travel Plaza	97	42.4%	75,000
Kern	I & J Farms Inc.	11	91.7%	70
Kern	Maple School Water System	5	45.5%	240
Kern	McFarland MWC	106	42.6%	8,000
Kern	North Shafter Farm Labor Center	106	36.8%	500
Kern	Sun Met Farm Lands, LLC	18	32.1%	900
Kern	Sun World International, Inc.—Com Center	9	100.0%	250
Kern	Sycamore Canyon Golf Course	23	100.0%	350
Kern	U C Shafter Research & Extension Center	17	100.0%	32
Kern	Wheeler Farms Headquarters	10	100.0%	25
Los Angeles	Alhambra City Water Dept.	12	6.1%	86,300
Los Angeles	Arcadia City Water Division	58	6.8%	42,480
Los Angeles	Azusa Light and Water	21	3.6%	103,616
Los Angeles	Burbank City Water Dept.	152	20.9%	105,332
Los Angeles	Cal. American Water Co.-San Marino	236	14.4%	47,656
Los Angeles	Calif State Polytechnical Univ—Pomona	21	32.3%	2,500
Los Angeles	California Domestic Water Company	35	14.2%	619
Los Angeles	Covina City Water Dept.	11	100.0%	47,988
Los Angeles	Crescenta Valley CWD	722	55.9%	31,000
Los Angeles	East Pasadena Water Co.	49	11.1%	9,101
Los Angeles	Glendale City Water Dept.	63	7.8%	200,000
Los Angeles	Glendora City Water Dept.	105	5.4%	53,200
Los Angeles	La Verne City WD	308	48.9%	34,009
Los Angeles	Las Flores Water Co.	71	29.7%	4,854
Los Angeles	Littlerock Creek Irrigation Dist.	16	3.0%	2,900
Los Angeles	Los Angeles City, Dept. of Water & Power	128	4.7%	3,700,000
Los Angeles	Monrovia City Water Dept.	32	5.2%	40,050
Los Angeles	New Apostolic Church Bouquet Canyon	8	88.9%	40
Los Angeles	North Trails Mutual Water Co	8	26.7%	100
Los Angeles	Palmdale Water Dist.	13	3.6%	85,000

County	Water Provider	Exceedences of Nitrate Standard (45mg/l)	Percent of All Which Exceed Standard	Population Served
Los Angeles	Pasadena City Water Dept.	36	4.5%	142,500
Los Angeles	Pomona City Water Dept.	787	40.8%	131,723
Los Angeles	San Gabriel CWD	81	18.7%	45,000
Los Angeles	San Gabriel Valley Water Co.—El Monte	23	2.0%	153,657
Los Angeles	SCWC—Claremont	27	2.6%	34,168
Los Angeles	SCWC—San Dimas	295	19.9%	51,282
Los Angeles	South Pasadena City Water Dept.	118	41.8%	24,000
Los Angeles	Suburban Water Systems—San Jose	150	12.9%	110,602
Los Angeles	Sunny Slope Water Co.	36	5.4%	30,177
Los Angeles	Valencia Heights Water Co.	134	23.8%	4,600
Los Angeles	Valley Water Co.	70	30.7%	9,477
Madera	Madera County M.D. #10A—Madera Ranchos	6	11.3%	2,750
Monterey	CWSC King City	10	38.5%	11,250
Monterey	CWSC Salinas	11	3.3%	98,430
Monterey	Salinas Valley State Prison	20	28.6%	5,200
Orange	City of Santa Ana	19	3.1%	293,700
Orange	City Of Tustin	319	70.9%	52,100
Riverside	Box Springs Mutual WC	28	45.9%	2,043
Riverside	California Rehabilitation Center—Norco	236	11.5%	4,842
Riverside	City of Corona	559	57.9%	104,000
Riverside	Eastern Municipal WD	63	36.2%	320,000
Riverside	City of Hemet	54	19.7%	21,000
Riverside	Jurupa Community SD	164	21.2%	35,000
Riverside	Moreno Valley Mutual WC	6	100.0%	3,000
Riverside	City of Norco	156	16.7%	24,704
Riverside	Nuevo Water Company	35	31.3%	5,000
Riverside	City of Riverside	62	3.9%	245,000
Riverside	Rubidoux Community SD	321	37.2%	22,800
Riverside	Santa Ana River Water Company	16	8.8%	8,000
Riverside	Swan Lake Mobile Home Park	25	18.7%	1,875
Riverside	Whispering Sands Mobile Estates	16	100.0%	37
Sacramento	CalAm—Rosemont	5	8.1%	18,232
San Benito	Arnold Park (O'Bannon's MHP)	18	30.5%	28
San Benito	McCormick Selph, Inc.	11	37.9%	225
San Benito	Quintero Labor Camp #1 (Wright Rd.)	17	32.1%	25
San Benito	Sunnyslope County Water Dist	29	39.7%	16,771
San Benito	Union Heights MWC	16	72.7%	75
San Benito	Valenzuela Water System	9	39.1%	90
San Bernardino	Arroyo Verde MWC	28	100.0%	400
San Bernardino	California Institution For Men	489	36.7%	814

TABLE 4 (CONTINUED)

County	Water Provider	Exceedences of Nitrate Standard (45mg/l)	Percent of All Which Exceed Standard	Population Served
San Bernardino	California Institution For Women	10	90.9%	2,400
San Bernardino	Chino Basin Desalter Auth.—DESALTER 1	19	61.3%	0
San Bernardino	City of Chino	54	40.6%	52,130
San Bernardino	City of Upland	72	20.2%	66,383
San Bernardino	Cucamonga CWD	691	22.5%	128,000
San Bernardino	CYA—Youth Correctional Facility	110	100.0%	2,930
San Bernardino	East Valley WD	77	15.7%	55,000
San Bernardino	Hi Desert WD	213	15.7%	28,000
San Bernardino	Monte Vista CWD	167	37.5%	38,001
San Bernardino	City of Ontario	24	9.4%	140,000
San Bernardino	Patton State Hospital	42	13.9%	1,600
San Bernardino	Redlands City Mud—Water DIV	122	22.4%	69,300
San Bernardino	San Antonio Water Company	29	7.2%	2,927
San Bernardino	San Bernardino City	42	5.5%	175,000
San Bernardino	San Gabriel Valley WC—Fontana	58	6.5%	102,599
San Bernardino	SO CA Water Co—Barstow	7	1.9%	28,119
San Bernardino	West San Bernardino CWD	24	13.5%	41,454
San Luis Obispo	Arroyo Grande Water Department	79	43.9%	15,035
San Luis Obispo	Cal. Cities—Los Osos	25	26.3%	8,220
San Luis Obispo	Grover Beach Water Department	196	63.4%	12,720
San Luis Obispo	San Miguel Community Services District	11	10.3%	1,250
San Luis Obispo	Templeton CSD	26	17.4%	4,000
San Mateo	California Water Service—San Francisco	92	21.8%	54,060
San Mateo	Daly City	27	26.7%	92,311
Santa Barbara	Cal Cities—Orcutt	26	18.7%	24,300
Santa Barbara	Rancho Marcelino Water & Serv.	8	100.0%	240
Santa Barbara	Santa Maria Water Department	22	17.2%	67,822
Santa Clara	Chiri Ranch Estates MWC	21	60.0%	58
Santa Clara	City of Morgan Hill	59	5.1%	31,896
Santa Clara	Farmers Labor Exchange	24	72.7%	150
Santa Clara	Gilroy Foods, Gilroy East Plant	14	31.1%	365
Santa Clara	Monterey Mushrooms	46	69.7%	200
Santa Clara	Pinocchio’s Pizza & Restaurant	7	26.9%	25
Santa Clara	Santa Clara County Horseman’s Assoc.	7	87.5%	25
Siskiyou	Grenada Water Company	6	27.3%	250
Sonoma	Chevron Products Co—Station #9-4377	6	28.6%	25
Stanislaus	City of Modesto, DE Grayson	384	47.4%	921
Stanislaus	City of Modesto	22	1.9%	180,320
Sutter	Calvary Temple Assembly of God	6	85.7%	0
Sutter	Country Village South MHP	17	94.4%	32
Sutter	Tierra Buena Tavern	5	100.0%	55
Sutter	Yuba City Groundwater-Region 5	37	40.7%	2,595

County	Water Provider	Exceedences of Nitrate Standard (45mg/l)	Percent of All Which Exceed Standard	Population Served
Tulare	City of Dinuba	8	10.5%	14,987
Tulare	LSID—Tonyville	65	76.5%	400
Tulare	Porterville Developmental Center	6	24.0%	2,336
Tulare	City of Porterville	13	4.9%	37,619
Tulare	Strathmore Public Util Dist	24	57.1%	2,500
Tulare	Terra Bella Irrigation District—TBT	13	20.3%	4,494
Ventura	Camrosa Water District	83	37.9%	27,000
Ventura	Casitas Municipal Water Dist	21	77.8%	60,000
Ventura	Santa Rosa Mutual Water Co	23	29.5%	480
Ventura	Tico Mutual Water Co	59	32.2%	105
Ventura	United Wtr Cons Dist	55	3.8%	0
Ventura	Vineyard Ave Estates MWC	6	17.1%	1,200
Yuba	Feather River Manor	5	100.0%	35
Yuba	Prune Tree	5	83.3%	25

Source: NRDC's analysis of drinking water quality data compiled by the California Department of Health Services, July 2002

waivers to expire by January 1, 2003, including the agriculture and dairy waivers issued by the Central Valley Regional Water Quality Control Board. The Central Valley Regional Board and the eight other Regional Boards around the state may reissue such waivers only if they determine in a public process that such exemptions remain in the public interest.[28] Facing burgeoning evidence documenting unacceptable levels of agricultural pollutants throughout the Central Valley, indeed the permeation of state groundwater resources with such pollutants, many experts believe that regulators must replace existing waivers with new pollution controls. Meaningful controls for agriculture and dairies are likely to be heavily opposed by agriculture lobby organizations—the Farm Bureau, for example. State regulators are already in the process of issuing controls for septic systems.

NOTES

1 "Ground Water Quality and Its Contamination from Non-Point Sources in California, UC Davis Centers for Water and Wildland Resources," June 1994, pg. 17, citing *Draft Water Quality Assessment Summary Report; Water Quality Concerns,* DWR Preliminary Report, April 1991.

2 *Ground Water Report to Congress,* Ground Water Protection Council, October 1999, pg. 9; *Ground Water Quality and Its Contamination from Non-Point Sources in California,* U.C. Davis Centers for Water and Wildland Resources, June 1994, pg. 17.

3 National Academy of Sciences, National Research Council, *Nitrate and Nitrite in Drinking Water,* 1995, available online at www.nap.edu/catalog/9038.html, and EPA, "Nitrates," fact sheet, available online at www.epa.gov/safewater/dwh/c-ioc/nitrates.html.

4 L. A. Croen, K. Todoroff, G. M. Shaw, "Maternal exposure to nitrate from drinking water and diet and risk for neural tube defects," *American Journal of Epidemiology,* 2001, 153(4).

5 Title 22, California Code of Regulations, Division 4, Chapter 15, Article 4, Section 64431.

6 Robbin Marks and Rebecca Knuffke, *America's Animal Factories: How States Fail to Prevent Pollution from Livestock Waste,* NRDC, December 1998, Chapter 1.

7 *Ground Water Quality and its Contamination from Non-Point Sources in California,* U.C. Davis Centers for Water and Wildland Resources, June 1994, pg. 18.

8 Ibid.

9 "Pollution From Feedlots Threatens Our Nation's Waters," Clean Water Network website, www.cwn.org/docs/facts/feedlot.htm, October 31, 2000.

10 "Water Quality Control Plan," Los Angeles Region's Strategic Planning and Implementation, June 13, 1994, pg. 4-46.

11 *Ground Water Quality and Its Contamination from Non-Point Sources in California*, U.C. Davis Centers for Water and Wildland Resources, June 1994, pg. 17.

12 Los Angeles Regional Water Quality Control Board Basin Plan 1994, pg. 4_59.

13 Central Coast Basin Plan, pg. IV-15.

14 Lohantan Regional Board Basin Plan, pp. 5.7-12-13.

15 Ground Water Atlas, Central Valley Aquifer System, pg. 11.

16 Phone Conversation between Alex Helperin, NRDC, and Anthony Saracino, October 26, 2000.

17 "MTBE found in deep aquifer," *Orange County Register,* October 26, 2000.

18 Ground Water Atlas, Central Valley Aquifer System, pg. 10.

19 The nitrogen data presented here are in the form of nitrate (NO_3) plus nitrite (NO_2), expressed as nitrogen, dissolved.

20 Counties in which there were fewer than 50 samples analyzed for nitrate (NO_3) plus nitrite (NO_2) over the ten-year period were considered to present insufficient data. The number of samples taken in the counties that are represented ranged from 51 to 2,010.

21 "Natural breaks" is a data classification method used to enable patterns to emerge from a data set. Statistical summary information inherently results in the loss of some data. Based on NRDC's professional judgment, it was determined that the information in this data set that would be lost using alternative methods of data classification (e.g., equal intervals or equal areas) would obscure the natural spatial patterns present in the results. Thus, natural breaks were used to ensure that the actual distributions emerged. This map was generated using ArcView version 3.2a. This mapping program identifies significant gaps in the data and creates boundaries based upon these gaps. This minimizes bias in the data.

22 "Ground Water Report to Congress," EPA, pg. 9.

23 NRDC's analysis of drinking water quality monitoring data compiled by the California Department of Health Services, July 2002. This statistics include exceedences of all nitrates standards, including nitrite. To avoid the problem of double- or triple-counting samples that exceeded more than one standard, NRDC treated multiple violations in the same day at a particular well or source as a single violation. For example, where a water provider reported exceedences of nitrite and nitrate at the same well on the same day, only a single exceedence was counted. If nitrate and nitrite violations occurred on the same day at two different wells, two exceedences were counted.

24 Includes exceedences for nitrate only. Does not include exceedences of standards for nitrite or nitrate + nitrite measured as total nitrogen, though exceedences of these standards were infrequent.

25 CDHS's drinking water quality database does not indicate whether the sampled drinking water sources are blended or treated prior to being distributed to consumers.

26 Includes exceedences for nitrate only. Does not include exceedences of standards for nitrite or nitrate + nitrite measured as total nitrogen, though exceedences of these standards were infrequent.

27 CDHS's drinking water quality database does not indicate whether the sampled drinking water sources are blended or treated prior to being distributed to consumers.

28 Section 13269 of the California Water Code.

CHAPTER 5

Summary of California Grades

Although Fresno, Los Angeles, San Diego, and San Francisco have all made progress towards improving water quality over the past decade, all have work left to do. The cities' challenges include aging and deteriorating infrastructures, outdated water treatment, and in Fresno, Los Angeles, and San Diego, serious pollution of drinking water sources. These factors combine to pose health risks in each city. All four municipalities have acknowledged the need for a major investments in their water infrastructure, but they must also make a strong commitment to upgrading their water treatment with state-of-the-art technology. And Fresno, Los Angeles, and San Diego should fortify drinking water source protection, using San Francisco's protection measures as a model. Finally, all four cities must improve their right-to-know reports to the public. Even Los Angeles's report—the best of the four cities—left room for improvement.

THE EARTH'S BEST DEFENSE

WHAT'S ON TAP?

Grading Drinking Water in U.S. Cities

EARLY RELEASE
CALIFORNIA EDITION

October 2002

FRESNO
System Population Served 485,000[1]
Water Quality and Compliance **2000▶Poor** **2001▶Poor**
Right-to-Know Report—Citizenship **2000▶Poor** **2001▶Poor**
Threats to Source Water **6** (1=least threat to 6=highest threat)
REPORT CARD

FRESNO

Fresno earned a water quality and compliance grade of Poor in 2000 and 2001. Problems with Fresno water include the following:

Fresno has many wells in which contamination exceeds EPA standards. Fresno contends, however, that it did not violate any enforceable EPA standards in 2000 and 2001 because it is allowed to average high contaminant readings with lower readings taken at other times throughout the year, or because it removes wells from service soon after they are found to exceed standards.

Nitrate levels are a serious concern in Fresno. Nitrates are the product of fertilizers, or human or animal waste. Infants who drink water containing excessive nitrates for even a short period of time can develop "blue baby syndrome," in which nitrate poisoning prevents their blood from holding oxygen. Fresno has had frequent nitrate problems in some wells. The city reported that several of its wells exceeded EPA standards for nitrate in 2000 and 2001, and were later removed from service. In addition:

▶ In 2001, one well "was lost to high nitrates and two more are currently off line while plans for treatment or modification are in design." Tests on another well in 2001 revealed nitrate levels far above the EPA's standard, but the city concluded that the finding was incorrect. A subsequent reanalysis confirmed the original result. The California Department of Health Services ordered the well shut down.

▶ Similar problems with nitrates were found in 2000. Fresno says it removed all wells that exceeded the EPA standard from service once it confirmed the wells were above the standard.

▶ In its 2000 right-to-know report, Fresno buried on page 5 the advice, "If you are pregnant, you should drink bottled water."[2] (It dropped this advice in its 2001 report.) Fresno went on to recommend, "If you are caring for an infant or you are pregnant, you should ask advice from your health care provider."[3]

▶ NRDC recommends that Fresno immediately shut down any well with a single analysis that indicates the finished water is at or even near the Maximum Contaminant Level (MCL) (the enforceable federal standard) for nitrates.

Pesticides and industrial chemicals are a serious concern.

▶ In 2000, at least 38 of approximately 250 city wells were found to be contaminated with the synthetic organic chemicals ethylene dibromide (EDB), trichloroethylene (TCE), perchloroethylene (PCE), and/or dibromochlorpropane (DBCP), requiring treatment and constant monitoring.

▶ Also in 2000, EDB and TCE levels in tap water exceeded standards in at least one well apiece. Additionally, DBCP was found in one well at a level equal to the tap water standard. Fresno says all wells contaminated in excess of standards were later taken out of service.

▶ In 2001, Fresno wells were found to be contaminated at levels above EPA standards with the industrial chemicals 1,1-dichloromethane or cis-1,2-dichloroethylene, or with the banned pesticide DBCP. At least two, and possibly four, wells provided water with DBCP levels in excess of the standard. Each highly contaminated well was taken offline only after the readings were confirmed with subsequent tests—sometimes after "six months of sampling."
▶ Many other synthetic and volatile organic chemicals have been found at generally low levels in Fresno's wells.

Radon is a serious concern. The radioactive gas is a leading cause of cancer, and, although it is better known for invading basements, it can also be found in groundwater. Fresno has high levels of radon, averaging more than twice the EPA's proposed standard, and sometimes reaching nine times the proposed EPA standard. Fresno may ultimately qualify for a waiver of the EPA's radon standard, if it or the state adopts a program to reduce radon levels in basements, which can pose an even greater cancer risk than tap water. But the cancer risks posed by the levels found in Fresno's water alone are significant.

Gross alpha radiation in the water is a concern. Cancer-causing gross alpha radiation usually results from the breakdown of natural radioactive elements in the ground. Some Fresno wells contain significant amounts of gross alpha radiation, sometimes at levels above the relevant EPA standard. Fresno says the wells do not violate the standard because average readings are not in violation.

Fresno levels meet the EPA's lead action level but may be a concern in some homes. Lead was found at levels that exceed the EPA action level in at least one household, but Fresno reports that the EPA action level requirements were met in more than 90 percent of homes tested, so it was in compliance with the EPA's lead treatment technique.

Arsenic is a potential concern. According to the city, Fresno's water contains arsenic at an average level well below the EPA's new standard of 10 parts per billion. Fresno's arsenic levels spike above the standard, but the city is not in violation because average readings do not exceed the standard. Nevertheless, Fresno's arsenic levels exceed the state's public health goal—and pose a cancer risk, according to National Academy of Sciences risk estimates.

The need for water infrastructure investment in Fresno. Fresno's Department of Public Utilities (DPU) has recognized the need for major investment in the city's water infrastructure. In its most recent capital improvement plan, Fresno DPU said it needed more than $394 million to pay for ongoing capital improvements from 2003 to 2007, and more than $143 million more during that period for new capital improvements—much, but not all, for rehabilitating and upgrading water infrastructure.[4] Included in this amount are a variety of drinking water-related projects, including rehabilitating water mains and treatment facilities, building a large diameter transmission line from the Surface Water Treatment Plant (SWTP), protecting canals for transport of water from Kings River to the SWTP, constructing wells, upgrading the Supervisory Control and Data Acquisition system (the computerized system that runs the water pump stations and other aspects of the water system), and funding for design for future capacity.[5]

Fresno earned a Poor for its 2000 and 2001 right-to-know reports.

On the "good citizen" side of the ledger:

▶ The report described the health effects of arsenic, radon, DBCP, nitrate, and lead. However, the report included these discussions in a section headlined, "Information from the EPA about *Possible* [emphasis added] Contaminants," making the section appear to be generalized reference information of unclear relevance to Fresno citizens. The report never linked these discussions of health effects to the specific finding that these contaminants are sometimes found at elevated levels in Fresno's water.

▶ Fresno offers translations of its reports in Spanish and Hmong. EPA and state rules require that systems serving "a large proportion of non-English speaking residents," defined in California's regulations as 10 percent or 1,000 people, must provide information on the importance of the report in the relevant language(s), or a phone number or address where citizens can get a translated copy of the report or assistance in their language.[8] Fresno went beyond that requirement by actually translating the report into Spanish and Hmong. That is particularly important, because 26 percent of Fresno residents speak Spanish in the home, according to the 2000 Census, and 12 percent essentially speak only Spanish. In addition, nearly 10 percent of city residents speak Hmong or other Asian or Pacific Island languages at home, while about 6 percent of residents speak only their native Asian or Pacific Island language.

▶ The reports listed levels of many unregulated contaminants found in water, even though the city is not required to do so.

▶ The reports candidly admitted that groundwater contamination is a serious problem for the system.

On the "not-so-good citizen" side of the ledger:

▶ A vitally important warning in the report for 2000 was buried on the fifth page. The recommendation urged pregnant women to avoid tap water because of high nitrate levels, and suggested that parents of infants consult with their health-care providers.[6] The warning should have been prominently highlighted on the front page of the report. Instead, the front page included this prominent claim: "Fresno Water Division Ranked #1."

▶ Both the 2000 and 2001 reports buried mention of city wells that exceeded drinking water standards for nitrates; 1,1-DCE; cis-1,2-DCE; DBCP; EDB; and TCE in footnotes printed in type so small it was nearly unreadable.

▶ The tables in the reports stated that Fresno did not violate any enforceable standards. In fact, for each of the contaminants discussed above, Fresno residents drank water exceeding the EPA health standard for some period of time. But because Fresno took the wells out of service later, or averaged the high levels with lower levels detected later, Fresno claimed there was no violation. This reading of the rules is questionable, particularly in the case of nitrate, an acute toxin for which averaging is not allowed.

▶ The reports included no information on specific known or potential polluters of Fresno's water, nor did they map or otherwise indicate the locations of such polluters. EPA and California rules require utilities to name known or likely sources of any specific regulated contaminant found in their tap water.[7] Even where this is not required, or where the specific polluter cannot be tied with assurance to a specific contaminant, the EPA encourages water systems to highlight significant sources of contamination in the watershed. Dissemination of such information helps increase consumer awareness of the importance of protecting the watershed.

Fresno earned a "Threats to Source Water" rating of 6, the worst possible rating.[9]

▶ At least 32 Fresno wells have serious contamination problems. The water in those wells must therefore be treated with granular activated carbon at the city's 28 treatment sites, and it must be monitored as often as weekly to determine whether it violates standards.

▶ Fresno's drinking water sources are highly susceptible to contamination by urban runoff and agricultural pollution.

▶ As Fresno forthrightly acknowledges in its right-to-know reports, groundwater contamination is a serious problem for the city.

KEY CONTAMINANTS FOUND ABOVE NATIONAL HEALTH GOALS

The following contaminants are found in Fresno's drinking water. For more information on their properties and health effects, see Chapter 2, "Health Concerns for Common Tap Water Contaminants."

INORGANIC CONTAMINANTS

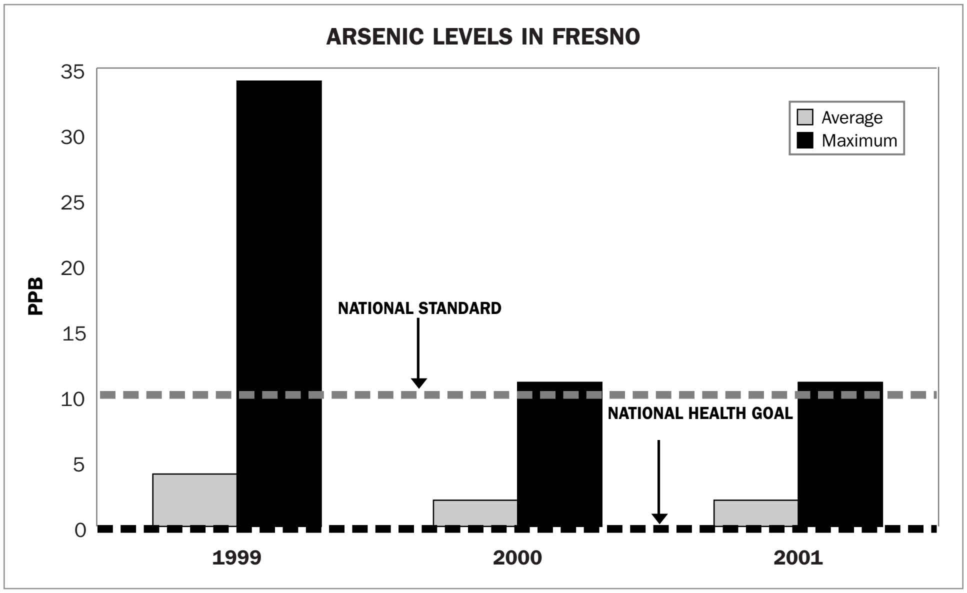
Arsenic

Levels Found 1999[10]	4 ppb average	34 ppb maximum
Levels Found 2000[11]	2 ppb average	11 ppb maximum
Levels Found 2001[12]	2 ppb average	11 ppb maximum

National Standard (MCL): 10 ppb (average) (effective 2006) (50 ppb effective through 2005)

National Health Goal (MCLG): 0 ppb—there is no known, fully safe level of arsenic

Arsenic is a known and potent human carcinogen, and is linked to a variety of other diseases. The National Academy of Sciences has estimated that a person who drinks water containing 4 parts per billion arsenic (the average level in Fresno in 1999) has a lifetime fatal total cancer risk of about 1 in 800, more than 10 times

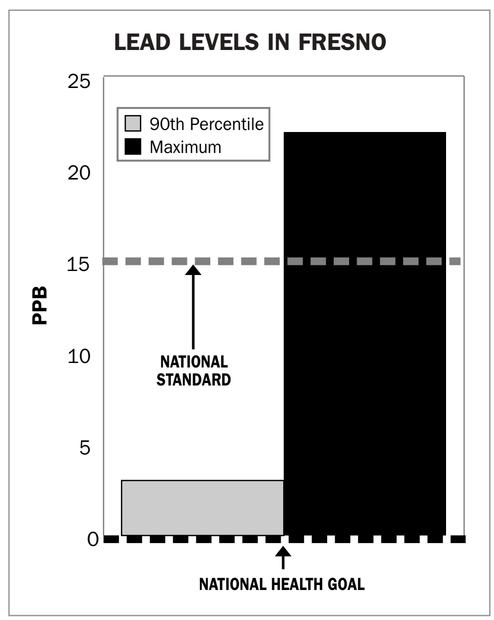


higher than the EPA traditionally allows (1 in 10,000 cancer risk).[13] Fresno reports that in 2000, it decreased its arsenic level to about 2 parts per billion—a commendable step.

Lead

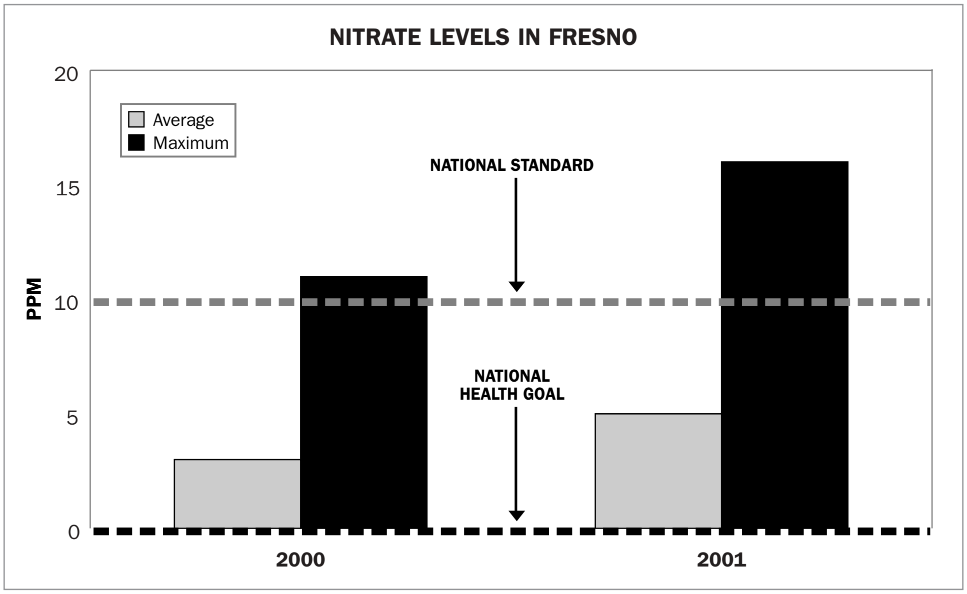
Levels Found 1999 (most recent published data)[14]
3 ppb 90th percentile home, i.e., 9 in 10 homes tested had 3 ppb or less lead
22 ppb high, i.e, 1 home of 50 tested exceeded 15 ppb
National Standard (TT): 15 ppb (action level)[15]
National Health Goal (MCLG): 0 ppb—there is no known fully safe level of lead

Lead is a major health threat—no amount of it is considered safe.[16] Infants, young children, and pregnant women and their fetuses are particularly susceptible to the adverse health effects of lead. While the tap water in most homes in Fresno apparently contains lead levels well below the EPA's action level, a small percentage of homes may still have a serious lead problem.



Nitrate

Levels Found 2000[17] 3 ppm average
11 ppm maximum (apparent violation)
Levels Found 2001[18] 5 ppm average
16 ppm maximum (apparent violation)
National Standard (MCL): 10 ppm (two-sample average in 24 hours)
National Health Goal (MCLG): 10 ppm



Excess nitrates, even after very short-term exposure, can pose an acute risk to infants, causing what is known as "blue baby syndrome."[19] Fresno admits some of its wells exceeded the EPA's 10-parts-per-million standard in 2000 and in 2001.[20,21] But Fresno insists it did not violate the EPA's standard even though the EPA treats nitrate as an acute toxin and does not allow averaging of multiple samples to determine compliance. For example, two consecutive samples from one well in 2000 were found to contain nitrates at a level exceeding the 10-parts-per-million standard, which appears to constitute a violation of the EPA's standard.[22] Fresno should have issued a public notification for such a violation, but it apparently did not do so. Fresno contends it did not violate the nitrate standard because it took the polluted well offline at some point after the second test. According to Fresno, "For an acute contaminant such as nitrate, the original and one confirmation sample is averaged [sic] for compliance purposes. In this situation the two samples collected from the well . . . averaged [11] mg/L. No violation exists because the well was removed from service immediately after confirmation."[23] This contention is incorrect, because EPA rules provide that if two consecutive samples, when averaged, exceed 10 parts per million, a violation has occurred, even if the well is later removed from service.[24] The EPA's Safe Drinking Water Information System reports that Fresno violated the nitrate standard beginning in January 1997, and returned to compliance in April 1997, but does not report any subsequent violations by Fresno.[25] It is the State of California's responsibility to report violations to the EPA.

Similarly, in 2001, Fresno admits that "a high nitrate result was recorded"—16 parts per million at one well—significantly over the 10-parts-per-million standard.[26] The original sample was re analyzed, and Fresno "confirmed the high level."[27] However, Fresno went back to the site and collected a "confirmation sample" and a well influent sample, which Fresno contended "indicate that the well site is in compliance with drinking water standards for nitrate, but reanalysis of the original sample confirmed the high [above standard] level."[28] The California Department of

Health Services ordered the well taken offline. Fresno notes that "it is possible the original sample may have been contaminated."[29] However, Fresno takes the position that no violation occurred.

In its 2000 right-to-know report, buried on page 5, Fresno states, in discussing general information about nitrate, that, "If you are pregnant, you should drink bottled water."[30] It goes on to recommend that, "If you are caring for an infant or you are pregnant, you should ask advice from your health care provider."[31] The 2001 report drops the first recommendation, for bottled water, but restates the suggestion to seek advice from a health care provider.[32]

Whether or not these periodic nitrate contamination problems are violations, the nitrate problem in Fresno is a serious public health issue.

RADIOACTIVE CONTAMINANTS

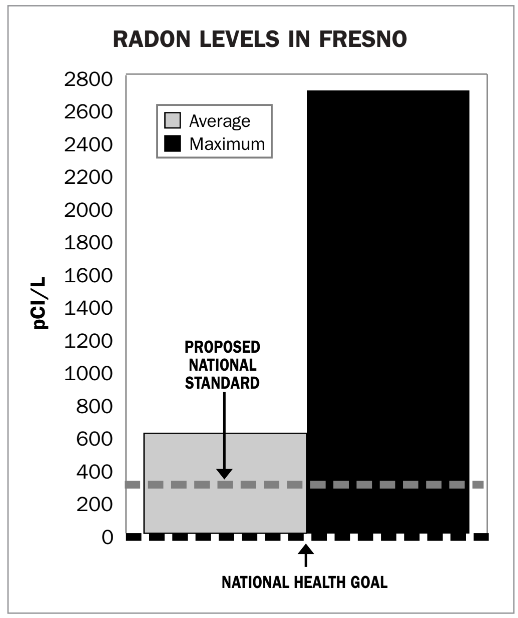
Radon

Levels Found 611 picocuries per liter (pCi/L) average
2708 pCi/L maximum.[33]

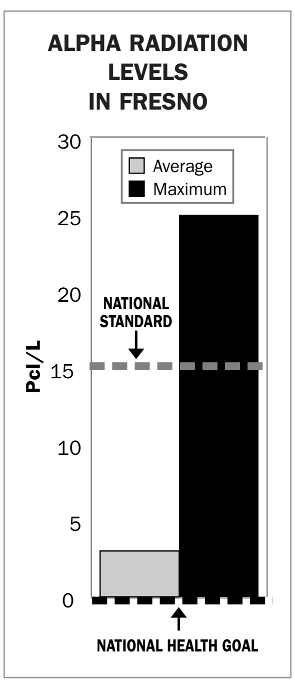
National Standard (MCL) (proposed): 300 pCi/L (alternate MCL of 4000 pCi/L where approved multimedia mitigation program is in place) (averages)

National Health Goal (MCLG) (proposed): 0 pCi/L—there is no known fully safe level of radon

Radon is a radioactive gas known to cause lung cancer. No amount of it is considered fully safe in tap water.[34]



Fresno has high levels of radon, averaging more than twice the EPA's proposed standard, and sometimes reaching nine times the proposed EPA standard.



Alpha Radiation

Levels Found 1999 (most recent data published)

3 picocuries per liter (pCi/L) average 25 pCi/L maximum[35]

National Standard (MCL): 15 pCi/L (average)

National Health Goal (MCLG): 0 pCi/L—there is no known, safe level of gross alpha radiation

Gross alpha radiation[36] is known to cause cancer. It usually results from the breakdown of natural radioactive elements in the ground. The finding of gross alpha radiation at a level as high as 25 pCi/L, nearly double the standard, is a health concern. While the standard allows averaging of multiple samples, it is unclear from Fresno's data whether some customers are provided water primarily from wells heavily contaminated with gross alpha radiation, thus rendering averaging across the system inappropriate under EPA rules.

MICROBIOLOGICAL CONTAMINANTS

Total Coliform Bacteria

Levels Found 2000: 1% highest month, one *E. coli* positive (not confirmed on retest)[37]
Levels Found 2001: 1% highest month[38]
National Standard: 5% in highest month; 0 repeat samples *E. coli*
National Health Goal: 0%—there is no known, fully safe level of coliform bacteria

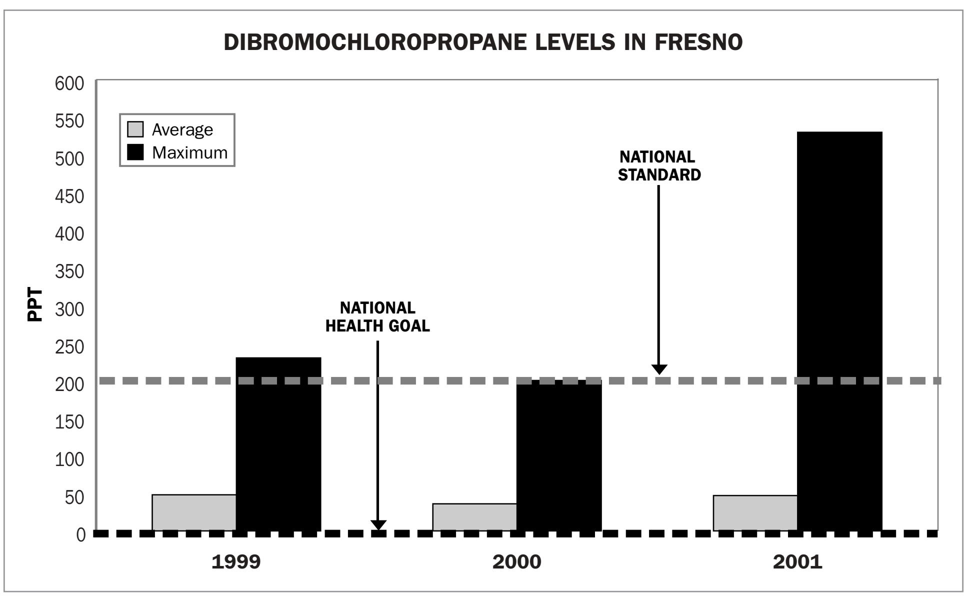
Note that the contaminant levels are presented as a percentage. Total coliform is regulated as a percentage of positive samples that are present in water. The national health standard of 5 percent means that if more than 5 percent of the utility's total coliform samples test positive, then the national health standard has been violated. To say that a sample tests positive is to say that there are total coliform bacteria present in the sample. Therefore, for compliance purposes, the utilities provide the percentage of total coliform samples that tested positive.

Total coliform bacteria[39] are microbial contaminants, whose presence is a potential indicator that disease-causing organisms may be present in tap water. Fresno also found *E. coli* in one sample in 2000, but the repeat sample found no bacteria. Although Fresno's total coliform bacteria percentages are not very high, any readings of *E. coli* or total coliform bacteria are a sign that vulnerable people may be at risk. In addition, the presence of coliform in Fresno's distribution system is a potential indication that bacteria may be regrowing in the city's pipes. Some studies suggest that serious regrowth problems may allow disease-causing pathogens to subsist in pipes.

ORGANIC CONTAMINANTS

Dibromochloropropane (DBCP)

Levels Found 1999[40] 48 ppt average 230 ppt maximum
Levels Found 2000[41] 36 ppt average 200 ppt maximum



Levels Found 2001[42] 47 ppt average 530 ppt maximum
National Standard (MCL): 200 ppt (average)
National Health Goal (MCLG): 0—there is no known fully safe level of DBCP

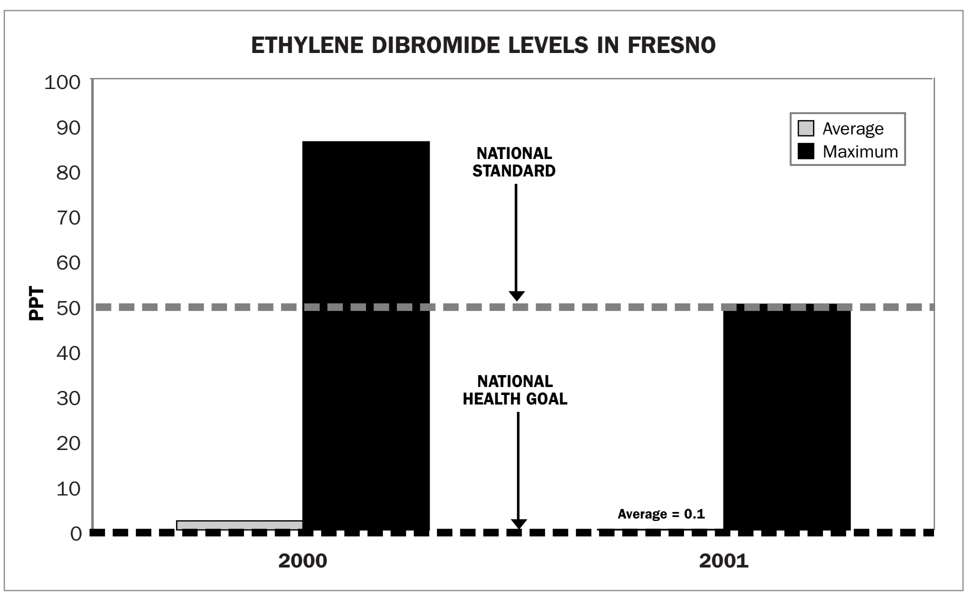
Dibromochloropropane (DBCP)[43] is a banned pesticide shown to cause cancer, sterility, and other health effects. It has been detected repeatedly in Fresno's water. The enforceable standard is an average of 200 parts per trillion. Fresno has had a long history with DBCP. In the 1980s, 44 wells were shut down due to DBCP contamination.[44] Fresno says it has not recently violated the DBCP standard because high spike levels averaged out with lower levels at other times. However, in 2001, Fresno residents had an average DBCP concentration of 47 parts per trillion—less than the 200-parts-per-trillion MCL, but still 25 times higher than the 1.7-parts-per-trillion public health goal, a statewide health goal specific to California and obviously well above the national health goal of zero.[45]

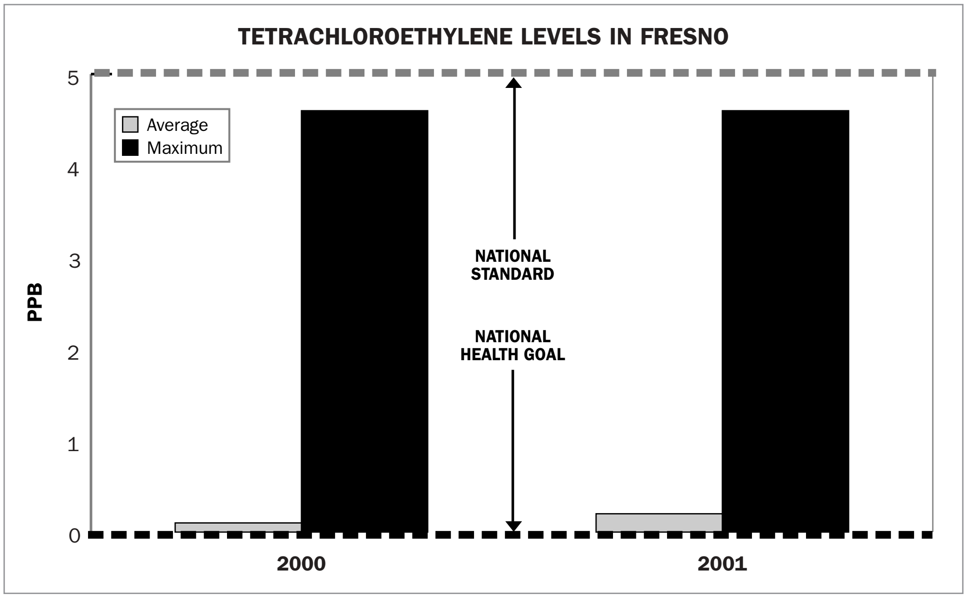
Ethylene Dibromide

Levels Found 2000[46] 2 ppt average 86 ppt maximum
Levels Found 2001[47] 0.1 ppt average 50 ppt maximum
National Standard (MCL): 50 ppt (average)
National Health Goal (MCLG): 0—there is no known fully safe level of EDB

Ethylene dibromide (EDB)[48] is a pesticide and industrial chemical, found by the EPA to "potentially cause the following health effects when people are exposed to it at levels above the MCL for relatively short periods of time: damage to the liver, stomach, and adrenal glands, along with significant reproductive system toxicity, particularly the testes."[49]

Fresno asserts that while it exceeded the EDB standard, it nevertheless is not in violation because the standard allows averaging. EDB's MCL is 50 parts per trillion, and its health goal is zero.





Tetrachloroethylene (also called Perchloroethylene, PCE, or Perc)

Levels Found 2000[51] 0.1 ppb average 4.6 ppb maximum

Levels Found 2001[50] 0.2 ppb average 4.6 ppb maximum

National Standard (MCL): 5 ppb (average)

National Health Goal (MCLG): 0—there is no known fully safe level of perc

Tetrachloroethylene[52] is used in dry cleaning and industrial metal-cleaning or finishing. Prolonged consumption of water contaminated by perc can cause liver problems, and may cause cancer. Fresno's system-wide average perc level is reported to have been well below the EPA MCL of 5 parts per billion, but at least one well contained perc in 2000 at up to 4.6 parts per billion—just below the EPA standard and above the EPA health goal of zero.

Trichloroethylene

Levels Found 2000[53] 0.4 ppb average 11 ppb maximum

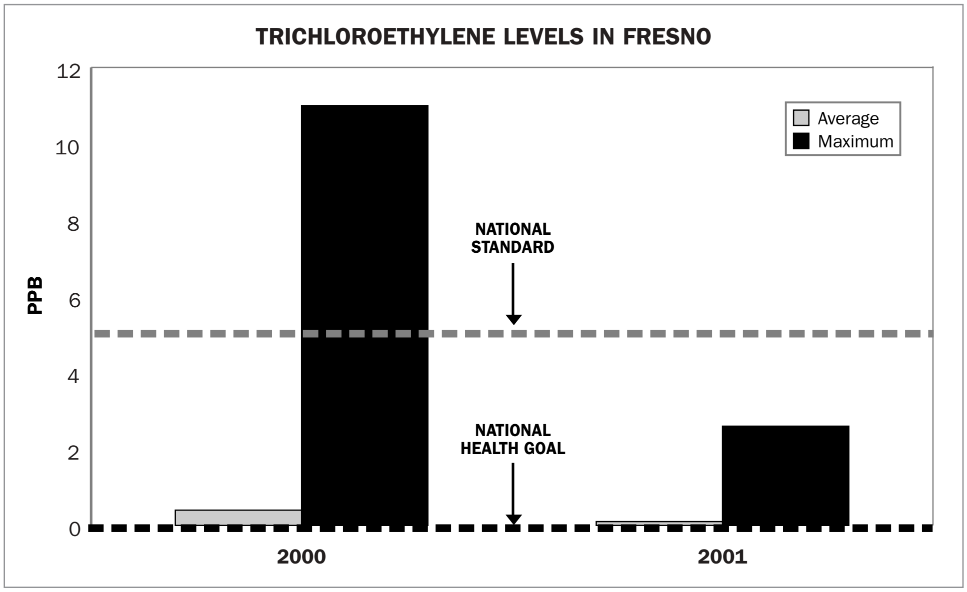
Levels Found 2001[54] 0.1 ppb average 2.6 ppb maximum

National Standard (MCL): 5 ppb (average)

National Health Goal (MCLG): 0—there is no known fully safe level of TCE

Trichloroethylene is a colorless liquid used as a solvent to remove grease from metal parts. It is present in most underground water sources and in many surface waters as a result of the manufacture, use, and disposal of the chemical. Humans exposed to high levels of trichloroethylene in their drinking water may experience harmful effects to their nervous systems, liver and lung damage, abnormal heartbeat, coma, and possibly death.[55]

Fresno reported a system wide average of less than 1 part per billion of TCE, but had a spike up to 11 parts per billion in 2000. The standard is 5 parts per billion. Fresno admits that it had a TCE problem, but argued it did not violate standards:



A single sample result exceeding the MCL for a less than acute contaminant such as TCE must first be verified with 1 or 2 follow-up samples. If the average exceeds the MCL, the utility is allowed to operate the affected source for up to 6 additional months and collect samples no less than monthly. The average of all results is used to determine compliance. In this situation, well 265 confirmed above the MCL and was removed from service. No violation exists because the well was removed from service immediately after confirmation.[56]

As in the case of several other contaminants, Fresno appears to be skating just along the edge of violating standards. Whether or not this technically constituted a standard violation—because Fresno was able to take advantage of provisions allowing averaging—it is clear that even by Fresno's account some customers were drinking water that exceeded the EPA's standard for many months.

Total Trihalomethanes

Levels Found 2000[57] <1 ppb average 11 ppb maximum

Levels Found 2001[58] <1 ppb average 3 ppb maximum

National Standard (MCL): 80 ppb (average) (effective 2002) (100 ppb effective through 2001)

National Health Goal (MCLG): 0 ppb—there is no known fully safe level of exposure to TTHMs

Total trihalomethanes (TTHMs) consist of a sum of the levels of four closely related chemicals—chloroform, dibromochloromethane, bromoform, and bromodichloromethane—which occur together at varying ratios when water is chlorinated. The latter two TTHMs have health goals of zero. The EPA promulgated and then withdrew (after a court decision) a zero health goal for chloroform, and has not yet issued a new goal for chloroform. Dibromochloromethane has a health goal of 60 parts per billion. Since water systems generally report only the combined TTHM level, and since it is essentially chemically impossible to create one *trihalomethane in tap water without some level of the others, we list the health goal for TTHMs as zero.*

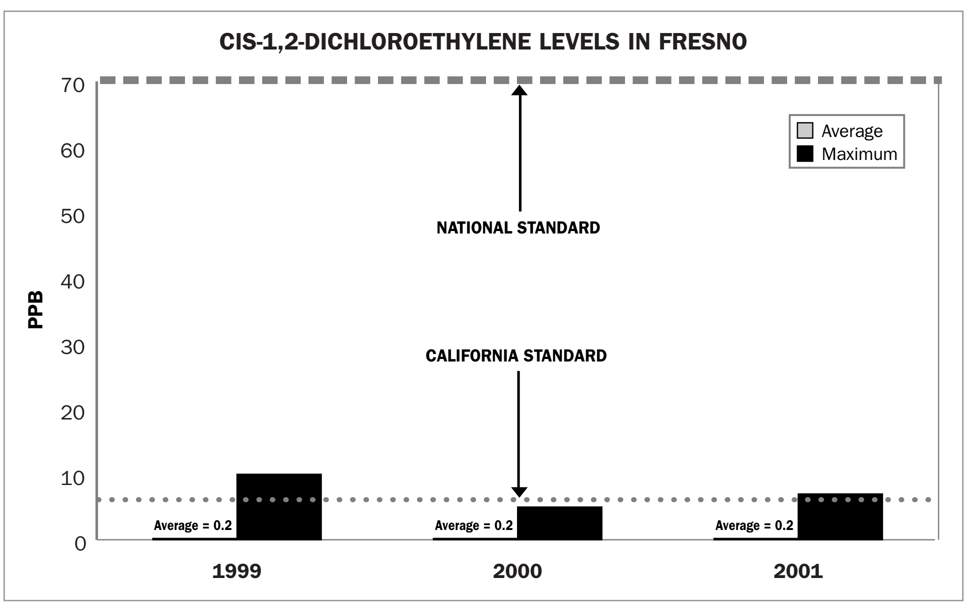
Total trihalomethanes[59] (TTHMs) are chemical contaminants that result when chlorine that is used to treat drinking water interacts with organic matter in the water. Many studies show that these chemicals are linked with cancer. Recent studies also link TTHMs to miscarriages and birth defects. Fresno's levels are far below the EPA standard. Even a high of 11 parts per billion (in 2000) is not a level at which studies show miscarriages or fetal development problems. Unlike many other major cities (especially those that rely on surface water), Fresno does not appear to have a problem with trihalomethanes.

OTHER WATER QUALITY ISSUES OF CONCERN

Fresno reported that it found several pesticides in its water, at times at levels of potential concern, although the system reports that it did not violate any standards for these chemicals from 1999 to 2001. Among the chemicals of concern found in Fresno's water were:[60]

Cis-1,2-dichloroethylene at a system-wide average of less than 1 part per billion, but spiking up to 7 parts per billion in 2001, up to 5 parts per billion in 2000, and up to 10 parts per billion in 1999. The federal standard, or maximum contaminant level (MCL), and health goal are both 70 parts per billion (average), but the stricter California MCL is 6 parts per billion (average). This volatile organic chemical reaches drinking water supplies as discharge from industrial chemical factories. It is linked with liver and nervous system problems.[61]

2,2-Dichloropropane (2,2-DCP) at an average of less than 1 part per billion but with a spike of up to 85 parts per billion in 2000. No standard has been established



for 2,2-DCP. It is a volatile organic chemical that evaporates at room temperature and is found in a few drinking water supplies, most of these from groundwater sources. It was once used as a soil fumigant in the farming industry. Its isomer 1,2-dichloropropane is linked to liver problems and cancer, however NRDC has been unable to find specific studies on the health effects of low-level exposure to the chemical.

PROTECTING FRESNO'S DRINKING WATER

Following are approaches to treating Fresno's drinking water, as well as a discussion of threats to source water. (For information on Fresno pollution sources, visit http://map2.epa.gov/enviromapper.) Also included in this section is information on how individuals can protect drinking water.

TREATMENT OPTIONS AVAILABLE FOR CONTAMINANTS OF GREATEST CONCERN

Arsenic: Treatment options available to reduce arsenic levels may include the use of activated alumina, anion exchange, or other technologies at a cost the EPA estimates would be about $20 per household per year for a city of Fresno's size.[62]

Radon: To reduce Fresno's radon levels, the city could use aeration—essentially bubbling air through the water—at a cost the EPA estimates to be about $9.50 per household per year for a system of Fresno's size.[63]

Organic Chemicals: Fresno treats approximately 38 of its wells with granular activated carbon (GAC) in order to reduce the organic chemicals found in the water. However, many other Fresno wells are not treated with GAC. Fresno's decentralized system of well fields works against it in this effort. Other cities have installed GAC technology for the entire water system at a central location, at a cost of about $25 per household per year, but Fresno has no central site, making treatment more difficult and more costly.

Alternative Water Sources: Alternative water sources may be available to Fresno. The city reports that in 2003 it will have a surface water treatment plant that will meet about 15 percent of the city's water demand.

CURRENT AND FUTURE THREATS TO FRESNO'S SOURCE WATER

Tap water provided by the City of Fresno Department of Public Utilities is treated groundwater. The source of that groundwater is Fresno Sole Source, a large, unconfined aquifer. Because groundwater depletion is a serious problem in Fresno, the system relies upon groundwater that has been artificially recharged, in part by Central Valley Project water from the San Joaquin River—reportedly one of the largest artificial recharge programs in the United States.

Fresno asserts that "groundwater contamination is a serious problem for Fresno."[64] NRDC agrees and concludes that Fresno merits a source water threat rating of "6"—a high degree of threat. The EPA's Index of Watershed Indicators (IWI) refers to the surface waters in the Fresno area as Tulare-Buena Vista Lakes. The groundwater aquifers in this area are the source waters for drinking water in the Fresno metropolitan area. Surface water contamination can pollute groundwater aquifers, and Fresno admits that most of its groundwater "actually comes from the Kings and San Joaquin River watersheds."

Overall, based on the IWI and other currently available data on source water quality, Fresno's watershed is highly vulnerable to contamination. This is true for three main reasons.

First, the IWI indicates that from 1991 to 1999, 10 to 15 percent of Fresno's population was served by community water systems with standards violations or treatment for chemical contaminants. In addition, between 1990 and 1997, 5 percent of the samples of ambient groundwater, Fresno's main source water type for drinking water, had chemical levels exceeding one-half the national standard (MCL) for that chemical.

Second, Fresno's drinking water sources are highly susceptible to contamination by urban runoff and percolation. This type of pollution occurs when water passes through an urban environment, picking up particles, dirt, and chemicals, and flows into the surface and ground water resources of the area. According to the most recent available IWI data—for 1990—more than 4 percent of the watershed's land area is more than one-quarter impervious. In other words, Fresno's watershed and consequently its water sources are likely to experience a heavy loading of pollutants as a result of urban runoff.

Third, Fresno's watershed is likely to be contaminated by agricultural pollutants. From 1990 to 1995, IWI estimated a high potential impact of agricultural runoff on Fresno's watershed. In particular, pesticide and nitrogen runoff have a high potential of polluting Fresno's drinking water sources, and sediment delivery to rivers and streams is determined to be moderate.

Of course, California is a major farming state, and the Central Valley region is particularly agriculture-intensive. Conventional agriculture relies heavily on nitrate-rich fertilizers, pesticides, and herbicides. Heavy use of these chemicals can cause water sources to become contaminated.

HOW INDIVIDUALS CAN PROTECT SOURCE WATER

You can take steps to protect Fresno's drinking water by protecting its sources.

Reduce the amount of water you use. Plant drought-resistant plants or "xeriscape" (use plants that need little or no watering), use low-flow shower-heads, shorten your shower time, don't spray down your driveway to clean it, minimize the number of times (and how long) you water your lawn. Consider installing low-flush toilets. For more tips on water conservation, see:

- www.monolake.org
- www.mwdh2o.com/mwdh2o/pages/conserv/save/tentips/tentips01.html

Avoid using pesticides in the home or yard, or storing pesticides in the home. Consumer pesticide use in the home leads to runoff into water resources.

FRESNO WATER UTILITY INFORMATION
City of Fresno Department of Public Utilities
City of Fresno Water Division
1910 East University Avenue
Fresno, CA 93703-2988
559-498-4136
www.ci.fresno.ca.us/public_utilities

Buy organic foods, if possible. Purchasing organically grown food helps prevent the drinking water source contamination from pesticide and herbicide runoff that results from conventional agricultural practices.

Attend meetings of your local water supplier, the City of Fresno Department of Public Utilities—Water Division. Check the right-to-know report or call and ask for dates, times, and locations. (Contact information above.)

Learn more from these groups:
- Clean Water Action, www.cleanwater.org
- NRDC, www.nrdc.org
- Clean Water Network, www.cwn.org.

NOTES

1 EPA, Safe Drinking Water Information Database.

2 Fresno Department of Public Utilities, Water Division, 2001 Water Quality Report.

3 Ibid.

4 Fresno, *Capital Summary Report: 2003–2007* at pages 573–578 (pp. 43–46 on web-version) (2002). Available online at www.ci.fresno.ca.us/budget/budgets/proposed%5F02%5F03/pdf/captial_summary.pdf.

5 Ibid., page 2.

6 Fresno Water Division, 2000 Water Quality Report.

7 See EPA regulations at 40 C.F.R. §141.153(d)(4)(ix), which provide that the RTK report must include "the likely source(s) of detected contaminants to the best of the operator's knowledge. Specific information about the contaminants may be available in sanitary surveys and source water assessments, and should be used when available to the operator." While EPA allows reliance upon general lists of potential sources where the water system is not aware of the specific source of pollution, where the water system is aware of the pollution source, the rules require that polluter to be identified.

8 40 CFR §141.153(h)(3).

9 Information on contamination is derived from City of Fresno, Water Division, 2000 & 1999 Water Quality Reports.

10 City of Fresno, Water Division, 1999 Water Quality Report.

11 City of Fresno, Water Division, 2000 Water Quality Report.

12 City of Fresno, Water Division, 2001 Water Quality Report.

13 Total cancer risk estimates are based upon the National Academy of Sciences' report Arsenic in Drinking Water: 2001 Update (2001).

14 Fresno Water Division, 1999 Water Quality Report.

15 The so-called "action level" standard for lead is different from the standard for most other contaminants. Water utilities are required to take many samples of lead in the tap water distribution system. If the amount of lead detected in the samples is *more* than 15 ppb at the 90th percentile (which means that 90% of the samples have 15 ppb or less), then the amount is said to exceed the "action level." Under the complex EPA lead rule, a water system that exceeds

the action level is not necessarily in violation. If a system exceeds the action level, additional measures such as chemical treatment to reduce the water's corrosivity (ability to corrode pipes and thus its ability to leach lead from pipes) must be taken. If this chemical treatment does not work, the water system may have to replace lead portions of its distribution system if they are still contributing to the lead problem.

16 See EPA, Consumer Fact Sheets on Lead, www.epa.gov/safewater/Pubs/lead1.html and www.epa.gov/safewater/standard/lead&co1.html, and IRIS summary for lead online at www.epa.gov/iris/subst/0277.htm.

17 Fresno Water Division, 2000 Water Quality Report. Fresno reported its nitrate levels as nitrate as nitrate (NO_3), rather than as N (nitrogen). NRDC has converted the reported values to Nitrate as N.

18 Fresno Water Division, 2001 Water Quality Report. Fresno reported its nitrate levels as nitrate as nitrate (NO_3), rather than as N (nitrogen). NRDC has converted the reported values to Nitrate as N.

19 The information regarding the health effects of nitrate are derived from National Academy of Sciences, National Research Council, *Nitrate and Nitrite in Drinking Water* (1995)(available online at www.nap.edu/catalog/9038.html), and EPA, Nitrates, fact sheet, available online at www.epa.gov/safewater/dwh/c-ioc/nitrates.html.

20 See note 17.

21 See note 18.

22 See 40 C.F.R. § 141.11 (nitrate MCL is 10 ppm); ibid. §141.23(o) (if 2 consecutive nitrate samples exceed the MCL for nitrate, this constitutes a violation and public notice is required).

23 See note 17.

24 See note 22.

25 EPA, SDWIS, available online at http://oaspub.epa.gov/enviro/sdw_report.first_table?report_id=633965&pwsid=CA1010007&state=CA&source=Ground%20water%20&population=485000&sys_num=0.

26 Fresno Water Division, 2001 Water Quality Report.

27 Ibid.

28 Ibid.

29 Ibid.

30 Fresno Water Division, 2000 Water Quality Report.

31 Ibid.

32 Fresno Water Division, 2001 Water Quality Report

33 Fresno Water Division, 2000 Water Quality Report.

34 The information in the radon section is derived from National Academy of Sciences, National Research Council, *Risk Assessment of Radon in Drinking Water,* 1999, available online at http://books.nap.edu/books/0309062926/html/index.html), and from EPA, Radon in Drinking Water (fact sheet available online at http://www.epa.gov/safewater/radon/proposal.html).

35 Fresno Water Division, 2000 Water Quality Report.

36 See note 34.

37 Fresno Water Division, 2000 Water Quality Report.

38 Fresno Water Division, 2001 Water Quality Report.

39 The information on health effects of coliform is derived from EPA, "Total Coliform Rule," 54 Fed.Reg. 27544-27568, June 29, 1989; and EPA, "Total Coliform Rule: A Quick Reference Guide," available online at *Total Coliform Rule: A Quick Reference Guide,* PDF File (816-F-01-035, September 2001).

40 Fresno Water Division, 1999 Water Quality Report.

41 Fresno Water Division, 2000 Water Quality Report.

42 Fresno Water Division, 2001 Water Quality Report.

43 Health effects and other general information on DBCP derived from EPA, Consumer Fact Sheet on Dibromochloropropane, available online at www.epa.gov/safewater/dwh/c-soc/dibromoc.html.

44 Brad Heavner, California Public Interest Research Group Charitable Trust, *Toxics on Tap: Pesticides in California Drinking Water Sources,* 1999, pg. 17; Fresno Water Division, 2001 Water Quality Report.

45 Ibid., pg. 22.

46 Fresno Water Division, 2000 Water Quality Report.

47 Fresno Water Division, 2001 Water Quality Report.

48 This EDB health and use information derived from EPA, Consumer Fact Sheet on Ethylene Dibromide," available online at www.epa.gov/safewater/dwh/c-soc/ethylene.html.

49 Ibid.

50 Fresno Water Division, 2000 Water Quality Report.

51 Fresno Water Division, 2001 Water Quality Report.

52 EPA, Consumer Fact Sheet on Tetrachloroethylene, available online at www.epa.gov/safewater/dwh/c-voc/tetrachl.html.

53 Fresno Water Division, 2000 Water Quality Report.

54 Fresno Water Division, 2001 Water Quality Report.

55 Agency for Toxic Substances and Disease Registry. ToxFAQs—Trichloroethylene (TCE), September 1997, available online at www.atsdr.cdc.gov/tfacts19.html (last visited January 4, 2001.).

56 Fresno Water Division, 2000 Water Quality Report.

57 Fresno Water Division, 2000 Water Quality Report.

58 Fresno Water Division, 2001 Water Quality Report.

59 Health effects information on disinfection byproducts is summarized in Chapter 2 as well as in *Trouble on Tap*, 1995; NRDC, *Bottled Water: Pure Drink or Pure Hype?*, 1999, available online at www.nrdc.org/water/drinking/bw/bwinx.asp; and EPA, draft Preamble for Stage 2 Disinfection Byproducts Regulation, available online at www.epa.gov/safewater/mdbp/st2dis-preamble.pdf.

60 All information in this section on levels of contaminants found are derived from City of Fresno, Water Division, 2000 Water Quality Report; and City of Fresno, Water Division, 1999 Water Quality Report.

61 EPA, Consumer Fact Sheet on 1,2-Dichloroethylene, available online at www.epa.gov/safewater/dwh/c-voc/12-dich2.html.

62 EPA, Final National Primary Drinking Water Regulation: Arsenic, 66 Fed. Reg. 6976, 7011, Table III.E-2 (costs per household); 7038, Table V.F-4.1 (treatment available), January 22, 2001.

63 EPA, Proposed National Primary Drinking Water Regulation: Radon-222, 64 Fed. Reg. 59246, 59328 Table XIII.11, November 2, 1999.

64 Fresno Water Division, 1999 Water Quality Report.

Los Angeles[1]

Los Angeles earned a water quality and compliance grade of Fair for 2000 and 2001.

Elevated levels of cancer-causing by-products of disinfection were found in the water in parts of Los Angeles, including total trihalomethanes (TTHMs) and haloacetic acids (HAAs). In Central and Eastern Los Angeles, levels averaged 80 parts per billion of TTHMs in 2001, the maximum allowed limit permitted under new EPA standards for TTHMs, effective in January 2002. Other parts of the city registered average TTHM levels between 59 and 69 parts per billion—lower, but still relatively high. While not a violation of the law, these levels present a health concern including a risk of cancer. Los Angeles has begun switching to "chloramines" for disinfection, a half solution that will only modestly reduce the levels of these chemicals and will not kill chlorine-resistant pathogens. In the meantime, levels remain unacceptably elevated in parts of the city. The EPA announced the reduced standard more than eight years ago, in July 1994, after extensive regulatory negotiations resulted in an agreement with the water industry—a process of which Los Angeles was well aware and in which Los Angeles and its wholesaler Metropolitan Water District of Southern California (MWD) participated.[3] The final rule was issued in 1998.[4]

Arsenic levels in many areas of Los Angeles, including parts of central and eastern Los Angeles, western Los Angeles, and the San Fernando Valley, averaged approximately 4 parts per billion. Although this arsenic level is below the EPA's new 10-parts-per-billion drinking water standard, it still poses a lifetime cancer risk exceeding 1 in 1,000[5]—more than 10 times worse than the highest cancer risk the EPA usually allows from tap water. While L.A. has made some recent successful efforts to reduce its arsenic levels, additional measures are needed to reduce arsenic risks.

Radon was detected in some of Los Angeles's water wells at levels above the EPA's proposed 300-picocuries-per-liter proposed standard. Some wells in the Central and Eastern service area in 2000 had levels of radon that exceeded the EPA's proposed standard, although these levels fluctuated in 2001, dipping below the proposed standard. Radon in tap water at this level poses a lifetime cancer risk of about 1 in 3,000[6]—more than triple what the EPA says is the highest acceptable cancer risk from tap water. Levels at wells in the San Fernando Valley also came very near the maximum levels allowed under the EPA's proposed Maximum Contaminant Level (MCL), posing a cancer risk of nearly 1 in 5,000. While Los Angeles might be eligible for a waiver from the EPA's proposed standard, and while, in many L.A. homes, radon seeping into the basement is likely to be a bigger risk than tap water radon, the elevated levels of radon in some of L.A.'s drinking water remain a health concern.

Perchlorate, an unregulated contaminant from rocket fuel, was found in the L.A. system including in some wells in the San Fernando Valley and in some water used in central

LOS ANGELES
System Population Served 3.8 million[2]
Water Quality and Compliance **2000▶Fair** **2001▶Fair**
Right-to-Know Report—Citizenship **2000▶Good** **2001▶Good**
Threats to Source Water Imported (90%) **5** Local (10%) **3** (1=least threat to 6=highest threat)
REPORT CARD

and eastern Los Angeles. Perchlorate levels ranged as high as 5 to 10 parts per billion—higher than California's January 2002 action level of 4 parts per billion, and much higher than the recently issued EPA draft safe level (the draft drinking water equivalent level, or DWEL) of 1 part per billion in drinking water. L.A. reports that average levels of perchlorate system-wide were less than 4 parts per billion, but some parts of the system had higher spikes.

Los Angeles continues to use two open, uncovered finished-water reservoirs that pose a threat to tap water. In 1998, state regulators cited the city for missing an interim deadline to remove one such reservoir from use. Finally, in 2001, Los Angeles took two Hollywood reservoirs out of service (except during emergencies), leaving the Encino and Lower Stone Canyon reservoirs online. The city is now under orders from the state to move gradually away from their use by 2003–2004. State and federal rules require that they be removed from service, or that water from them be treated further, because runoff into the uncovered reservoirs could contaminate tap water with microbes or other contaminants.

Nitrate levels sometimes exceeded EPA standards in wells. While L.A. water generally contains very low levels of nitrates, at least some wells in the San Fernando Valley contained nitrates at levels up to 11 parts per million—in excess of the EPA standard of 10 parts per million. L.A. authorities deny that the water was in violation, because the city blends higher nitrate water with lower nitrate water from other sources, bringing the levels in water actually delivered to customers below the standard—at most, about half the standard.[7] Nitrate is the product of fertilizers and human or animal waste, and infants who drink excessive nitrates for even a short period of time can develop "blue baby syndrome," in which nitrate poisoning prevents their blood from holding oxygen. Nitrate levels in L.A.'s water therefore merit careful monitoring.

Other contaminants detected in Los Angeles's treated water in 2000 or 2001 that are of potential health concern include total chromium and chromium 6, cancer-causing radioactive contaminants (including alpha and beta radiation, radium, and uranium), perchloroethylene (also called "perc," PCE, or tetrachloroethylene), toluene, and trichloroethylene (TCE). None were found at levels that exceeded EPA standards, although in some cases, the EPA has no standard in place. Levels did often exceed California's health goals, the level at which no harmful health effects are caused.

The need for major capital investment in L.A.'s water infrastructure

The Los Angeles Department of Water and Power (LADWP) has adopted a five-year, $2 billion capital improvement budget for water services, including more than $500 million to pay for water quality improvements.[8] The LADWP pipeline rehabilitation program has relined approximately 850 miles of old water mains already, and expects to spend $340 million over the next 10 years to line an additional 130 miles per year.[9] Los Angeles is replacing water meters to improve their accuracy, and improving computer controls, telemetry, and water quality monitoring.[10] Water costs are expected to increase over the next five years as Los Angeles complies with new drinking water standards and continues to replace aging water mains.[11] A capital improvement program to bring the city's open reservoirs into compliance with EPA and state standards will cost an estimated $417 million over the next decade.[12]

Los Angeles earned a Good for its 2001 and 2000 right-to-know reports.

On the "good citizen" side of the ledger:

▶ The format of the reports and their tables were relatively user friendly—one of the better reports reviewed by NRDC.

▶ The reports described specifics on how the water is treated, and included useful diagrams.

▶ Los Angeles produced four separate right-to-know reports; each provided "area-specific" data, thus preventing the confusion that could occur if all areas were grouped together into one report.

▶ The reports included good source water information and maps.

▶ The reports revealed information about the health effects of some contaminants found in the city's water, even though such information is not required by the EPA.

▶ The 2001 reports included a "public health goal report" that acknowledged that Los Angeles does not meet 13 state Public Health Goals or Maximum Contaminant Level Goals, discussed the reasons for those failings, and put forth the city's plans for fixing the problems.

▶ The 2001 reports prominently included a "special notice to immuno-compromised" individuals, under a large headline on the first page after the cover letter.

▶ The reports included useful information on system rehabilitation and treatment and on water conservation.

▶ The reports made no sweeping statements about the absolute safety of the water, although they did emphasize that L.A. water "met or surpassed all drinking water standards."

▶ The reports summarized special information on the switch to chloramines as a disinfectant, and gave "special notice" to users of kidney dialysis machines, and fish owners about the implications of the switch for them.

On the "not-so-good citizen" side of the ledger:

▶ Los Angeles did not translate its reports into Spanish or any other language. According to the 2000 Census, 42 percent of L.A.'s population speak Spanish at home, and 25 percent speak Spanish but speaks English "less than very well." The EPA and state rules require that systems serving "a large proportion of non-English speaking residents," defined in California's regulations as 10 percent or 1,000 people, must provide information on the importance of the report in the relevant language(s), or a phone number or address where citizens can get a translated copy of the report or assistance in their language.[13] Los Angeles admits that it "should have" translated the report at least into Spanish, but still has not done so.[14] Los Angeles does make the mandatory reference in Spanish in the reports to their importance, and gives a phone number for more information in Spanish, but provides no translated reports. In addition, more than 8 percent of L.A. citizens, far more than the 1,000 cited by state regulations, speak Asian or Pacific Island languages, yet the reports only included the mandatory short statement in five other languages directing consumers to find someone to translate the report into their native tongue. Chinese, Korean, Vietnamese, and Cambodian are widely spoken in Los Angeles and the city should consider translating the reports, or at least providing assistance in these languages.

▶ The 2000 and 2001 reports included no information on specific known or potential polluters in L.A.'s watershed, nor did they map or otherwise indicate the locations or types of such polluters. EPA and state rules require utilities to name known or likely sources of any regulated contaminant found in tap water.[15] For example, L.A. and the Metropolitan Water District of Southern California are aware that a Kerr-McGee plant in Nevada is the source of the perchlorate contamination in the portion of the city's water supply that comes from the Colorado River, but the right-to-know report never specifically mentioned this plant. Even where EPA rules do not require such specific notice about a specific polluter, or where the specific polluter cannot be tied with assurance to a specific contaminant, the EPA encourages water systems to highlight significant sources of contamination in the watershed. Dissemination of such information helps increase consumer awareness of the importance of protecting the watershed.

▶ While the right-to-know reports discussed some health effects of some contaminants—perchlorate and chromium 6, for example—they did not include explanations of the health effects of certain regulated contaminants found at levels in excess of health goals, including, for example, chlorination by-product chemicals linked to cancer and possibly to reproductive problems (e.g., trihalomethanes and haloacetic acids), and radioactive contaminants known to cause cancer.

Los Angeles earned "Threats to Source Water" ratings of 3 for the area surface water in the water supply, and 5 for the vast majority of the water supply that is from local groundwater or imported from elsewhere.

As discussed in greater detail below, nearly 90 percent of Los Angeles's water is imported from elsewhere. The EPA ranks the threats to many of the sources for the city's imported waters as "5" on its Index of Watershed Indicators (IWI) watershed threat scale, a six-point scale ranging from 1 (least threat) to 6 (highest threat). In 2001, about 47 percent of Los Angeles's water came from the Colorado River (the source of water for the Colorado River Aqueduct) or from Northern California (sources of water for the State Water Project). Parts of the Colorado River watershed and these Northern California watersheds have a high threat ranking of 5. In addition, parts of the watershed originating at Mono Lake and feeding the Los Angeles Aqueduct, which in 2001 provided about 41 percent of Los Angeles's water, also rank as a 5 on the watershed threat scale. Finally, about 12 percent of the city's water (particularly in the San Fernando Valley and the Manhattan well field, which is sometimes used to supply water to parts of Eastern and Central L.A.) is from local groundwater supplies. The EPA ranks the water quality threats to Los

Angeles's local watershed as a 3.[16] While the EPA does not use the IWI scale to rank threats to groundwater, some of the local groundwater used by Los Angeles is threatened by urban pollution, agricultural pollution, and other pollution sources, as is illustrated by the fairly low levels of industrial chemicals and other contaminants found in local wells.

KEY CONTAMINANTS FOUND ABOVE NATIONAL HEALTH GOALS

The following contaminants are found in Los Angeles's drinking water. For more information on their properties and health effects, see chapter 2, "Health Concerns for Common Tap Water Contaminants."

MICROBIOLOGICAL CONTAMINANTS

Total Coliform Bacteria

Levels found city wide 2000[17]	Range: 0–0.30%	Average: 0.08%
Levels found city wide 2001[18]	Range: 0–0.5%	Average: 0.2%

National Standard (MCL) for Coliform Bacteria: 5%

National Health Goal (MCLG) for Coliform Bacteria: 0

Note that contaminant levels are presented as a percentage. Total coliform is regulated as a percentage of positive samples that are present in water. The national standard of 5 percent means that if more than 5 percent of the utility's total coliform samples test positive, then the national standard has been violated. To say that a sample tests positive is to say that there are total coliform bacteria present in the sample. Therefore, for compliance purposes, the utilities provide the percentage of total coliform samples that tested positive.

Total coliform bacteria is a microbial contaminant and its presence is a potential indicator that disease-causing organisms may be present in tap water. The coliform bacteria finding in Los Angeles is not viewed as a serious health threat to healthy consumers. The fact that low levels of coliform are detected in Los Angeles's water is a potential indication that bacterial regrowth may be occurring in the city's distribution system. Some studies suggest that serious regrowth problems may allow disease-causing pathogens to subsist in pipes.

INORGANIC CONTAMINANTS

Arsenic

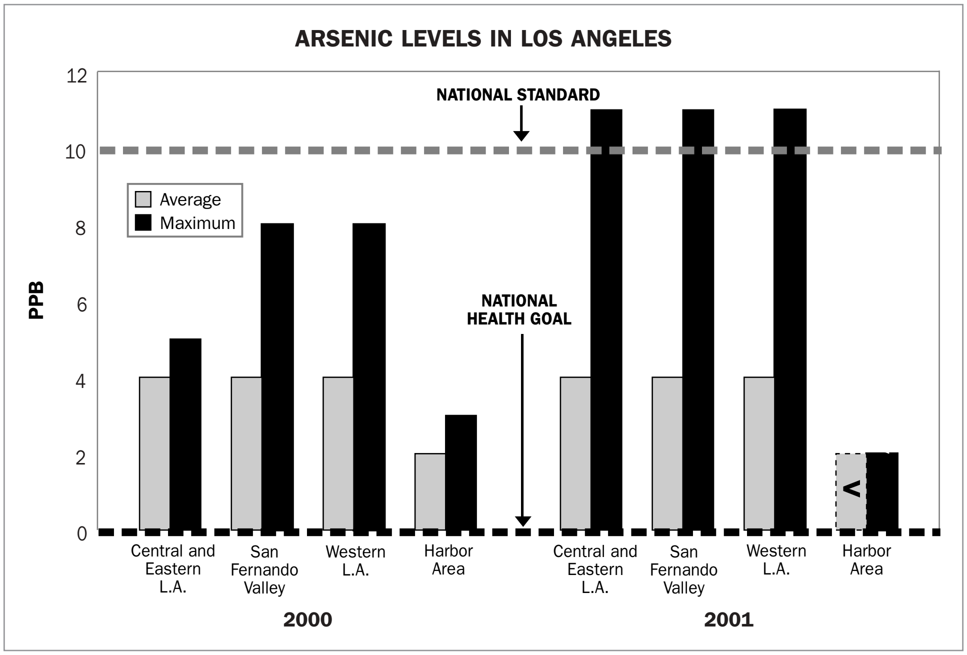
Levels found 2000

Central and East Los Angeles	4 ppb average[19]	5 ppb maximum
San Fernando Valley	4 ppb average[20]	8 ppb maximum
Western Los Angeles	4 ppb average[21]	8 ppb maximum
Harbor Area	2 ppb average[22]	3 ppb maximum

Central and East Los Angeles average is for the Upper Hollywood Reservoir, highest in the area. San Fernando Valley average is for the L.A. Aqueduct water, highest in the area.

Levels found 2001

Central and East Los Angeles	4 ppb average[23]	11 ppb maximum
San Fernando Valley	4 ppb average[24]	11 ppb maximum



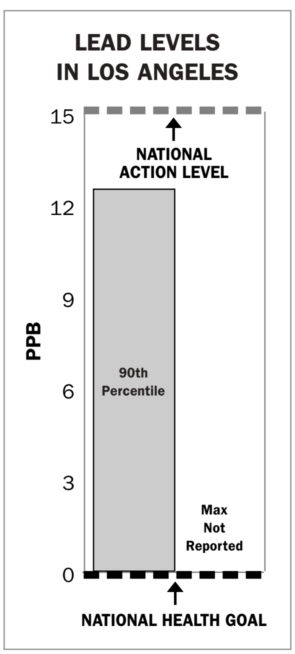
Western Los Angeles	4 ppb average[25]	11 ppb maximum
Harbor Area	<2 ppb average[26]	2 ppb maximum

Central and East Los Angeles average is for the Los Angeles Filtration Plant, highest in the area. San Fernando Valley average is for the L.A. Filtration Plant and Encino Reservoir water, highest in the area.

National Standard (MCL): 10 ppb (average) (effective 2006) (50 ppb effective through 2005)

National Health Goal (MCLG): 0 ppb—there is no known fully safe level of arsenic

Arsenic is a known and potent human carcinogen and is linked to a variety of other diseases.[27] While the average arsenic level in Los Angeles's blended and treated water is below the new EPA standard of 10 parts per billion, even at 3 parts per billion arsenic poses a cancer risk of about 1 in 1,000, according to the National Academy of Sciences.[28] That risk level is 10 times higher than the EPA usually allows. According to the most recent published information from LADWP, the major contributing source of arsenic is Hot Creek near Lake Crowley, apparently a source of naturally occurring arsenic. Other local wells are also problematic.[29] Los Angeles could and should take additional action to remedy the city's arsenic problem.



Lead

Levels Found 1992: 12–13 ppb at 90th percentile levels (1992 data is most recent tap sampling reported)[30]

National Standard (TT): 15 ppb (action level)

National Health Goal (MCLG): 0 ppb—there is no known fully safe level of lead

Los Angeles's most recent reported sampling for lead was completed in 1992. Lead[31] is a major environmental threat; no amount of it in water is considered safe. Even though it has reported no lead testing for a decade, Los Angeles claims it has been in compliance with the EPA standard since at-the-tap monitoring began in 1992, saying it did not exceed the EPA action level in more than 10 percent of homes tested. However, it appears to NRDC that EPA rules, as amended in 2000, required LADWP to conduct updated monitoring by 2000, as well as to install corrosion control within 18 months if, as appears is the case, the city's 90th percentile lead level (12 to 13 parts per billion in 1992) was more than 5 parts per billion higher than its lead level when it left the treatment plant. LADWP says it plans to install corrosion control treatment that will make L.A. water less likely to leach lead from pipes.[32] A demonstration facility to reduce lead leaching through the addition of a corrosion inhibiter will be constructed in Stone Canyon Reservoir complex. The facility is scheduled to be operational in 2002, and the technology will be installed system-wide later.[33]

Nitrate

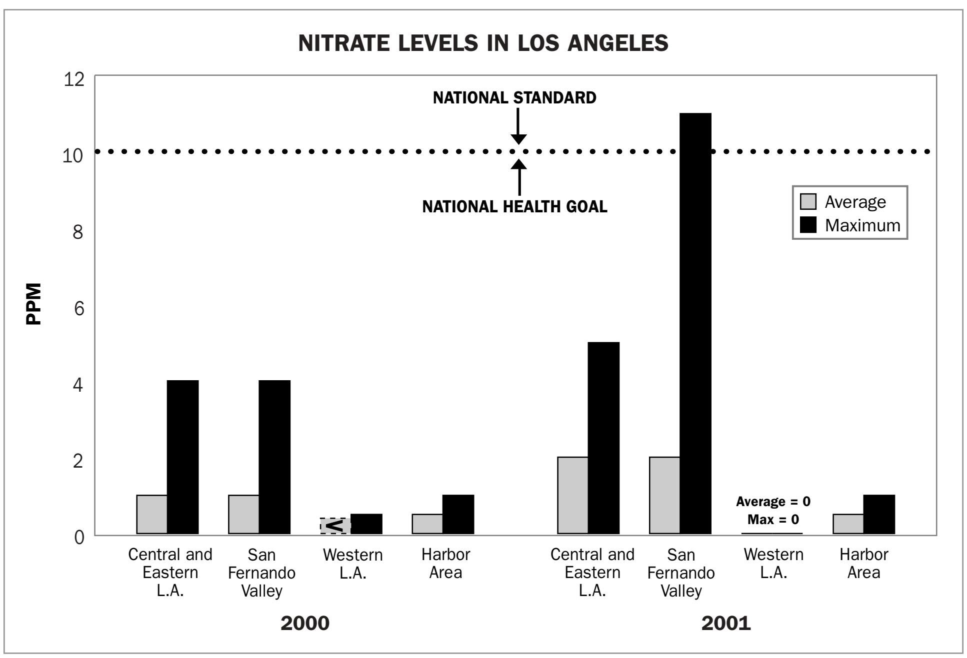
Levels Found 2000

Central and East Los Angeles	1 ppm average[34]	4 ppm maximum
San Fernando Valley	1 ppm average[35]	4 ppm maximum
Western Los Angeles	<0.4 ppm average[36]	0.5 ppm maximum
Harbor Area	0.5 ppm average[37]	1 ppm maximum

Central and East Los Angeles average listed is for the Upper Hollywood Reservoir, highest in the area. San Fernando Valley average is for the Los Angeles Aqueduct water, highest in the area.

Levels Found 2001

Central and East Los Angeles	2 ppm average[38]	5 ppm maximum
San Fernando Valley	2 ppm average[39]	11 ppm maximum
Western Los Angeles	Not detected[40]	
Harbor Area	0.5 ppm average[41]	1 ppm maximum



Central and East Los Angeles average is for the Los Angeles Filtration Plant, highest in the area. San Fernando Valley average is for the Los Angeles Filtration Plant and Encino Reservoir water, highest in the area.

National Standard (MCL): 10 ppm (two-sample average within 24 hours)

National Health Goal (MCLG): 10 ppm

Excess nitrates, even after very short-term exposure, can pose an acute risk to infants, causing what is known as "blue baby syndrome."[42]

Perchlorate

Levels Found 2000

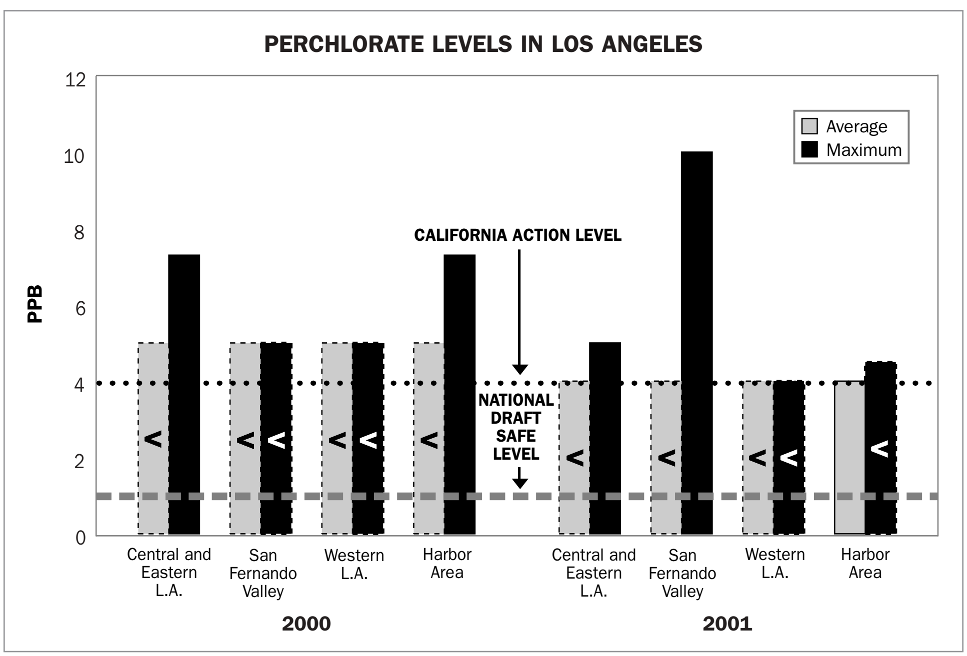
Central and Eastern Los Angeles	<5 ppb[54] average	7.3 ppb maximum
San Fernando Valley	<5 ppb[55] average	<5 ppb maximum
Western Los Angeles	<5 ppb[56] average	<5 ppb maximum
Harbor Area	<5 ppb[57] average	7.3 ppb maximum

Central and Eastern Los Angeles maximum level recorded at Lower Hollywood reservoir. Harbor Area maximum level recorded at Weymouth Treatment Plant.

Levels Found 2001

Central and Eastern Los Angeles	<4 ppb[58] average	5 ppb maximum
San Fernando Valley	<4 ppb[59] average	10 ppb maximum
Western Los Angeles	<4 ppb[60] average	<4 ppb maximum
Harbor Area	4 ppb[61] average	<4.5 ppb maximum

Central and Eastern Los Angeles maximum level recorded at MWD's Weymouth Plant. San Fernando Valley maximum level recorded in combined wells for San Fernando Valley. Harbor Area maximum level recorded at Weymouth Treatment Plant reported in Central and Eastern LA was 5 ppb; according to the Harbor Area report, the same Weymouth plant had a maximum of <4.5 ppb.



National Standard (MCL): None established
National Draft Safe Level ("Drinking Water Equivalent Level,"or DWEL): 1 ppb[62]
California Action Level (health-based advisory level): 4 ppb

Perchlorate is an inorganic contaminant that harms the thyroid and may cause cancer. It usually comes from rocket fuel spills or leaks at military facilities.[63] Perchlorate gets into Los Angeles water via the Metropolitan Water District's Colorado River Aqueduct, which has been contaminated by perchlorate from a Kerr-McGee site in Henderson, Nevada.[64] Some LADWP wells in the San Fernando Valley also contain perchlorate.

ORGANIC CONTAMINANTS

Total Trihalomethanes

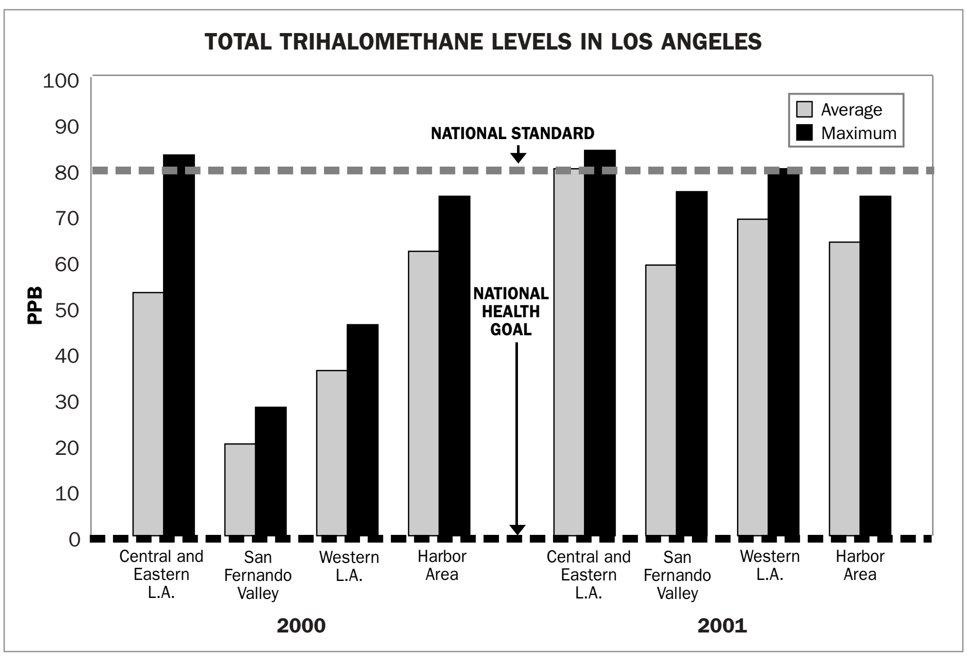
Levels Found 2000

Central and Eastern Los Angeles	53 ppb average[43]	83 ppb maximum
San Fernando Valley	20 ppb average[44]	28 ppb maximum
Western Los Angeles	36 ppb average[45]	46 ppb maximum
Harbor Area	62 ppb average[46]	74 ppb maximum

Levels Found 2001

Central and Eastern Los Angeles	80 ppb average[47]	84 ppb maximum
San Fernando Valley	59 ppb average[48]	75 ppb maximum
Western Los Angeles	69 ppb average[49]	80 ppb maximum
Harbor Area	64 ppb average[50]	74 ppb maximum

National Standard (MCL): 80 ppb (average) (effective 2002) (100 ppb effective through 2001)
National Health Goal (MCLG): 0 ppb—there is no known fully safe level of trihalomethanes



Total trihalomethanes (TTHMs) consist of a sum of the levels of four closely related chemicals—chloroform, dibromochloromethane, bromoform, and bromodichloromethane—which occur together at varying ratios when water is chlorinated. The latter two TTHMs have health goals of zero. The EPA promulgated and then withdrew (after a court decision) a zero health goal for chloroform, and has not yet issued a new goal for chloroform. Dibromochloromethane has a health goal of 60 ppb. Since water systems generally report only the combined TTHM level, and since it is essentially chemically impossible to create one trihalomethane in tap water without some level of the others, we list the health goal for TTHMs as zero.

Total trihalomethanes (TTHMs)[51] are chemical contaminants that result when chlorine used to treat drinking water interacts with organic matter in the water. Many studies show that these chemicals are linked with cancer, and the EPA has classified some TTHMs as probable human carcinogens. Recent preliminary studies also link TTHMs to miscarriages and birth defects.

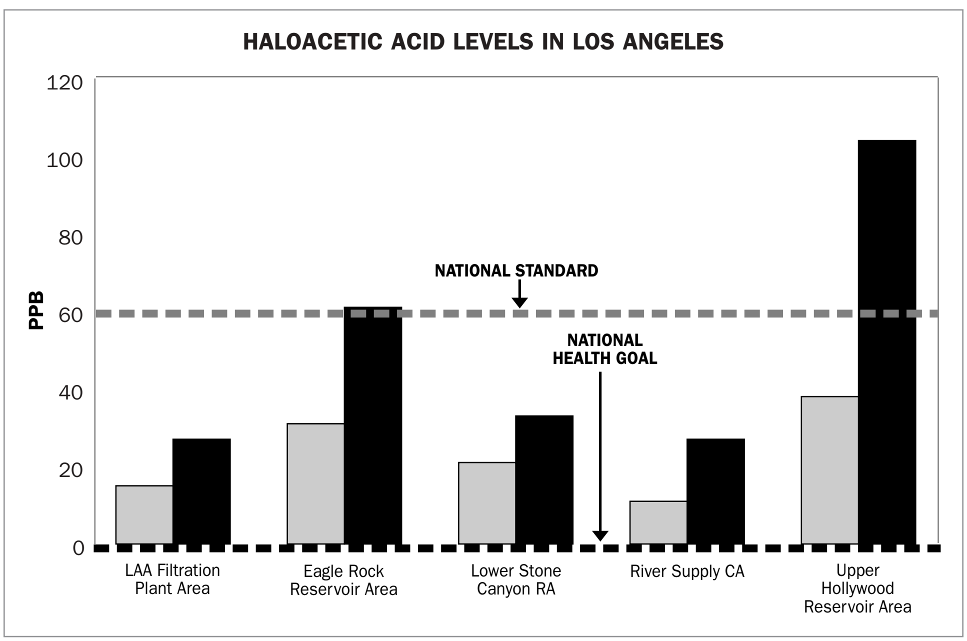
Haloacetic Acids

Haloacetic Acids Levels found (1997–1998—most recent reported data)[52]

LAA Filtration Plant Area	15 ppb average	27 ppb maximum
Eagle Rock Reservoir Area	31 ppb average	61 ppb maximum
Lower Stone Canyon RA	21 ppb average	33 ppb maximum
River Supply CA	11 ppb average	27 ppb maximum
Upper Hollywood Reservoir Area	38 ppb average	104 ppb maximum

National Standard (MCL): 60 ppb (average) (effective 2002; no previous standard)
National Health Goal (MCLG): 0 ppb—no known fully safe level of haloacetic acid

Some of the haloacetic acids have national health goals of 0 and others have non-zero goals. For the purposes of consistency, we list the national health goal as 0 because we list a single standard.



Haloacetic acids, like TTHMs, are by-products of disinfection. People exposed to haloacetic acids in drinking water over a long term may be at risk of developing cancer.[53]

RADIOACTIVE CONTAMINANTS

Radon

Levels Found in 2000 (in picocuries per liter, pCi/L)

Radon found in groundwater portions of system only

Central and Eastern Los Angeles[65]		
Metro. Water Dist. (MWD)	<100 pCi/L average	119 pCi/L maximum
Combined Wells	369 pCi/L average	525 pCi/L maximum
San Fernando Valley[66]		
Combined Wells	234 pCi/L average	256 pCi/L maximum
Western Los Angeles[67]	no radon detected	
Harbor[68]	no radon detected.	

Averages listed are highest average for a source in the area listed.

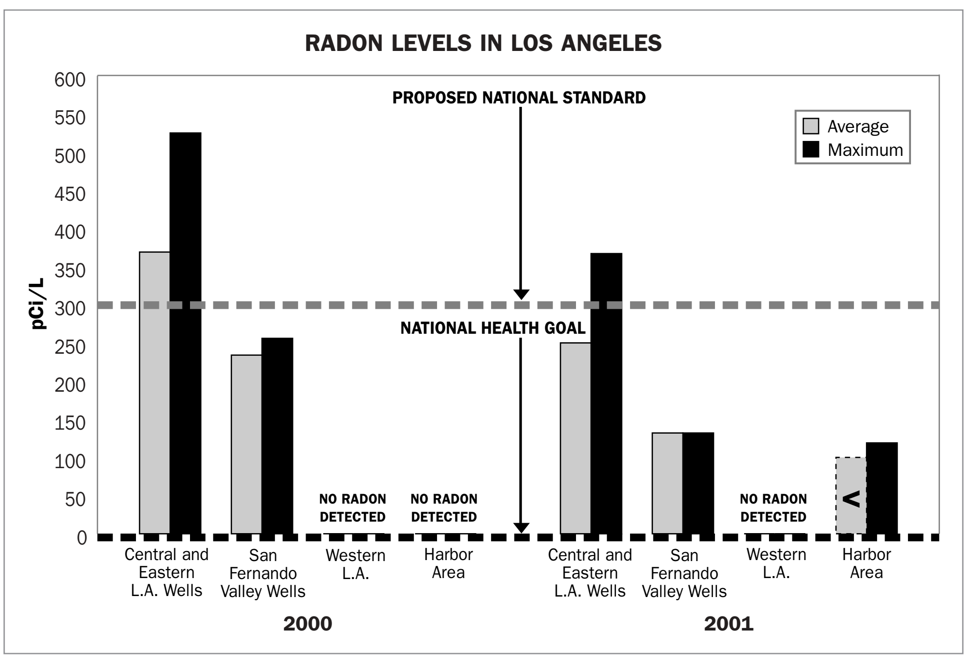
Radon's Cancer Risk at 300 pCi/L: 1 in 5,000 twice the EPA's usual maximum acceptable cancer risk.[69]

Levels Found in 2001 (in picocuries per liter, pCi/L)

Radon found in groundwater portions of system only

Central and Eastern Los Angeles	250 pCi/L average[70]	367 pCi/L maximum
San Fernando Valley	132 pCi/L average[71]	132 pCi/L maximum
Western Los Angeles	no radon detected[72]	
Harbor Area	<100 pCi/L average[73]	119 pCi/L maximum

Averages listed are highest average for a source in the area listed. Central and Eastern Los Angeles maximum level recorded at combined wells, which had the highest radon levels in the



area. San Fernando Valley maximum level recorded in combined wells for San Fernando Valley. Harbor Area maximum level recorded at Weymouth Treatment Plant.

Radon's cancer risk at 300 pCi/L: 1 in 5,000, twice EPA's usual maximum acceptable cancer risk.[74]

National Standard (MCL) (proposed): 300 pCi/L (alternate MCL is 4000 pCi/L where approved multimedia mitigation program is in place) (averages)

National Health Goal (MCLG)(proposed): 0 pCi/L—there is no known fully safe level of radon

Radon is a radioactive gas known to cause lung cancer. Radon was detected in some Los Angeles water supplies drawn from groundwater. Surface water supplies in L.A. did not contain detectable levels of radon.[75] In 2000, wells in the Central and Eastern service area had average levels of radon exceeding 360 pCi/L, well above the proposed national MCL, but average levels reported in this area in 2001 dropped to 250 pCi/L. Levels at combined wells in the San Fernando Valley came close to the EPA proposed MCL in 2000, posing a cancer risk of about 1 in 5,000. But levels dropped to about 130 pCi/L in 2001.

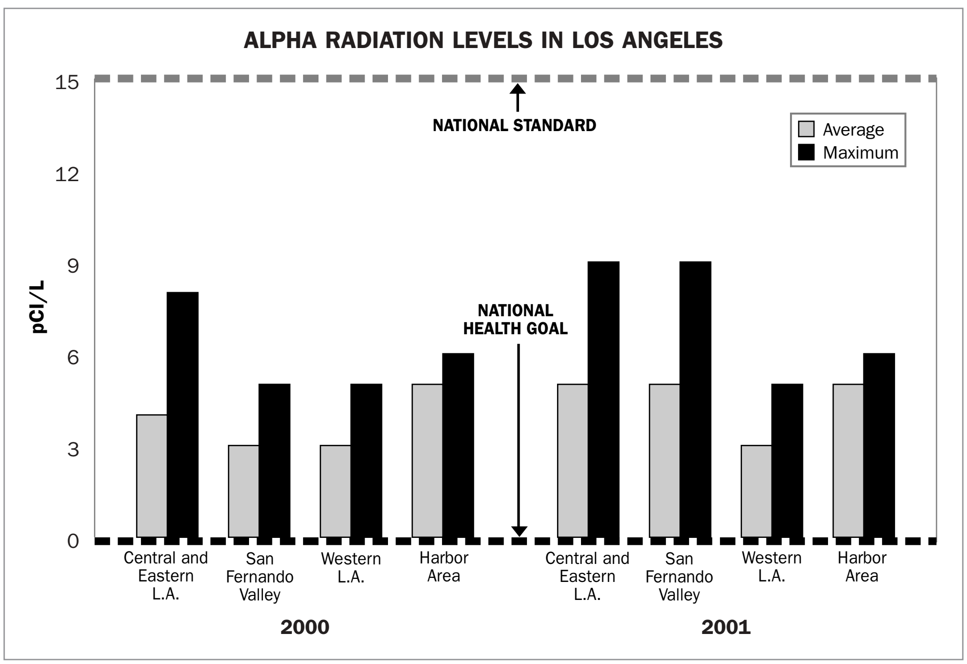
While no drinking water standard or monitoring requirement has been established for radon, levels detected in Los Angeles in 2000 were above the proposed national standard in some places.

Alpha Radiation

Levels Found 2000

Central and Eastern Los Angeles	4 pCi/L average	8 pCi/L[76] maximum
San Fernando Valley	3 pCi/L average	5 pCi/L[77] maximum
Western Los Angeles	3 pCi/L average	5 pCi/L[78] maximum
Harbor Area	5 pCi/L average	6 pCi/L[79] maximum

Averages listed are highest average for a source in the area listed.



Levels Found 2001

Central and Eastern Los Angeles	5 pCi/L average	9 pCi/L[80] maximum
San Fernando Valley	5 pCi/L average	9 pCi/L[81] maximum
Western Los Angeles	3 pCi/L average	5 pCi/L[82] maximum
Harbor Area	5 pCi/L average	6 pCi/L[83] maximum

Averages listed are highest average for a source in the area listed.

National Standard (MCL): 15 pCi/L

National Health Goal (MCLG): 0 pCi/L—there is no known fully safe level of alpha radiation

Gross alpha radiation[84] causes cancer. It generally comes from decay of radioactive minerals in underground rocks, and in some cases it can come from mining or the nuclear industry. Levels in L.A.'s water were below the EPA's standard, but still present a cancer risk.

Beta Radiation

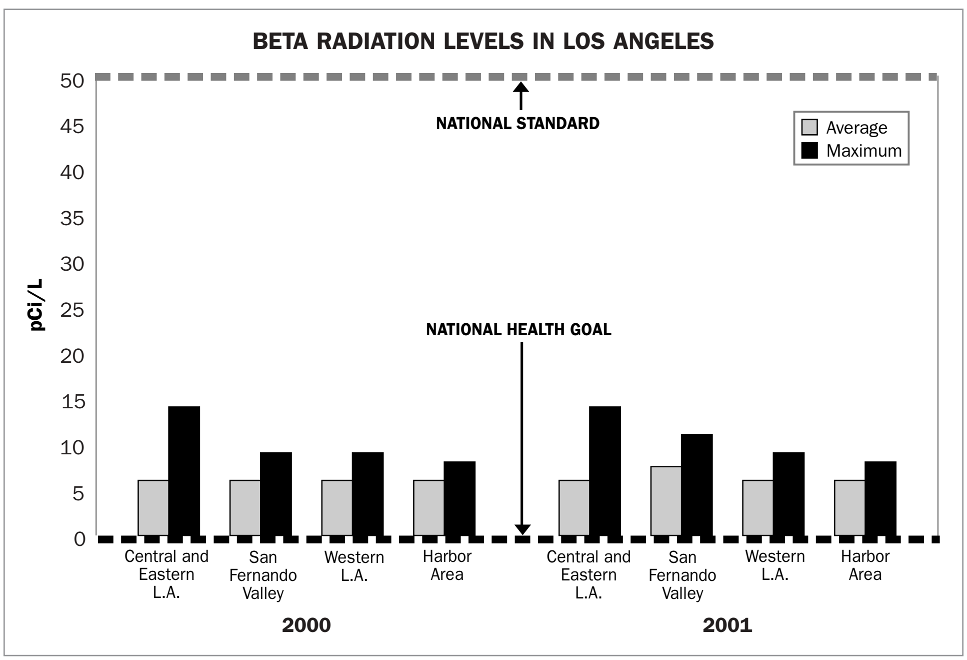
Levels Found 2000

Central and Eastern Los Angeles[85]	6 pCi/L average	14 pCi/L maximum
San Fernando Valley[86]	6 pCi/L average	9 pCi/L maximum
Western Los Angeles[87]	6 pCi/L average	9 pCi/L maximum
Harbor Area[88]	6 pCi/L average	8 pCi/L maximum

Averages listed are highest average for a source in the area listed.

Levels Found 2001

Central and Eastern Los Angeles[89]	6 pCi/L average	14 pCi/L maximum
San Fernando Valley[90]	7.5 pCi/L average	11 pCi/L maximum
Western Los Angeles[91]	6 pCi/L average	9 pCi/L maximum
Harbor Area[92]	6 pCi/L average	8 pCi/L maximum



Averages listed are highest average for a source in the area listed.

National Standard (MCL): 50 pCi/L (average)

National Health Goal (MCLG): 0 pCi/L—there is no known fully safe level of beta radiation

Beta radiation[93] causes cancer. It generally comes from decay of radioactive minerals in underground rocks, although in some cases has also come from nuclear testing or the nuclear industry. The levels of beta emitters in Los Angeles water are below the EPA standards, but still present a cancer risk.

Uranium

Levels Found 2000

Central and Eastern Los Angeles	4 pCi/L average	5 pCi/L maximum[94]
San Fernando Valley	3 pCi/L average	5 pCi/L maximum[95]
Western Los Angeles	3 pCi/L average	4 pCi/L[96]
Harbor Area	3 pCi/L average	4 pCi/L[97]

Averages listed are highest average for a source in the area listed.

Levels found 2001

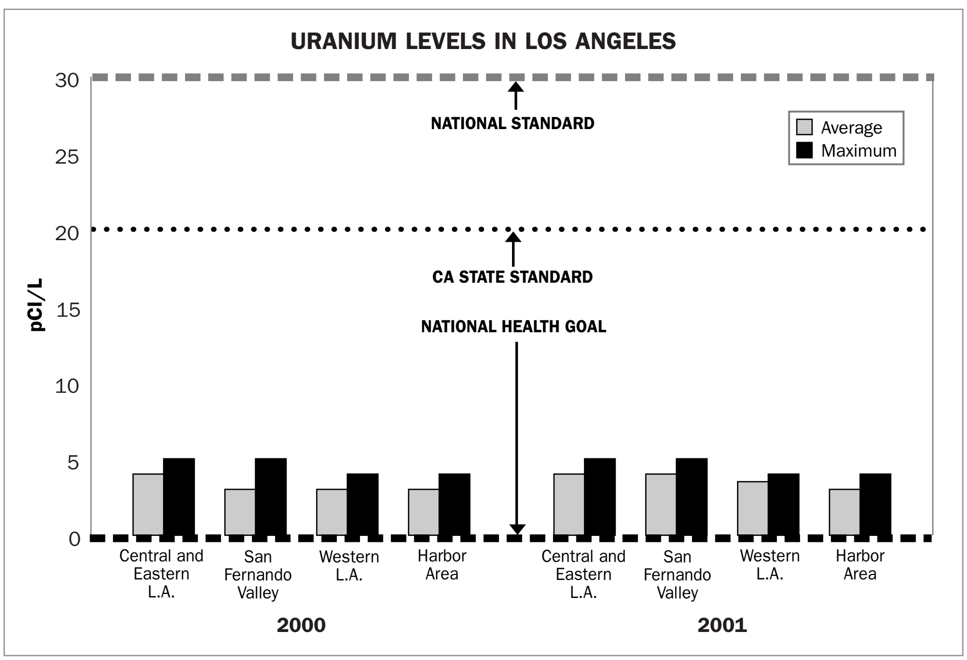
Central and Eastern Los Angeles	4 pCi/L average	5 pCi/L maximum[99]
San Fernando Valley	4 pCi/L average	5 pCi/L maximum[99]
Western Los Angeles	3.5 pCi/L average	4 pCi/L maximum[100]
Harbor Area	3 pCi/L average	4 pCi/L maximum[101]

Averages listed are highest average for a source in the area listed.

National Standard (MCL): 30 mg/L (EPA assumes to be @30 pCi/L)

National Health Goal (MCLG): 0 pCi/L—there is no known fully safe level of uranium

California Standard: 20 pCi/L



Uranium is radioactive and may cause cancer when ingested.[102] In addition, the EPA has determined that uranium also causes serious kidney damage at levels above the MCL. Uranium is contained in minerals in the ground, and sometimes is released by mining or by the nuclear industry. The source of the uranium and some other radionuclides in L.A. water is not known. Uranium tailings were placed along the Colorado plateau, and the Colorado River aqueduct also travels through the Coso range, which contains much radioactivity (see "Threats to Source Water" section on Colorado River, below). One expert notes that while uranium often occurs naturally, L.A. soil contains very little uranium.[103] Another potential source is a former Rocketdyne facility in the western end of the San Fernando Valley that is reported to have operated nuclear reactors, reprocessed nuclear fuel, and conducted fabrication. In addition, it is possible, this expert notes, that wells were recharged with water from the Colorado River.

While the EPA admits that uranium poses a cancer risk at levels below the EPA MCL of 30 pCi/L, the agency completed a cost-benefit analysis and found that, considering all U.S. water systems, including small systems where costs can be much higher per customer than they would be for larger systems like Los Angeles, the cost of reducing uranium to less than 30 pCi/L would not be justified by its benefits. The cancer risk at 30 pCi/L is about one in 10,000[104], the highest cancer risk the EPA usually allows in drinking water, and about 100 times higher than the one in one million risk the EPA allows for carcinogens under the Superfund or pesticide programs. California's standard of 20 pCi/L is about one-third lower than the EPA's MCL. L.A.'s water never approaches the California standard, but, in some areas of the city, still contains sufficient amounts of uranium to pose a modest cancer risk.

PROTECTING LOS ANGELES'S DRINKING WATER

Following are approaches to treating Los Angeles's drinking water, as well as a discussion of threats to source water. Also included in this section is information on how individuals can protect drinking water.

TREATMENT OPTIONS AVAILABLE FOR CONTAMINANTS OF GREATEST CONCERN

Treatment to reduce disinfection by-products, such as trihalomethanes and haloacetic acids. Los Angeles's disinfection by-product levels are relatively high in those areas of the city reliant upon surface water. The Los Angeles Department of Water and Power is phasing in a system-wide conversion to chloramines as an alternative disinfectant, with the goals of reducing the levels of DBPs that result from chlorine disinfection and improving the taste and odor of the water. Unlike "free chlorine" (pure chlorine gas) chloramines are considered less reactive, and form fewer disinfection by-products. Although they have recently been linked to the creation of very low levels of NDMA, a nitrogen-containing disinfection by-product with potential health risks, most experts believe that, on balance, chloramines are preferable to free chlorine because they modestly reduce TTHMs and many other chlorination by-products.

Disinfection by-products and other contaminants could be reduced with additional treatments. For significant reductions in TTHM levels, Los Angeles should plan to switch to activated carbon, or an alternative primary disinfectant such as ozone or ultraviolet light, which would reduce disinfection by-product levels further. L.A.'s Sylmar treatment plant, which treats most, but not all, of the city's water, uses ozone as part of its disinfection treatment train, but the city continues to use chlorine as well.[105] The continued use of chlorine negates some of the benefits that might be realized through a system-wide switch to ozone as the sole primary disinfectant, and chloramines as the secondary disinfectant for the distribution system—the city's pipes.

Treatment to Reduce Arsenic. Los Angeles has successfully reduced its drinking water arsenic levels somewhat in recent years, but additional reductions could be achieved with targeted treatment. The water sources that contain the highest levels of arsenic—Hot Creek, for example—could be targeted for treatment with activated alumina, granular ferric hydroxide, membranes, or other technologies that would further reduce arsenic levels in the city. The city says it has been studying options for arsenic treatment for several years in joint projects with the American Water Works Research Foundation. The city has not published cost estimates for such treatment, but the EPA projects that, in a city the size of Los Angeles, even if *all of the water* were treated for arsenic—a step not under consideration in Los Angeles—the cost of getting arsenic levels below 3 parts per billion would be less than $.75 per household per month.[106]

Treatment to Reduce Radon. The EPA has found that radon levels in tap water are very inexpensive to reduce using aeration, a technology that essentially bubbles air through the water. The cost per household is less than $.80 per month for families served by a large utility, according to the EPA.[107]

THREATS TO SOURCE WATER QUALITY

Los Angeles gets its water from three main sources. Some comes from the Los Angeles Aqueduct (LAA), some is purchased and imported by the Metropolitan Water District of Southern California (MWD), and some comes from local groundwater.

The Los Angeles Aqueduct provided for about 41 percent of the city's water needs in 2001, according to the 2001 right-to-know report from the Los Angeles Department of Water and Power (LADWP). Court decisions to provide additional aqueduct water to benefit the ecosystem in the Mono Basin and Owens Valley have limited the City's aqueduct deliveries. Still, over the next 20 years the Los Angeles Aqueduct (LAA) is expected to continue to provide nearly half of the city's water.[108] LADWP owns more than 314,000 acres of largely undeveloped watershed lands in the eastern Sierra, which are used to supply water to the LAA.[109] However, according to the EPA's Index of Watershed Indicators (IWI), the water quality in some of the streams and rivers upon which the LAA relies for water is threatened. For example, in the waters upstream of the LAA, Mono Lake[110] and Crowley Lake[111] are fragile ecosystems ranked as a 5 on the EPA's water quality threat scale (ranging from a low of 1 to a high of 6); further depletion of these threatened waters will not only cause environmental havoc, it would likely also reduce drinking water quality. The Owens River,[112] which feeds much of the LAA, is also ranked a 5 by the EPA. Hot Creek, which drains into the Owens River near Crowley Lake and ultimately into the LAA, is the most concentrated source of arsenic in the city's water supply, reportedly due to naturally occurring arsenic in this geothermally active area.[113] L.A.'s diversion of the Owens River for city water resulted in Owens Lake drying up completely by the 1920s, so the exposed dry lakebed became a major source of easily inhaled and arsenic-laden windblown dust.[114] The EPA classified the area as a serious nonattainment area for particulates (dust) in 1991 and required California to prepare a State Implementation Plan (SIP) to bring the region into compliance with federal air-quality standards by 2006.[115] Part of this SIP requires flooding part of the area with water.

The Metropolitan Water District of Southern California (MWD) is the largest wholesaler of water in California. On average, MWD provides approximately 47 percent of the city's water supply.[116] Much of this MWD water is from the State Water Project, which diverts water from the Sacramento-San Joaquin Delta in Northern California to Los Angeles.[117] The San Joaquin Delta is rated by the EPA's IWI as a 5 out of 6,[118] and an NRDC report concludes that the Bay-Delta area ecosystem and water quality are severely threatened.[119] Similarly, according to a review of Bay-Delta water quality by the state-federal agency CALFED, the contaminants in Bay-Delta waters of "most concern with respect to the production of drinking water include microbial pathogens, bromide, natural organic matter, dissolved solids, salinity, turbidity, and nutrients. Some other contaminants of Delta waters, including pesticides, metals, and methyl tertiary-butyl ether (MTBE), were evaluated and considered to be of limited significance to drinking water at this time because of their relatively low concentrations in Delta waters."[120] This relatively sanguine view of pesticides, metals, and gasoline constituents in Bay-Delta waters may change as additional data become available and more pollution sources are located in the watersheds.

The city also purchases MWD's Colorado River water. Colorado River water travels through a largely unprotected watershed past thousands of miles of farms, towns, and historical mining sites. The Colorado receives water containing substantial concentrations of the rocket fuel perchlorate from the Las Vegas Wash in Nevada, which is contaminated by a leaking waste area at a Kerr-McGee plant in Henderson, Nevada, and also receives contaminants from urbanized areas, including poorly treated wastewater discharges and runoff. A uranium tailing pile in Moab, Utah, is the size of 118 football fields, making it the largest tailings pile situated on the bank of a river—just 750 feet from the Colorado River and 10 feet above the aquifer, according to data collected by the Project on Government Oversight (POGO).[121] The tailings pile contains about 10.5 million tons of uranium mill wastes, including 426 million gallons of highly contaminated liquid.[122] The uranium tailing contaminant leakage into the Colorado River is estimated at 9,648 gallons per day. Radioactive uranium, ammonia, molybdenum, aluminum, iron, nitrates, and sulfates from the tailings site are contaminating groundwater that feeds into the Colorado River.[123] The river also has flooded 26 times this century to the level of the tailings.[124] In addition, the Colorado passes along the route of potential exposure from Yucca Mountain, the selected site for storage of the national repository of high-level radioactive waste.[125]

The U.S. Geological Survey (USGS) notes that water quality problems in the Colorado River include pesticides from farms, nutrients, metals from historic mining (although these often adhere to sediments), and dissolved solids.[126] USGS reports that the "salinity of the Colorado River probably is the biggest water-quality issue in the basin. The major sources of salinity are the saline soils of the Colorado Plateau and agricultural irrigation-return flows. . . . Urbanization, population growth, mining, agricultural practices, and recreation affect the salinity concentrations in the Colorado River."[127] The Colorado River water's elevated levels of total dissolved solids make reuse difficult and wreak havoc on plumbing and infrastructure.

Local Groundwater. LADWP says the city draws approximately 12 percent of its water supply from wells in the San Fernando Basin (SFB), and the Central, Sylmar and West Coast groundwater basins.[128] About 80 percent of this groundwater comes from the SFB, and in emergencies or during droughts, additional groundwater can be extracted from the SFB. LADWP says the availability of groundwater supplies is expected to increase by 2015 when recycled water will be used to recharge and replenish groundwater stored in the SFB.[129] Much of this groundwater is potentially vulnerable to surface contamination from industry, agriculture, and urbanization. An NRDC report documenting widespread groundwater contamination in California found that the San Fernando Basin is threatened by nitrate, chromium, solvents and other volatile organic compounds, and other contaminants.[130] The LADWP says that this groundwater is "replenished by deep percolation from rainfall, surface runoff, and from a portion of the water used (mainly from irrigation) within these basins."[131] Thus, at least some of these wells are potentially vulnerable to contamination from agricultural chemicals and other pollution sources.

OPEN RESERVOIRS

Of serious local concern are four uncovered reservoirs that hold treated drinking water before it is sent to consumers. Los Angeles was ordered by the California Department of Health Services to remove these from regular service, and was cited in 1998 for failing to meet an interim milestone for one of them—the Lower Stone Canyon reservoir. These uncovered reservoirs are subject to degradation from algae, aquatic organisms, microbes, airborne particles, humans and animals. Covering, abandoning, or replacing these uncovered reservoirs is needed to provide better protection. Until improvements are completed, Los Angeles will

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be out of compliance with the state interpretation of the requirements of the EPA's Surface Water Treatment Rule (SWT).[132] Even though the water stored in these reservoirs has been treated, it is considered raw because the reservoirs are uncovered. L.A. has said that all of these reservoirs will be maintained for use as reserve water supply for emergency conditions.[133] As of late 2001, L.A. continued to use two of the open-air reservoirs even in non-emergency situations, thereby posing a threat to tap water quality. Los Angeles did take two Hollywood reservoirs out of service in 2001, although it continued to operate them for use in emergencies. But the Encino and Lower Stone Canyon Reservoirs are open and still being used to supply drinking water. The city is under state orders to stop using them by 2003–2004.

HOW INDIVIDUALS CAN PROTECT SOURCE WATER

You can take steps to protect Los Angeles's drinking water by protecting its sources.

Reduce the amount of water you use. Plant drought-resistant plants or "xeriscape" (use plants that need little or no watering), use low-flow shower-heads, shorten your shower time, don't spray down your driveway to clean it, minimize the number of times (and how long) you water your lawn. Consider installing low-flush toilets. For more tips on water conservation, see:

- www.monolake.org
- www.mwdh2o.com/mwdh2o/pages/conserv/save/tentips/tentips01.html

Avoid using pesticides in the home or yard, or storing pesticides in the home. Consumer pesticide use in the home leads to runoff into water resources.

Buy organic foods, if possible. Purchasing organically grown food helps prevent the drinking water source contamination from pesticide and herbicide runoff that results from conventional agricultural practices.

Attend meetings of the Los Angeles Department of Water and Power (contact info below). The LADWP Board meets on the first and third Tuesdays of each month at 1:30 p.m. at LADWP, 111 N. Hope St., Room 1555H, in Los Angeles. For agendas visit www.ladwp.com/whatsnew/index.htm and look under "public meetings."

Attend meetings of the Metropolitan Water District of Southern California (MWD), which provides Los Angeles with about half of its water. According to MWD, "the general public is welcome to attend the monthly meetings of Metropolitan's board of directors, usually scheduled for the second Tuesday of each month. The meetings are held in the lobby-level boardroom at Metropolitan's headquarters in downtown Los Angeles, 700 North Alameda Street, adjacent to Union Station. For more information about the board meeting agenda, or to confirm the date and start time, please call Metropolitan's External Affairs Group at (213) 217-6485." You can also check MWD's website for more information at www.mwd.dst.ca.us/

Learn more from these groups:

- Clean Water Action, www.cleanwater.org
- Mono Lake Committee, www.monolake.org
- NRDC, www.nrdc.org
- Santa Monica Baykeeper, www.smbaykeeper.org
- Heal the Bay (Santa Monica), www.healthebay.org
- WaterKeepers Northern California, www.sfbaykeeper.org
- CALPIRG, www.calpirg.org
- Clean Water Network, www.cwn.org.

NOTES

1 Peer reviewers of the L.A. report included Marguerite Young, California Clean Water Action; Jonathan Parfrey, Executive Director, Los Angeles Physicians for Social Responsibility; and Frances Spivey-Weber, Mono Lake Committee, and David Beckman, NRDC.

2 City of Los Angeles Department of Water and Power (DWP), Annual Water Quality Report 2000, pg. 6, available online at www5.dwp.ci.la.ca.us/water/quality/Annual/index.htm (last visited March 30, 2002).

3 See EPA, Proposed Stage I Disinfection Byproducts Rule, 59 Fed. Reg. 38668 (July 29, 1994).

4 See EPA, Final Stage I Disinfection Byproducts Rule, 63 Fed. Reg. 69389 (December 16, 1998).

5 Cancer risk estimate is taken from NAS, National Research Council, *Arsenic in Drinking Water: 2001 Update*, 2001.

6 Cancer risk estimate is from EPA, Proposed National Primary Drinking Water Regulations: Radon 222, 64 Fed. Reg. 59246, 59270, Table VII.1 (November 2, 1999), which in turn is based upon the National Academy of Sciences' estimates in NAS, National Research Council, *Risk Assessment of Radon in Drinking Water*, pg. 17, Table ES-2 (1999).

7 Personal Communication with Mike Remwick, LADWP, August 19, 2002.

8 City of Los Angeles DWP, Annual Water Quality Report 2001, pg. 3, available online at www5.dwp.ci.la.ca.us/water/quality/Annual/AnnRep01/index.htm (last visited August 19, 2002).

9 LADWP, "City of LA Water Services: Water Supply Fact Sheet," available online at www5.ladwp.com/water/supply/facts/index.htm.

10 Ibid.

11 Ibid.

12 Ibid.

13 40 CFR §141.153(h)(3).

14 Personal Communication with LADWP, August 21, 2002.

15 See EPA regulations at 40 C.F.R. §141.153(d)(4)(ix), which provide that the RTK report must include "the likely source(s) of detected contaminants to the best of the operator's knowledge. Specific information about the contaminants may be available in sanitary surveys and source water assessments, and should be used when available to the operator." While EPA allows reliance upon general lists of potential sources where the water system is not aware of the specific source of pollution, where the water system *is* aware of the pollution source, the rules require that polluter to be identified.

16 EPA Index of Watershed Indicators, available online at www.epa.gov/iwi/hucs/18070105/score.html (last visited March 30, 2002).

17 City of Los Angeles DWP, Annual Water Quality Report 2000, pg. 6, available online at www5.dwp.ci.la.ca.us/water/quality/Annual/AnnRep00/index.htm (last visited March 31, 2002).

18 City of Los Angeles DWP, Annual Water Quality Report 2001, pg. 6, available online at www5.dwp.ci.la.ca.us/water/quality/Annual/AnnRep01/index.htm (last visited August 19, 2002).

19 City of Los Angeles DWP, Annual Water Quality Report 2001, pp. 8–9, available online at www5.dwp.ci.la.ca.us/water/quality/Annual/AnnRep01/WQARCELA.pdf (last visited March 31, 2002).

20 City of Los Angeles DWP, Annual Water Quality Report 2001, pp. 8–9, www5.dwp.ci.la.ca.us/water/quality/Annual/AnnRep01/WQARSF.pdf (last visited March 31, 2002).

21 City of Los Angeles DWP, Annual Water Quality Report 2000, pp. 8–9, available online at www5.dwp.ci.la.ca.us/water/quality/Annual/AnnRep00/WQARWLA.pdf (last visited March 31, 2002).

22 City of Los Angeles DWP, Annual Water Quality Report 2000, pp. 8–9, available online at www5.dwp.ci.la.ca.us/water/quality/Annual/AnnRep00/WQARH.pdf (last visited March 31 2002).

23 See note 19.

24 See note 20.

25 City of Los Angeles DWP, Annual Water Quality Report 2001, pp. 8–9, www5.dwp.ci.la.ca.us/water/quality/Annual/AnnRep01/WQARWLA.pdf (last visited March 31 2002).

26 City of Los Angeles DWP, Annual Water Quality Report 2001, pp. 8–9, www5.dwp.ci.la.ca.us/water/quality/Annual/AnnRep01/WQARH.pdf (last visited March 31 2002).

27 National Academy of Sciences, National Research Council, *Arsenic in Drinking Water,* 1999, available online at books.nap.edu/books/0309063337/html/index.html; National Academy of Sciences, National Research Council, *Arsenic in Drinking Water: 2001 Update,* 2001, available online at www.nap.edu/books/0309076293/html/.

28 National Academy of Sciences, National Research Council, *Arsenic in Drinking Water: 2001 Update,* 2001, available online at www.nap.edu/books/0309076293/html/. For a summary of the report, see www4.nationalacademies.org/news.nsf/isbn/0309076293?OpenDocument.

29 City of Los Angeles DWP, Arsenic Fact Sheet, available online at www.ladwp.com/water/quality/wq_arsnc.htm.

30 See note 26.

31 See EPA, Consumer Fact Sheets on Lead, available online at www.epa.gov/safewater/Pubs/lead1.html and www.epa.gov/safewater/standard/lead&co1.html, and IRIS summary for lead online at www.epa.gov/iris/subst/0277.htm.

32 City of Los Angeles DWP, Annual Water Quality Report 2001, pg. 13, available online at www5.dwp.ci.la.ca.us/water/quality/Annual/AnnRep01/WQARH.pdf; City of Los Angeles DWP, www5.ladwp.com/water/quality/wq_ldcp.htm.

33 Ibid.

34 See note 19.

35 See note 20.

36 See note 21.

37 See note 22.

38 See note 19.

39 See note 20.

40 See note 25.

41 See note 26.

42 The information regarding the health effects of nitrate are derived from National Academy of Sciences, National Research Council, *Nitrate and Nitrite in Drinking Water,* 1995, available online at www.nap.edu/catalog/9038.html; and EPA, Nitrates, (Fact sheet), available online at www.epa.gov/safewater/dwh/c-ioc/nitrates.html.

43 City of Los Angeles DWP, Annual Water Quality Report 2000, pp. 8–9, available online at www5.dwp.ci.la.ca.us/water/quality/Annual/AnnRep00/WQARCELA.pdf (last visited March 31, 2002).

44 City of Los Angeles DWP, Annual Water Quality Report 2000, pp. 8-9, available online at www5.dwp.ci.la.ca.us/water/quality/Annual/AnnRep00/WQARSF.pdf (last visited March 31, 2002).

45 See note 21.

46 See note 22.

47 See note 19.

48 See note 20.

49 See note 25.

50 See note 26.

51 Health effects information on disinfection by-products is summarized from NRDC, *Trouble on Tap* (1995); NRDC, *Bottled Water: Pure Drink or Pure Hype?* (1999), available online at www.nrdc.org/water/drinking/bw/bwinx.asp; and EPA, Draft Preamble for Stage 2 Disinfection By-products Regulation, available online at www.epa.gov/safewater/mdbp/st2dis-preamble.pdf.

52 From July 1997 to December 1998, participating water systems nationwide collected data on their raw and finished water under the Information Collection Rule (ICR) to guide future regulatory and public health decisions.

53 See note 51.

54 City of Los Angeles DWP, Annual Water Quality Report 2000, pp. 8-9, available online at, www5.dwp.ci.la.ca.us/water/quality/Annual/AnnRep00/WQARCELA.pdf (last visited March 31, 2002).

55 City of Los Angeles DWP, Annual Water Quality Report 2000, pp. 8-9, www5.dwp.ci.la.ca.us/water/quality/Annual/AnnRep00/WQARSF.pdf (last visited March 31, 2002).

56 See note 21.

57 See note 22.

58 See note 19.

59 See note 20.

60 See note 25.

61 See note 26.

62 A DWEL is the presumed level of perchlorate that one would need to consume in tap water to reach the Reference Dose—the maximum safe level. See EPA, “Perchlorate,” Fact Sheet, available online at www.epa.gov/safewater/ccl/perchlor/perchlo.html.

63 California Office of Environmental Health Assessment, Draft Public Health Goal for Perchlorate in Drinking Water (March 2002), available online at www.oehha.org/water/phg/pdf/PHGperchlorate372002.pdf.

64 MWD is well aware that this Henderson facility is the source of this perchlorate. See MWD, “In the News: Perchlorate.” Available online at www.mwdh2o.com/mwdh2o/pages/yourwater/ccr02/ccr03.html; MWD Press Release, “Water Officials Report Significant Progress in Perchlorate Removal,” April 17, 2002. This release puts an unduly optimistic face on the problem, since MWD is well aware that the cleanup of the facility remains problematic and partially unsuccessful. See also Environmental Working Group, Rocket Science (2001).

65 City of Los Angeles DWP, Annual Water Quality Report 2000, pg. 10, available online at, www5.dwp.ci.la.ca.us/water/quality/Annual/AnnRep00/WQARCELA.pdf (last visited March 31, 2002).

66 City of Los Angeles DWP, Annual Water Quality Report 2000, pg. 10, available online at, www5.dwp.ci.la.ca.us/water/quality/Annual/AnnRep00/WQARSF.pdf (last visited March 31, 2002).

67 City of Los Angeles DWP, Annual Water Quality Report 2000, pg. 10, available online at, www5.dwp.ci.la.ca.us/water/quality/Annual/AnnRep00/WQARWLA.pdf (last visited March 31, 2002).

68 City of Los Angeles DWP, Annual Water Quality Report 2000, pg. 10, available online at, www5.dwp.ci.la.ca.us/water/quality/Annual/AnnRep00/WQARH.pdf (Mar. 31, 2002).

69 EPA, Proposed Radon in Drinking Water Rule, 64 Fed. Reg. 59246, 59270 (Table VII.1) (last visited November 2, 1999).

70 City of Los Angeles DWP, Annual Water Quality Report 2001, pg. 10, available online at, www5.dwp.ci.la.ca.us/water/quality/Annual/AnnRep01/WQARCELA.pdf (last visited August 19, 2002).

71 City of Los Angeles DWP, Annual Water Quality Report 2001, pg. 10, www5.dwp.ci.la.ca.us/water/quality/Annual/AnnRep01/WQARSF.pdf (last visited August 19, 2002).

72 City of Los Angeles DWP, Annual Water Quality Report 2001, pg. 10, www5.dwp.ci.la.ca.us/water/quality/Annual/AnnRep01/WQARWLA.pdf (last visited August 19, 2002).

73 City of Los Angeles DWP, Annual Water Quality Report 2001, pg. 10, www5.dwp.ci.la.ca.us/water/quality/Annual/AnnRep01/WQARH.pdf (last visited August 19, 2002).

74 See note 69.

75 Ibid.

76 See note 65.

77 See note 66.

78 See note 67.

79 See note 68.

80 See note 70.

81 See note 71.

82 See note 72.

83 See note 73.

84 See EPA Fact Sheets on radionuclides for information on health effects and sources, available online at www.epa.gov/safewater/hfacts.html#Radioactive; and www.epa.gov/safewater/rads/technicalfacts.html.

85 See note 65.

86 See note 66.

87 See note 67.

88 See note 68.

89 See note 70.

90 See note 71.

91 See note 72.

92 See note 73.

93 See note 84.

94 See note 65.

95 See note 66.

96 See note 67.

97 See note 68.

98 See note 70.

99 See note 71.

100 See note 72.

101 See note 73.

102 Health effects information is derived from EPA's final rule issued in December 2000, 65 Fed. Reg. 76708 (December 7, 2000), available online at www.epa.gov/safewater/rads/radfr.pdf.

103 Personal Communication with Jonathan Parfrey, Executive Director, Physicians for Social Responsibility, Los Angeles, June 6, 2002.

104 EPA, Final Radionuclides National Primary Drinking Water Regulation, 65 Fed. Reg, 76708, pg. 76715 (December 7, 2000).

105 LADWP, "City of LA Water Services: Water Supply Fact Sheet," available online at www5.ladwp.com/water/supply/facts/index.htm.

106 EPA, Final Arsenic National Primary Drinking Water Regulation, 66 Fed. Reg. 7011, Table III.E-2 (January 22, 2001).

107 EPA, Proposed Radon in Drinking Water Rule, 64 Fed. Reg. 59246, 59328 (Table XIII.11)(Nov. 2, 1999).

108 Information quoted from LADWP Factsheet, available online at www.ladwp.com/water/supply/facts/index.htm.

109 http://web.ladwp.com/~wsoweb/Aqueduct/default.htm.

110 www.epa.gov/iwi/hucs/18090101/score.html.

111 www.epa.gov/iwi/hucs/18090102/score.html.

112 www.epa.gov/iwi/hucs/18090103/score.html.

113 J. Hering, "Chinatown Revisited: Arsenic and the Los Angeles Water Supply," Engineering & Science (1997), available online at http://pr.caltech.edu/periodicals/EandS/articles/Hering%20Feature.pdf.

114 Ibid.; see also LADWP, "Urban Water Management Plan, Fiscal Year 2000–2001 Annual Update, pg. 6.

115 LADWP, "Urban Water Management Plan, Fiscal Year 2000-2001 Annual Update, pg. 6.

116 Information from LADWP, 2001 Water Quality Report, and LADWP Factsheet, available online at www.ladwp.com/water/supply/facts/index.htm.

117 San Diego website, www.sannet.gov/water/quality/#a.

118 EPA, IWI, for the Jan Joaquin Delta is available online at www.epa.gov/iwi/hucs/18040003/score.html.

119 See www.nrdc.org/water/conservation/cabay/fcabay.asp.

120 CALFED, *Water Quality Program Plan,* pp. 3–5, July 2000.

121 See POGO, "Moab Utah Uranium Mill Tailings Fact Sheet," available online at www.pogo.org/p/environment/eo-000507-moab.htm.

122 Ibid.

123 Ibid.

124 Ibid.

125 See State of Nevada, *Mountain of Trouble: A Nation at Risk* (2002) (outlining risks to local hydrology from Yucca Mountain high level waste depository and from transportation of waste to the site).

126 USGS, "Water Quality in the Upper Colorado River Basin, 1996-1998, available online at http://water.usgs.gov/pubs/circ/circ1214/; USGS, "Monitoring the Quality of the Nation's Largest Rivers: The Colorado River NASQAN Program," available online at http://water.usgs.gov/nasqan/progdocs/factsheets/clrdfact/clrdfact.html.

127 USGS, "Monitoring the Quality of the Nation's Largest Rivers: The Colorado River NASQAN Program," available online at http://water.usgs.gov/nasqan/progdocs/factsheets/clrdfact/clrdfact.html

128 Information quoted from LADWP Factsheet, available online at www.ladwp.com/water/supply/facts/index.htm.

129 Ibid.

130 NRDC, *California's Contaminated Groundwater: Is the State Minding the Store?*, 2001, available online at www.nrdc.org/water/pollution/ccg/ccg.pdf.

131 www.ladwp.com/water/supply/grdwtr/index.htm.

132 "The reservoirs are Encino, Lower Stone Canyon, and Upper and Lower Hollywood. Projects are being developed with significant involvement from surrounding communities to meet this new standard. The Department's compliance is governed by an agreement with DHS entered into July 1993. Milestones include completion required by June 15, 1998, for Lower Stone Canyon Reservoir; January 1, 2001, for the Hollywood Reservoirs; and January 1, 2003, for Encino Reservoir." City of Los Angeles, Annual Water Quality Report 2000, pg. 14.

133 Ibid.

San Diego[1]

San Diego earned water quality and compliance grades of Fair in 2001 and 2000.

San Diego has no recent reported violations of current, pending, or proposed standards for water, but it does face some significant water quality issues.

Some areas of San Diego have high levels of cancer-causing chlorination byproducts (total trihalomethanes, or TTHMs), averaging just below the new EPA standard. In 2001, for example, San Diegans served by the Otay treatment plant had water in their taps with average TTHM levels of about 70 parts per billion (ppb), and peak levels of 95 parts per billion. The new EPA standard, effective in 2002, is an average of 80 parts per billion. While no apparent violations occurred, these high levels of TTHMs present a health concern, including a risk of cancer. The EPA announced the reduced TTHM standard more than eight years ago, in July 1994, after extensive regulatory negotiations resulted in an agreement with the water industry—a process of which San Diego was well aware and in which its wholesaler, the Metropolitan Water District of Southern California (MWD), participated.[3] The final rule was issued in 1998.[4]

Water from parts of the San Diego system contains the unregulated contaminant perchlorate, used in rocket fuel and explosives, at levels up to 4.8 parts per billion—higher than California's January 2002 action level of 4 parts per billion, and *much higher* than the 1 part per billion draft safe level proposed by the EPA in its recently issued draft drinking water equivalent level (DWEL). Perchlorate interferes with thyroid function. San Diego reports the average levels of perchlorate served by the Miramar plant were "less than 4.07 parts per billion," without citing the exact average, but some of the system had higher spikes.

At various times, several other contaminants were found in San Diego tap water at levels in excess of EPA health goals, albeit below enforceable standards. These included the carcinogen and reproductive toxin ethylene dibromide, lead, coliform bacteria, and three cancer-causing radioactive contaminants—gross alpha radiation, gross beta radiation, and uranium. Though not found at levels high enough to trigger violations, these contaminants pose a health concern since they occur at levels in excess of EPA health goals.

San Diego earned a Fair for its 2000 and 2001 right-to-know reports.

On the "good citizen" side of the ledger:

▶ The format of the right-to-know reports and tables was relatively user friendly.

▶ The reports made no overarching claim that the water is absolutely safe, as did some other cities' reports.

▶ San Diego translated the reports into Spanish and distributed them upon request to residents. An EPA-translated announcement about the importance of the report,

SAN DIEGO

System Population Served
1.2 million[2]

Water Quality and Compliance
2000▶Fair
2001▶Fair

Right-to-Know Report—Citizenship
2000▶Fair
2001▶Fair

Threats to Source Water
Imported Water **5**
Local **2**
(1=least threat to 6=highest threat)

REPORT CARD

along with a call for citizens to get it translated by someone who can understand it, was printed in six other languages on the report cover.

▶ The 2001 report included helpful information on the health effects of two important contaminants found in San Diego tap water at levels below EPA standards—perchlorate and trihalomethanes (TTHMs). The 2000 report also provided some information on TTHMs' effects. Although this information was incomplete for its failure to mention possible reproductive effects from TTHM exposure as identified in several studies, it commendably went beyond what the EPA requires by providing useful health effects information.

On the right-to-know, "not-so-good citizen" side of the ledger:

▶ The 2000 and 2001 reports both failed to disclose the results of the city's lead and copper monitoring. The most recent lead and copper test results are legally required to be disclosed in the right-to-know report.[5] San Diego revealed in 1999 that 10 percent of homes in the city had more than 5 parts per billion lead in their tap water, a finding that parents of infants and young children should have been told about in the 2000 and 2001 reports.[6]

▶ The reports failed to disclose the levels of several regulated contaminants found in the city's water, an apparent violation of EPA's rules for right-to-know reports. For example, in testing done in 2001,[7] San Diego found arsenic at levels reaching 1.7 parts per billion, barium at up to 83 parts per billion, chromium at up to 3.4 parts per billion, copper at up to 20 parts per billion, and selenium at up to 4.9 parts per billion. But the 2001 right-to-know report never mentioned these findings. While these contaminants were found at levels below EPA standards, some may be of health interest to consumers, including the arsenic and some of the radioactive contaminant findings that exceed the EPA health goals and present a cancer risk. EPA regulations clearly require that citizens be informed of these findings.[8]

▶ Similarly, San Diego's 2001 report did not acknowledge the presence of the gasoline additive MTBE in the city's water. San Diego's main supplier, the Metropolitan Water District of Southern California (MWD), has said that MTBE was in water delivered to the city in 2001. Interestingly, San Diego's 1999 report noted MTBE levels. EPA rules "strongly encourage," but do not require, disclosure of findings of such unregulated contaminants.

▶ The 2000 and 2001 reports included no information on specific known polluters of San Diego's watershed or aquifer, nor did they map or otherwise indicate the locations or types of such polluters. San Diego gave only generalized information on the *types* of facilities that may cause some pollutants (such as EDB and selenium) to contaminate city tap water, but EPA and California rules require utilities to name any specific known or likely sources of a regulated contaminant found in tap water.[9] For example, San Diego and the Metropolitan Water District are well aware that the source of the perchlorate contamination in the city's water supply that comes from the Colorado River is a Kerr-McGee plant in Nevada, but the RTK report never mentioned the plant, or any other source of perchlorate.[10] Even where EPA rules do not require such specific notice about a specific polluter, or where the specific polluter cannot be tied with assurance to a specific contaminant, EPA encourages water systems to highlight significant sources of contamination in the watershed. Dissemination of such information helps increase consumer awareness of the importance of protecting the watershed.

▶ The reports did not explain how San Diego's water is treated.

▶ The reports did not provide average levels of some contaminants, only the range of detections and a statement that the average level was "less than" a certain value. EPA rules require that the average level be disclosed. For example, the reports stated that the average level of haloacetic acids and certain radioactive contaminants was less than a certain level, but never revealed an average value. This obscuring of the actual level made it difficult for residents to compare the levels of particular contaminants to the EPA standard.

The need for major capital investments.

San Diego estimates that it will need to spend $146.5 million on drinking water capital investments in 2002, and has a five-year capital investment need of $528.5 million to upgrade, replace, and expand current facilities.[11] This figure includes near-term upgrade and expansion of two plants, the Alvarado Water Treatment Plant ($197.5 million), and the Miramar Water Treatment Plant ($143.5 million). It also includes water main replacements costing $50 million.[12]

In addition, San Diego Water's Public Advisory Group issued a long-term "Strategic Plan for Water Supply" in 1997 urging a $773 million Capital Improvements Program. The plan recommended "upgrading all three of the City's water treatment plants and expanding the capacity of two other treatment plants; service upgrades and repairs to pump stations and reservoirs; implementing state and federal mandated projects; increasing water conservation by five percent over current levels; and continuing the current water reclamation projects, including the North City Reclamation System, with the proposed repurification project."[13] The City Council approved a water revenue plan in 1997, along with a rate increase to support the recommended infrastructure improvements. In 1998, the city sold $383 million in water bonds.[14]

In addition, the San Diego County Water Authority (SDCWA), from which San Diego purchases much of its water, says it has a $1.2 billion capital improvement budget.[15]

San Diego earned "Threats to Source Water" ratings of 2 for its local water and 5 for its imported water.

San Diego relies on three major sources of drinking water. The City of San Diego Water Department uses surface water—storage reservoirs that capture rainwater—to supply 10 to 20 percent of the city's water. The city purchases the remaining 80 to 90 percent of its water from the Metropolitan Water District of Southern California (MWD). That water's primary source is the Colorado River, but some water also comes from the Sacramento-San Joaquin Delta in Northern California.

According to the EPA's Index of Watershed Indicators (IWI), the local San Diego watershed scored a 2 on a scale of 1 (least threat) to 6 (highest threat).[16] However, the water San Diego imports from the Sacramento-San Joaquin Delta is under extreme stress from heavy upstream agricultural use, including heavy pesticide and herbicide applications, and is rated by EPA's IWI as a 5 out of 6, due to "more serious problems" with water quality.[17] The water can also contain significant levels of bromide and organic carbon, which react with disinfectants and can contribute to elevated levels of harmful disinfection byproducts. The lower Sacramento River is ranked by IWI as a 3[18] on the scale of 1 to 6, but as its water travels downstream it becomes increasingly threatened and earns the worst IWI rating of 6.[19] The other source of MWD water, the Colorado River, has problems of its own. By the time it reaches Lake Havasu it has traveled through a largely unprotected watershed past thousands of miles of farms, towns, and old mining sites. For example, the enormous uranium tailing piles in Moab, Utah, are leaking radioactive uranium and other contaminants into the Colorado,[20] and the river passes along the route of potential exposure from Yucca Mountain, the selected site for storage of the national repository for high-level radioactive waste.[21] On its trip, water in the Colorado becomes contaminated in Henderson, Nevada, with perchlorate in the Las Vegas Wash from the Kerr-McGee facility, which manufactured rocket fuel, and receives poorly treated wastewater discharges. The U.S. Geological Survey (USGS) notes that water quality problems in the Colorado River include pesticides from farms, nutrients, metals from historic mining (although these often adhere to sediments), and dissolved solids.[22] In addition, the Colorado River water is high in total dissolved solids, which can make reuse difficult and wreak havoc on plumbing and infrastructure.

KEY CONTAMINANTS FOUND ABOVE NATIONAL HEALTH GOALS

The following contaminants are found in San Diego's drinking water. For more information on their properties and health effects, see Chapter 2, "Health Concerns for Common Tap Water Contaminants."

MICROBIOLOGICAL CONTAMINANTS

Total Coliform Bacteria

Levels Found 1999[23]	Alvarado: 0.8%	Miramar: 0%	Otay: 0%
Levels Found 2000[24]	Alvarado: 1.22%	Miramar: 0.41%	Otay: 0.41%
Levels Found 2001[25]	Alvarado: 0.42%	Miramar: 0%	Otay: 0.41%

National Standard: 5%

National Health Goal: 0%—there is no known, fully safe level of coliform bacteria.

Note that the contaminant levels are presented as a percentage. Total coliform is regulated as a percentage of positive samples present in water. The national standard of 5 percent means that if more than 5 percent of the utility's total coliform samples test positive, then the national standard has been violated. To say that a sample tests positive is to say that total coliform bacteria are present in the sample. Therefore, for compliance purposes, the utilities provide the percentage of total coliform samples that tested positive.

San Diego did not exceed the enforceable level for total coliform,[26] however, coliform bacteria were on occasion found in San Diego's water. As discussed in Chapter 2, total coliform bacteria are microbial contaminants used as a potential indicator that disease-causing microbes may be present in tap water. The highest reported total coliform level in any month in San Diego was 1.2 percent. The federal standard allows up to 5 percent coliform-positive samples per month, so San Diego's coliform finding is not viewed as a serious health risk to healthy consumers. However, on at least one occasion (in March 1998), San Diego found *Cryptosporidium* and *Giardia* parasites in untreated source water coming into the Otay filtration plant.[27] In addition, San Diego's occasional identification of coliform bacteria in its distribution system is an indication that bacteria may regrow in the city's pipes.

INORGANIC CONTAMINANTS

Lead

Levels Found 1999: 5 ppb at 90th percentile, 1 site > EPA Action Level
Levels Found 2000–2001: Not reported[28] (Apparent violation of EPA rules to fail to report lead levels in 2000 and 2001 right-to-know reports)
National Standard (TT): 15 ppb (action level)

Please note that the standard (or action level) for measuring lead is different than those of other contaminants. Water utilities are required to take 50 samples of lead in the tap water distribution system. If the amount of lead detected in the samples is more than 15 ppb at the 90th percentile (which means that 90 percent of the samples have 15 ppb or less), then the amount is considered a violation, and additional measures such as a treatment technique must be implemented.

National Health Goal (MCLG): 0 ppb—there is no known fully safe level of lead

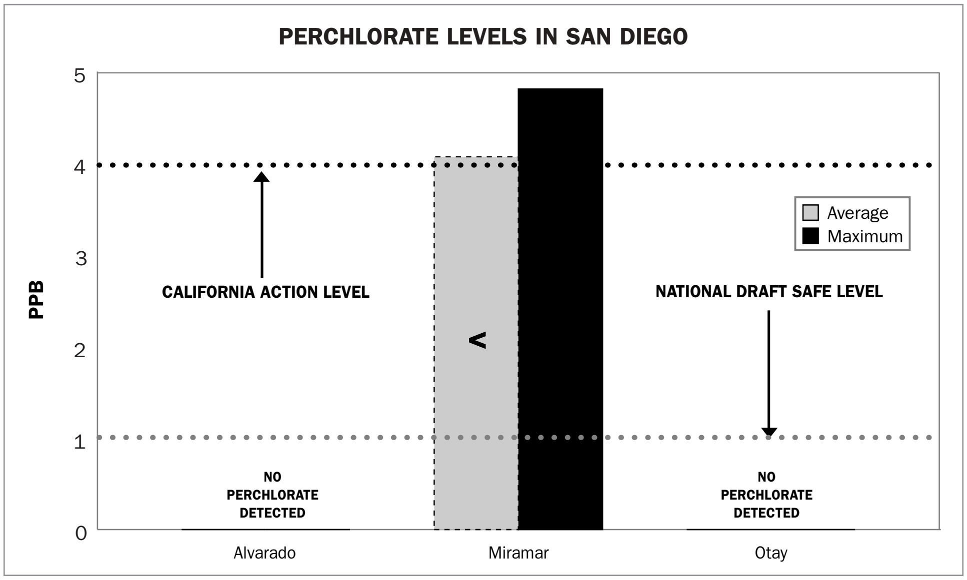
Lead is a major environmental threat; no amount of it in water is considered safe.[29] Infants, young children, and fetuses are particularly susceptible to the adverse health effects of lead. San Diego found no hazardous levels of lead in any of the homes it tested, but lead levels can vary enormously depending upon household plumbing. San Diego reports that its water is not corrosive and so is less likely to dissolve lead from plumbing fixtures than other cities' water. Lead pipe reportedly is not used in any of the city's water utility systems.

Perchlorate

Levels Found 2001[30]
Alvarado: not detected   Miramar: <4.07 average, 4.81 ppb high   Otay: not detected
National Standard (MCL): None established
National Draft Safe Level: (Drinking Water Equivalent Level): 1 ppb[31]
California Action Level: (health-based advisory level): 4 ppb[32]

Perchlorate[33] is an inorganic contaminant that harms the thyroid and may cause cancer. It usually comes from rocket fuel spills or leaks at military facilities.

San Diego's perchlorate levels of 4 to 4.8 parts per billion in part of the system are a health concern, based upon the state and federal EPA safety levels. It is troubling that San Diego, in issuing its 2001 right-to-know report published in June 2002, cited the outdated 18 parts per billion California action level, rather than the



updated 4 parts per billion California action level issued on January 18, 2002, five months before the San Diego report was issued.

ORGANIC CONTAMINANTS

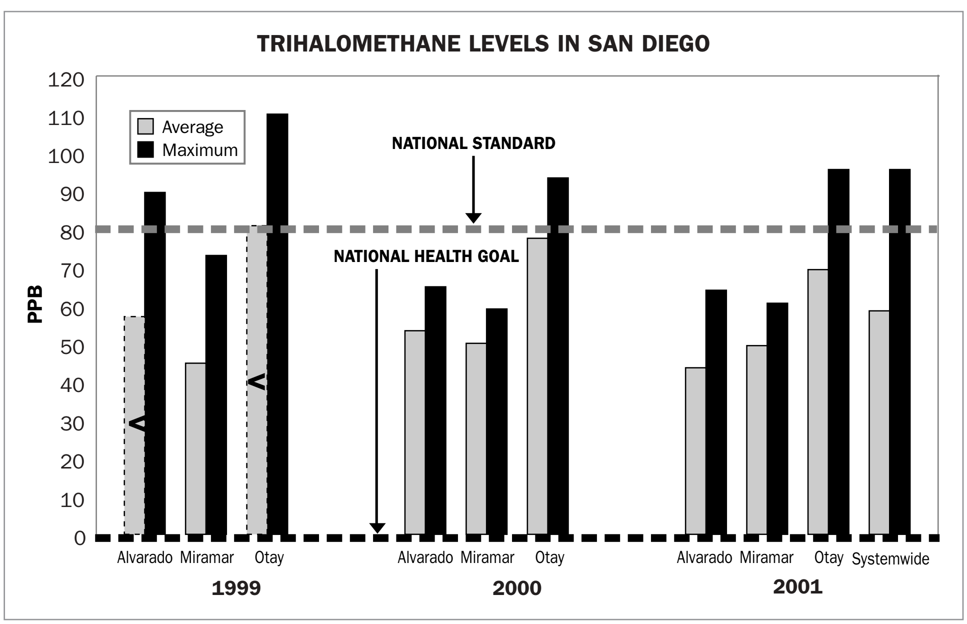
Total Trihalomethanes

Levels Found 1999[34]

Alvarado:	<57 average	89.5 maximum
Miramar	44.8 average	73.0 maximum
Otay	<80.8 average	110 maximum

Levels Found 2000[35]

Alvarado:	53.3 average	64.8 maximum



Miramar:	50.0 average	59.0 maximum
Otay:	77.5 average	93.3 maximum

Levels Found 2001[36]

System-wide	58.5 average	95.5 maximum
Alvarado	43.6 average	63.9 maximum
Miramar:	49.4 average	60.5 maximum
Otay	69.3 average	5.5 maximum

National Standard (MCL): 80 ppb (average) (effective 2002) (100 ppb effective through 2001))

National Health Goal (MCLG): 0 ppb—there is no known fully safe level of trihalomethanes.

Total trihalomethanes (TTHMs) consist of a sum of the levels of four closely related chemicals—chloroform, dibromochloromethane, bromoform, and bromodichloromethane—which occur together at varying ratios when water is chlorinated. The latter two TTHMs have health goals of zero. EPA promulgated and then withdrew (after a court decision) a zero health goal for chloroform, and has not yet issued a new goal for chloroform. Dibromochloromethane has a health goal of 60 ppb. Since water systems generally report only the combined TTHM level, and since it is essentially chemically impossible to create one trihalomethane in tap water without some level of the others, we list the health goal for TTHMs as zero.

Total trihalomethanes[37] are chemical contaminants that result when chlorine used to treat drinking water interacts with organic matter in the water. Many studies show that these chemicals are linked with cancer, and the EPA has classified some TTHMs as probable human carcinogens. Recent preliminary studies also link TTHMs to miscarriages and birth defects. The levels in San Diego—averaging right at the new 80 ppb standard in 2000 and averaging somewhat less in 2001—are a concern, particularly with spike levels as high as 95.5 ppb in 2001.

Haloacetic Acids

Levels found 2000[38]

Alvarado	<24.9 ppb average	<27.5 ppb maximum
Miramar	<23.5 ppb average	<26.3 ppb maximum
Otay	<34.4 ppb average	<45.4 ppb maximum

Levels found 2001[39]

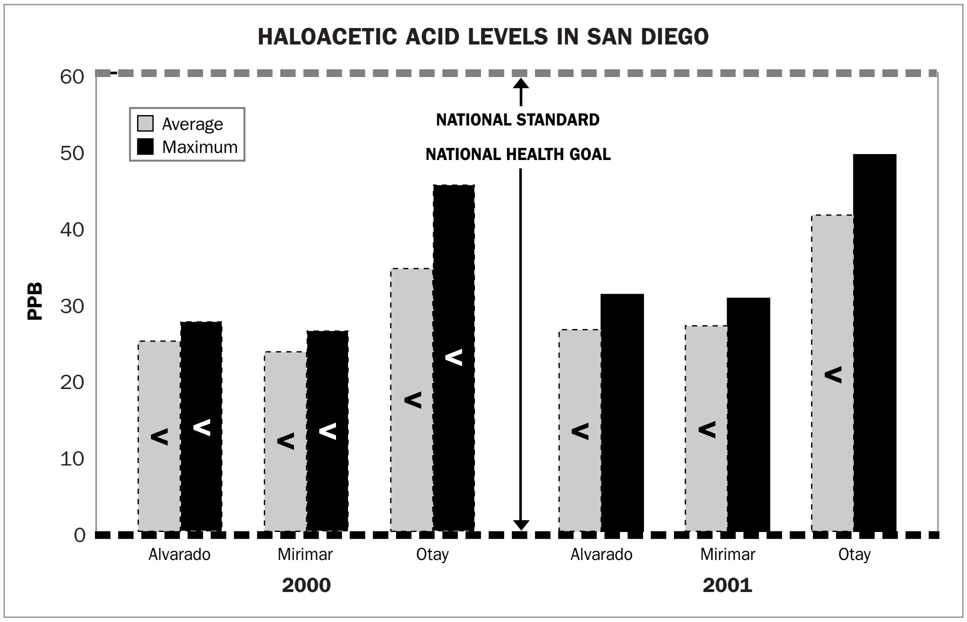
Alvarado	<26.4 ppb average	31 ppb maximum
Miramar	<26.9 ppb average	30.5 ppb maximum
Otay	<41.4 ppb average	49.3 ppb maximum

National Standard: 60 ppb (average) (effective 2002; no previous standard)

National Health Goal: 0 ppb—there is no known fully safe level of haloacetic acid

Some of the haloacetic acids have national health goals of zero and others have non-zero goals. For the purposes of consistency, we list the national health goal as zero because we list a single standard.

Haloacetic acids,[40] like TTHMs, are by-products of disinfection. People exposed to haloacetic acids in drinking water over a long term may be at risk of developing cancer and possibly other health problems.



Ethylene Dibromide (EDB)

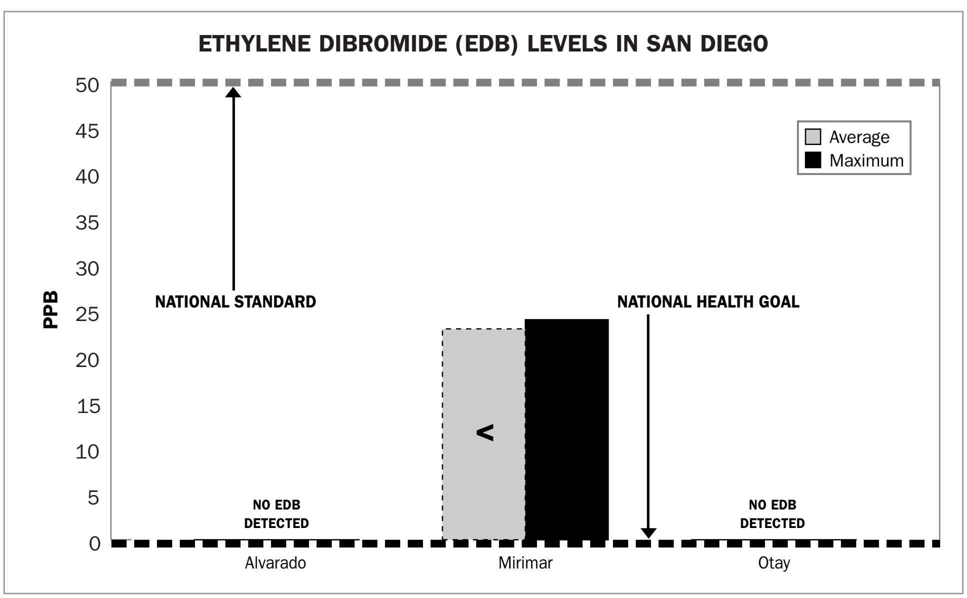
Levels Found 2002 (most recent data reported)[41]

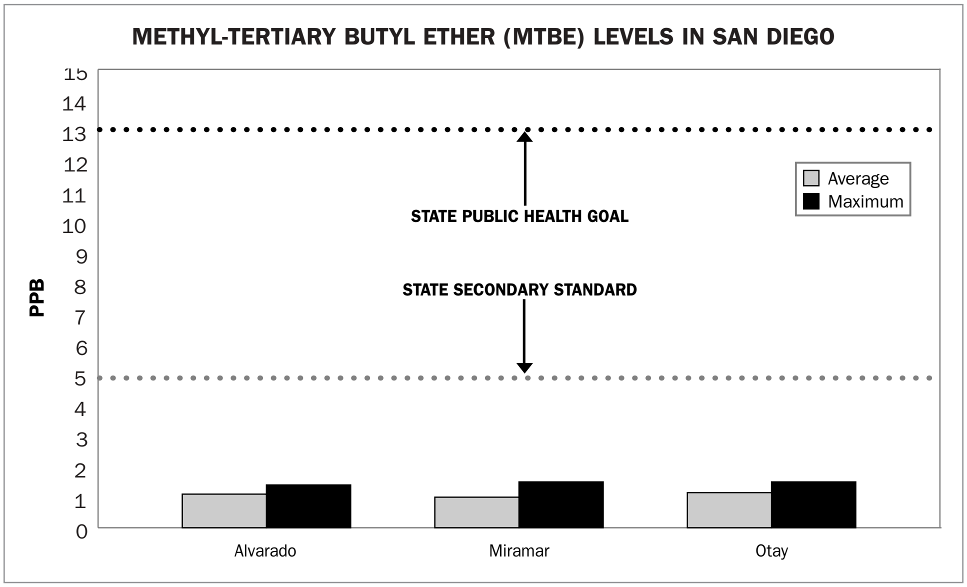
Alvarado	not detected	
Miramar	<23 ppt average	24 ppt high
Otay	not detected	

National Standard (MCL): 50 ppb (average)

National Health Goal (MCLG): 0 ppb—there is no known fully safe level of EDB.

Ethylene dibromide (EDB)[42] is a pesticide and industrial chemical found by the EPA to "potentially cause the following health effects when people are exposed to it at levels above the MCL for relatively short periods of time: damage to the liver, stomach, and adrenal glands, along with significant reproductive system toxicity,





particularly the testes."[43] The EPA also says that "EDB has the potential to cause the following effects from a lifetime exposure at levels above the MCL: damage to the respiratory system, nervous system, liver, heart, and kidneys; cancer."[44]

Methyl-Tertiary Butyl Ether (MTBE)

Levels Found 1999 (most recent data reported by San Diego)[45]

Alvarado	1.1 ppb average	1.4 ppb maximum
Miramar	1.0 ppb average	1.5 ppb maximum
Otay	1.15 ppb average	1.5 ppb maximum

Levels Found 2002 (reported by MWD for Skinner Plants, which serve San Diego)

	Non-detect average	1.3 ppb maximum

National or California Standard: none

National Health Goal (MCLG): none

EPA Health Advisory: 20–40 ppb (based on taste and odor concerns; the EPA says safe health level is higher)

California Secondary Standard (based on taste and odor problems): 5 ppb

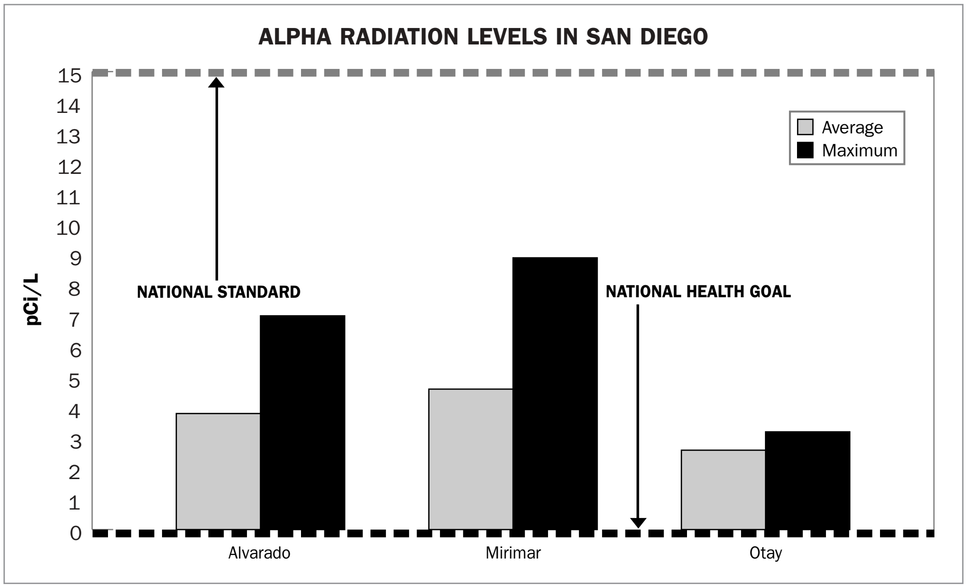
California Public Health Goal (based on cancer risk): 13 ppb[46]

Methyl-tertiary butyl ether[47] (MTBE) is a gasoline additive that gets into drinking water through discharges from chemical or petroleum factories, or from gasoline spills or leaks from underground or aboveground fuel storage tanks. It has been found in animal studies to cause testicular cancer, kidney cancer, lymphoma, and leukemia.

RADIOACTIVE CONTAMINANTS

Alpha Radiation

Levels Found 1998 (in picocuries per liter, or pCi/L, most recent data reported)[48]

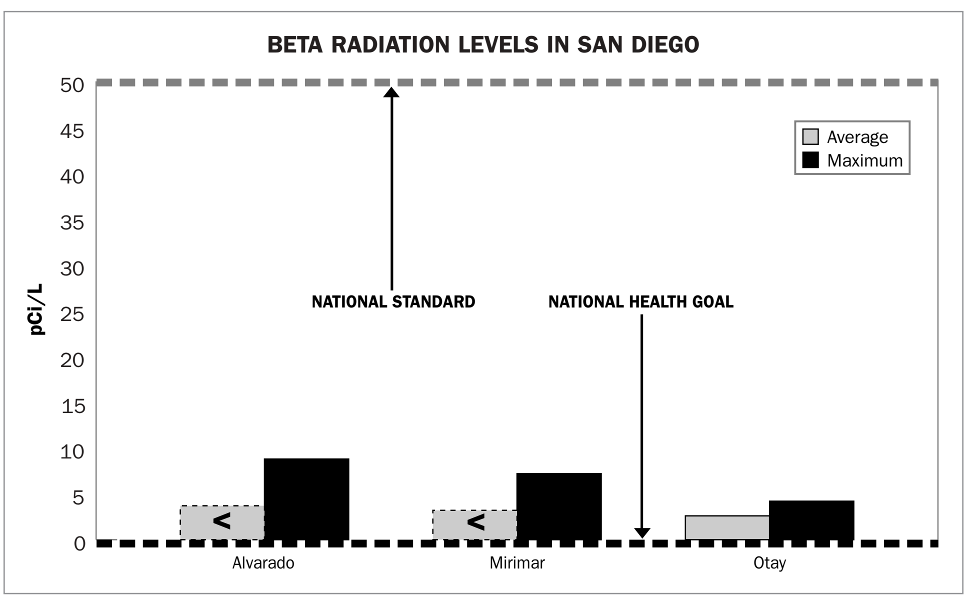


Alvarado	3.8 pCi/L average	7.0 pCi/L maximum
Miramar	4.6 pCi/L average	8.9 pCi/L maximum
Otay	2.6 pCi/L average	3.2 pCi/L maximum

National Standard (MCL): 15 pCi/L (average)

National Health Goal (MCLG): 0 ppb—there is no known fully safe level of alpha radiation

Alpha radiation is known to cause cancer. It usually results from the breakdown of natural radioactive elements in the ground. Because any level of exposure to gross alpha radiation can cause cancer, the EPA has set a health goal of zero for this radioactive contaminant. Thus, any exposure to this radioactive contaminant poses some cancer risk.



Beta Radiation

Levels Found 1998 (in picocuries per liter, or pCi/L, most recent data reported)[49]

Alvarado	<3.7 pCi/L average	8.8 pCi/L maximum
Miramar	<3.2 pCi/L average	7.2 pCi/L maximum
Otay	2.6 pCi/L average	4.2 pCi/L maximum

National Standard (MCL): 50 pCi/L (average)

National Health Goal (MCLG): 0 ppb—there is no known fully safe level of beta radiation

Gross beta particles are a form of radiation that can pollute drinking water when radioactive minerals in the environment erode, or as a result of mining or surface disturbances that may mobilize radioactive minerals. Gross beta radiation is a known human carcinogen. Because any level of exposure to gross beta radiation can cause cancer, EPA has set a health goal of zero for this radioactive contaminant. Thus, any exposure to this radioactive contaminant poses some cancer risk.

Uranium

Levels Found 1998 (in picocuries per liter, or pCi/L, most recent data reported)[50]

Alvarado	<1.4 pCi/L average	1.8 pCi/L maximum
Miramar	2.2 pCi/L average	2.5 pCi/L maximum
Otay	<0.8 pCi/L average	1.1 pCi/L maximum

National Standard (MCL): 30 mg/L (EPA assumes to be @30 pCi/L)

National Health Goal (MCLG): 0 ppb—there is no known fully safe level of uranium

California Standard: 20 pCi/L (average)

Uranium is a radioactive element that can pollute drinking water when radioactive uranium-containing minerals in the environment erode, or as a result of mining or surface disturbances that may mobilize radioactive minerals.[51] Uranium is a known human carcinogen, and it also causes damage to the kidneys. Because any level of radiation can cause cancer, EPA has set a health goal of zero for this radioactive contaminant. Thus, any exposure poses some cancer risk.

PROTECTING SAN DIEGO'S DRINKING WATER

Following are approaches to treating San Diego's drinking water, as well as a discussion of threats to source water. Also included in this section is information on how individuals can protect drinking water.

TREATMENT OPTIONS AVAILABLE FOR CONTAMINANTS OF GREATEST CONCERN

Treatment to Reduce Disinfection Byproducts (Such as Trihalomethanes and Haloacetic Acids). By comparison to other cities that use surface water, San Diego's disinfection by-product levels are high and should be reduced with additional treatment. For example, enhanced coagulation, activated carbon, and/or the use of an alternative primary disinfectant such as ozone or ultraviolet light could reduce by-product levels further. In addition, San Diego has found *Cryptosporidium* and *Giardia* parasites in untreated source water coming into the Otay filtration plant.[52] Although

San Diego claims it has never found viable *Cryptosporidium* in its *finished* drinking water (*Crypto* generally is impossible to find in finished water for methodological reasons), ozone or ultraviolet light would offer a measure of additional assurance against *Crypto.* These disinfection technologies are far more effective at killing *Crypto* and certain other resistant parasites than is San Diego's current choice, chlorine. The use of ozone may, however, be somewhat limited if San Diego uses its water sources with high bromine water because high bromine water creates bromate at elevated levels when ozonated.

CURRENT AND FUTURE THREATS TO SOURCE WATER

San Diego has not yet completed the source water assessment that must be done by 2003, but has finished a "Watershed Sanitary Survey," which is available from the water department by calling (619) 527-3121. Some of the watersheds relied upon by the city are known to be susceptible to such problems as cattle and other grazing animals, urban runoff, wastewater collection systems and discharges, concentrated animal facilities, human residential and recreational use, and agricultural and industrial use.

Three water treatment plants serve the City of San Diego. South San Diego gets water from the Otay Filtration Plant, central San Diego's water comes from the Alvarado Filtration Plant located at Lake Murray, and north San Diego gets water from the Miramar Filtration Plant.[53] About 80 to 90 percent of San Diego's water is purchased from the Metropolitan Water District of Southern California,[54] the largest wholesaler of water in the state.

Colorado River Water. In 2001, most of the city's water—about two-thirds of SDCWA water[55]—was purchased from MWD's Colorado River system. Colorado River water travels through a largely unprotected watershed past thousands of miles of farms, towns, and historical mining sites. The Colorado receives water containing substantial concentrations of the rocket fuel perchlorate in Nevada from the Las Vegas Wash, which is contaminated by a leaking waste area at a Kerr-McGee plant in Henderson, Nevada, and also receives contaminants from urbanized areas, including poorly treated wastewater discharges and runoff. Uranium tailing piles in Moab, Utah, are the size of 118 football fields, making them the largest tailings pile situated on the banks of a river, situated as they are just 750 feet from the Colorado River and 10 feet above the aquifer, according to data collected by the Project on Government Oversight (POGO).[56] The tailings piles contain about 10.5 million tons of uranium mill wastes including 426 million gallons of highly contaminated liquid.[57] The uranium tailing contaminant leakage into the Colorado River is estimated at 9,648 gallons per day. Radioactive uranium, ammonia, molybdenum, aluminum, iron, nitrates, and sulfates from the tailings site are contaminating groundwater that feeds into the Colorado River.[58] The river also has flooded 26 times this century to the level of the tailings.[59] In addition, the Colorado passes along the route of potential exposure from Yucca Mountain, the selected site for storage of the national repository for high level radioactive waste.[60]

The U.S. Geological Survey (USGS) notes that water quality problems in the Colorado River include pesticides from farms, nutrients, metals from historic mining (although these often adhere to sediments), and dissolved solids.[61] USGS reports that the "salinity of the Colorado River probably is the biggest water-quality issue in the basin. The major sources of salinity are the saline soils of the Colorado Plateau and agricultural irrigation-return flows. . . . Urbanization, population growth, mining, agricultural practices, and recreation affect the salinity concentrations in the Colorado River."[62]

The Colorado River's elevated levels of total dissolved solids (salinity) make reuse difficult and wreak havoc on plumbing and infrastructure. Because of this problem, San Diego officials have sought more water from other, cleaner sources (such as from the Sacramento-San Joaquin Delta, see below) to mix with saltier Colorado River water. Estimates are that the Colorado River water carries 9 million tons of salt to Southern California's local surface and groundwater sources each year.[63] Most of the urbanizing watersheds in San Diego County (*e.g.* the San Diego River watershed) are already listed as impaired because of excessive total dissolved solids (salt), which also adversely affect groundwater quality.[64]

The SDCWA recently reached a water transfer agreement with the Imperial Irrigation District. The agreement is expected to go into force in 2003 with a delivery of 20,000 acre-feet of water. By 2012, the transfer will bring up to 200,000 acre-feet of Colorado River water annually to the SDCWA's service area.[65]

Sacramento–San Joaquin Delta Water from Northern California. The rest of San Diego's MWD water, about a quarter of San Diego County Water Authority water in 2001, was imported via the "State Water Project," which comes from the Sacramento-San Joaquin Delta in Northern California.[66] The San Joaquin Delta earned a 5 rating by EPA's IWI, on a scale of 1 (best) to 6 (worst).[67] An NRDC report concludes that the Delta area ecosystem and water quality are severely threatened.[68] And, according to a review of Delta water quality by the state-federal agency CALFED, the contaminants in Delta waters of "most concern with respect to the production of drinking water include microbial pathogens, bromide, natural organic matter, dissolved solids, salinity, turbidity, and nutrients. Some other contaminants of Delta waters, including pesticides, metals, and methyl tertiary-butyl ether (MTBE), were evaluated and considered to be of limited significance to drinking water at this time because of their relatively low concentrations in Delta waters."[69] This relatively sanguine view of pesticides, metals, and gasoline constituents in Delta waters may change as additional data become available and more pollution sources are located in the watersheds.

Local Water Sources. Finally, about 10 to 20 percent of the city's water supply is made up of local rainfall captured in reservoirs.[70] EPA's Index of Watershed Indicators (IWI) ranks the local San Diego watershed as a 2 out of 6 (1 is least threat; 6 is highest threat). In EPA's words, "The overall IWI score. . . describes the health of the aquatic resources for this watershed. A score of 2 indicates Better Water Quality (few problems with watershed condition), High Vulnerability to stressors such as pollutant

Figure 1
Imported Sources of Water for San Diego and Southern California

Source: Metropolitan Water District of Southern California, 2002

loadings (due to significant pollution and high vulnerability to declines in aquatic health)."[71] Generally, locally produced water is of relatively high quality, but urban sprawl and polluted runoff, coupled with salinity from imported water sources, threatens local potable water quality.[72] Unfortunately, San Diego County does little or nothing to coordinate land use planning and source water protection, posing a significant threat to future use of local water resources.[73]

The City of San Diego is evaluating a 3,800 acre-feet per year groundwater recharge and recovery program in the San Pasqual basin.[74] Other alternatives that have been proposed include using Pueblo water rights for the city. In addition, many other localities served by the San Diego County Water Authority (SDCWA) are currently using groundwater; some jurisdictions now recharge or plan to recharge groundwater with "reclaimed water"—that is, treated municipal wastewater.[75] Such projects have sometimes been highly controversial, due in part to concerns about water quality and the safety of relying upon such water for drinking. In addition, parts of the SDCWA service area are already using or seriously evaluating the use of reverse osmosis treatment to desalinate salty water for use as a drinking water source. Recently, the SDCWA board decided to initiate a study of seawater desalination as a possible additional way to diversify the county's water supplies.[76]

The SDCWA and others locally have promoted water-conserving plumbing fixtures, appliances, landscaping, and agricultural irrigation systems. According to the SDCWA, per capita water use in the county is now 13 percent less than it was in 1990.[77]

HOW INDIVIDUALS CAN PROTECT SOURCE WATER

You can take steps to protect San Diego's drinking water by protecting its sources.

Reduce the amount of water you use. Plant drought-resistant plants or "xeriscape" (use plants that need little or no watering), use low-flow shower-heads, shorten your shower time, don't spray down your driveway to clean it, minimize the number of times (and how long) you water your lawn. Consider installing low-flush toilets. Recycled wastewater can be used for landscaping and industrial applications. You can even get a voucher for an ultra-low-flush toilet in San Diego. See the City Water Department's excellent website on water conservation at www.sandiego.gov/water/conservation/consprogram.shtml for details.

For more tips on water conservation, see:

- www.monolake.org
- www.mwdh2o.com/mwdh2o/pages/conserv/save/tentips/tentips01.html

Get a *free* water conservation survey for your San Diego home conducted by the Water Department. A Water Conservation representative will tour your property to identify leaks and water-saving opportunities. The representative will even give you low-flow showerheads, faucet aerators, and other free items! The representative will evaluate your landscape and irrigation systems. For a free water survey, call the City of San Diego Water Conservation Hotline at (619) 515-3500 or E-mail them at water@sandiego.gov.

Avoid using pesticides in the home or yard, or storing pesticides in the home. Consumer pesticide use in the home leads to runoff into water resources.

Buy organic foods, if possible. Purchasing organically grown food helps prevent the drinking water source contamination from pesticide and herbicide runoff that results from conventional agricultural practices.

Attend meetings of the City of San Diego Water Department (info below), and the San Diego County Water Authority, (828) 522-6700, (www.sdcwa.org). Ask for dates, times, and locations.

Attend meetings of your local water supplier, the City of Fresno Department of Public Utilities—Water Division. Check the right-to-know report or call and ask for dates, times, and locations. (Contact information above.)

F**ind out what watershed you live in and contact the San Diego stormwater pollution prevention program for information on how to reduce stormwater pollution.** Check out

SAN DIEGO WATER UTILITY INFORMATION
City of San Diego Water Department
Operations Division 2797
Caminito Chollas, MS 43
San Diego, CA 92105-5097
(619) 527-3121
www.sandiego.gov/water
www.thinkbluesd.org

the "Think Blue San Diego" website for tips on how to reduce storm water pollution at www.thinkbluesd.org.

Learn more from these groups:
- Clean Water Action, www.cleanwater.org
- NRDC, www.nrdc.org
- Environmental Health Coalition, www.environmentalhealth.org
- Mono Lake Committee, www.monolake.org
- WaterKeepers Northern California, www.sfbaykeeper.org
- CALPIRG, www.calpirg.org
- Clean Water Network, www.cwn.org

NOTES

1 Peer Reviewers for the San Diego report included Suzanne Michel, San Diego State University, and Marguerite Young, California Clean Water Action.

2 The City of San Diego, Water Department, Consumer Confidence Report 2001, available online at www.sandiego.gov/water/quality/index.shtml or www.sannet.gov/water/quality/report01.pdf.

3 See EPA Proposed Stage I Disinfection Byproducts Rule, 59 Fed. Reg. 38668, July 29, 1994.

4 See EPA Final Stage I Disinfection Byproducts Rule, 63 Fed. Reg. 69389, December 16, 1998.

5 See 40 C.F.R. § 141.153(d)(4)(vi).

6 The City of San Diego, Water Department, "Consumer Confidence Report 1999," available online at www.sannet.gov/water/quality/report99.pdf .

7 Testing reported in online file at www.sandiego.gov/water/quality/monthly.pdf.

8 See 40 C.F.R. §141.153(d)(4).

9 See EPA regulations at 40 C.F.R. § 141.153(d)(4)(ix), which provide that the right-to-know report must include "the likely source(s) of detected contaminants to the best of the operator's knowledge. Specific information about the contaminants may be available in sanitary surveys and source water assessments, and should be used when available to the operator." While EPA allows reliance upon general lists of potential sources where the water system is not aware of the specific source of pollution, where the water system is aware of the pollution source, the rules require that polluter to be identified.

10 See, for example, MWD—Southern California's online fact sheet on perchlorate, mentioning Nevada source of perchlorate, a fact not mentioned by San Diego. See www.mwd.dst.ca.us/mwdh2o/pages/yourwater/ccr02/ccr03.html.

11 "Larger Cities Report Capital Improvement Needs," *WaterWorld: Water and Wastewater Technology*, December 2001, available online at www.pennet.com/Articles.

12 Ibid.

13 City of San Diego Water Department, Infrastructure and Capital Improvements, fact sheet available online at www.sandiego.gov/water/cip/background.shtml.

14 Ibid.

15 See San Diego County Water Authority: An Overview (fact sheet), July 2002, available online at www.sdcwa.org/about/sdcwa-overview-2002.pdf.

16 EPA Index of Watershed Indicators, at www.epa.gov/iwi/hucs/18070304/score.html (last visited 3/31/02).

17 EPA, IWI, for the San Joaquin Delta is available online at www.epa.gov/iwi/hucs/18040003/score.html.

18 See EPA, IWI at www.epa.gov/iwi/hucs/18020109/score.html.

19 Ibid.

20 See POGO, "Moab Utah Uranium Mill Tailings Fact Sheet," available online at www.pogo.org/p/environment/eo-000507-moab.htm.

21 See State of Nevada, *Mountain of Trouble: A Nation at Risk,* (2002), outlining risks to local hydrology from Yucca Mountain high-level waste depository and from transportation of waste to the site.

22 USGS, "Water Quality in the Upper Colorado River Basin, 1996-1998, available online at http://water.usgs.gov/pubs/circ/circ1214/; USGS, "Monitoring the Quality of the Nation's Largest Rivers: The Colorado River NASQAN Program," available online at http://water.usgs.gov/nasqan/progdocs/factsheets/clrdfact/clrdfact.html.

23 See note 6.

24 Ibid.

25 See note 7.

26 The information on health effects of coliform is derived from EPA, "Total Coliform Rule," 54 Fed.Reg. 27544-27568, June 29, 1989, and EPA, "Total Coliform Rule: A Quick Reference Guide" available online at *Total Coliform Rule: A Quick Reference Guide* PDF File 816-F-01-035, September 2001.

27 EPA, ICR Data for San Diego Water Department, available online at www.epa.gov/enviro/html/icr/utility/report/CA3710020960610083945.html.

28 The City of San Diego, Water Department, "Consumer Confidence Report 2000," available online at www.sannet.gov/water/quality/report00.pdf (last visited April 1, 2002).

29 See EPA, "Consumer Fact Sheets on Lead," www.epa.gov/safewater/Pubs/lead1.html and www.epa.gov/safewater/standard/lead&co1.html; IRIS summary for lead online at www.epa.gov/iris/subst/0277.htm.

30 See note 2.

31 A DWEL is the presumed level of perchlorate that one would need to consume in tap water to reach the Reference Dose—the maximum safe level. See EPA, "Perchlorate," fact sheet available online at http://www.epa.gov/safewater/ccl/perchlor/perchlo.html.

32 See California Department of Health Services, "Drinking Water Action Level for Perchlorate," available online at www.dhs.ca.gov/ps/ddwem/chemicals/perchl/actionlevel.htm.

33 California Office of Environmental Health Assessment, "Draft Public Health Goal for Perchlorate in Drinking Water," March 2002, available online at www.oehha.org/water/phg/pdf/PHGperchlorate372002.pdf.

34 See note 6.

35 See note 28.

36 See note 30.

37 Health effects information on disinfection byproducts is summarized from NRDC, *Trouble on Tap* (1995); NRDC, *Bottled Water: Pure Drink or Pure Hype?* (1999), available online at www.nrdc.org/water/drinking/bw/bwinx.asp; and EPA, draft Preamble for Stage 2 Disinfection By-products Regulation, available online at www.epa.gov/safewater/mdbp/st2dis-preamble.pdf.

38 See note 28.

39 See note 2.

40 See note 37.

41 See note 28.

42 This EDB health and use information derived from EPA, "Consumer Fact Sheet on Ethylene Dibromide," (available online at www.epa.gov/safewater/dwh/c-soc/ethylene.html).

43 Ibid.

44 Ibid.

45 See note 6.

46 California OEHHA, MTBE Public Health Goal, 1999, available online at www.oehha.ca.gov/water/phg/pdf/mtbe_f.pdf.

47 Ibid.

48 See note 2.

49 Ibid.

50 Ibid.

51 For further information, see EPA's Final Rule for Uranium and other radionuclides at 65 Fed. Reg. 76708, December 7, 2000, available online at www.epa.gov/safewater/rads/radfr.pdf.

52 EPA, ICR Data for San Diego Water Department, available online at www.epa.gov/enviro/html/icr/utility/report/CA3710020960610083945.html.

53 www.sannet.gov/water/quality/#a.

54 See note 2.

55 See San Diego County Water Authority: An Overview (fact sheet), July 2002, available online at www.sdcwa.org/about/sdcwa-overview-2002.pdf.

56 See POGO, "Moab Utah Uranium Mill Tailings Fact Sheet," available online at www.pogo.org/p/environment/eo-000507-moab.htm.

57 Ibid.

58 Ibid.

59 Ibid.

60 See State of Nevada, *Mountain of Trouble: A Nation at Risk,* (2002) (outlining risks to local hydrology from Yucca Mountain high-level waste depository and from transportation of waste to the site).

61 USGS, "Water Quality in the Upper Colorado River Basin, 1996–1998," available online at http://water.usgs.gov/pubs/circ/circ1214/; USGS, "Monitoring the Quality of the Nation's Largest Rivers: The Colorado River NASQAN Program," available online at http://water.usgs.gov/nasqan/progdocs/factsheets/clrdfact/clrdfact.html.

62 USGS, "Monitoring the Quality of the Nation's Largest Rivers: The Colorado River NASQAN Program," available online at http://water.usgs.gov/nasqan/progdocs/factsheets/clrdfact/clrdfact.html.

63 Personal Communication with Suzanne Michel, San Diego State University, June 18, 2002, citing Newcomb, Josh, "Getting Serious About Salt: Urban Water Purveyors Seek Solution to Mounting Problem," *Western Water*. Sacramento, CA., Water Education Foundation, September/October 1999.

64 Ibid.

65 See San Diego County Water Authority: An Overview (fact sheet), July 2002, available online at www.sdcwa.org/about/sdcwa-overview-2002.pdf.

66 San Diego website, www.sannet.gov/water/quality/#a.

67 EPA, IWI, for the San Joaquin Delta is available online at www.epa.gov/iwi/hucs/18040003/score.html.

68 See www.nrdc.org/water/conservation/cabay/fcabay.asp.

69 CALFED, *Water Quality Program Plan,* July 2000, pp. 3–5.

70 See note 7.

71 EPA Index of Watershed Indicators, at www.epa.gov/iwi/hucs/18070304/score.html (last visited March 31, 2002.

72 Personal Communication with Suzanne Michel, San Diego State University, June 18, 2002.

73 Ibid.

74 See San Diego County Water Authority Groundwater Study (1999), available online at www.sdcwa.org/manage/groundwater-exec-summary.phtml.

75 Ibid.

76 Ibid.

77 See San Diego County Water Authority: An Overview (fact sheet), July 2002, available online at www.sdcwa.org/about/sdcwa-overview-2002.pdf.

SAN FRANCISCO[1]

San Francisco earned a water quality and compliance grade of Poor for 2000 and 2001.

Factors in this grade included the following:

Although San Francisco's source water is generally very well protected, the city had high levels of cancer-causing contaminants called total trihalomethanes, or TTHMs, by-products of the heavy use of chlorine for disinfection of its tap water. San Francisco is one of the few large cities in the United States with TTHM levels still in excess of a new EPA tap water standard that went into effect in January 2002. San Francisco also has potentially dangerous high spikes in the levels of these chemicals in its tap water. The city applied for and received a two-year extension from the EPA for bringing the system into compliance with this standard. The San Francisco Public Utilities Commission (SFPUC) should not have allowed this problem to continue into 2002. The city says it is taking steps to reduce its TTHM levels by 2003, but its "solution," a switch to chloramine disinfection, is a half-measure that will only moderately reduce TTHM levels and will not kill chlorine-resistant microbes. The EPA announced the reduced standard more than eight years ago, in July 1994, after extensive regulatory negotiations resulted in an agreement with the water industry—a process of which San Francisco was well aware.[3] The final rule was issued in 1998.[4] Under NRDC's grading system, any water system that exceeds the new EPA standard for chemicals that cause cancer and potentially cause miscarriage and birth defects can receive a water quality grade no higher than Poor.

In addition, San Francisco's water in 2000 and 2001 raised other concerns:

Cryptosporidium and *Giardia*, waterborne microbes that can present human health concerns, particularly for individuals with weakened immune systems, were found at low levels in San Francisco's *treated* tap water. The presence of these pathogens even at fairly low levels is of some concern. That is particularly the case because the city does not filter its Hetch Hetchy water supply, and this unfiltered water occasionally had spikes in turbidity levels (cloudiness in the water that can indicate the presence of pathogens) of up to 0.76 nephelometric turbidity units (NTU) in 2001. Unfiltered water has a standard of 5 NTU and filtered water a standard of 1 NTU, so while the turbidity of this water supply does not violate EPA standards, it bears continued careful scrutiny. Installation of advanced alternative disinfection to kill chlorine-resistant pathogens like *Crypto* is recommended, and would reduce TTHM levels as well.

Lead levels were found in excess of the EPA health goal. In 2001, lead levels at 4 of 53 tested residences (8 percent) were over the EPA action level. The EPA allows up to 10 percent of tap water to exceed the action level, so the city was not in violation. But San Francisco's lead problem is a concern for children and pregnant women who drink from taps containing excessive lead.

SAN FRANCISCO
System Population Served **2.4 million[2]**
Water Quality and Compliance **2000▶Poor** **2001▶Poor**
Right-to-Know Report—Citizenship **2000▶Fair** **2001▶Fair**
Threats to Source Water **2** (1=least threat to 6=highest threat)
REPORT CARD

San Francisco has an ongoing cross-connection risk because it operates two separate water supply systems: one for potable domestic use and one that contains non-potable water for fire fighting use when the domestic water system is insufficient to meet demand. This could result in contaminated bay water entering the drinking water system, putting customers at risk. While the SFPUC has conducted a study of the problem in response to a state order and tried to identify any cross connections, worries persist about the prospect of contaminated water commingling with drinking water supplies as a result of this highly unusual arrangement.

San Francisco earned a Fair for its 2000 and 2001 right-to-know reports

On the "good citizen" side of the ledger:

▶ San Francisco accurately named and described its water sources in its right-to-know report, and described some of the risks to these sources.

▶ The 2000 report included information on the risks of lead in water, as well as tips on minimizing risks. Unfortunately, little of this information appeared in the 2001 report.

▶ According to the 2000 census, 46 percent of San Franciscans speak languages other than English at home, and 25 percent speak English "less than very well." Fully 26 percent of the city speaks Asian languages at home, with 16 percent speaking Asian languages but little or no English. An additional 12 percent of the population speaks Spanish at home, with 6 percent speaking Spanish but little or no English. San Francisco included in its reports an EPA- and state-required notice in more than a dozen languages alerting customers that the reports include important information and should be translated, and provided a phone number for additional information in Chinese, Spanish, and Tagalog. Ideally, the city would also have provided a written translation into any language spoken by more than 10 percent of the city population that cannot speak English well. However, the availability of city translators for the three biggest foreign languages on demand was a good second choice to a printed translation.

On the "not-so-good citizen" side of the ledger:

▶ The reports included overarching, prominent (first paragraph), and unwarranted claims that the city's water is "top quality." This assertion ignored the high TTHM level problem, and undermined the report's subsequent mandatory, and less prominent, warnings to vulnerable populations, potentially deterring many readers from reading through the full report to reach these warnings.

▶ San Francisco minimized the risks posed by *Cryptosporidium* and *Giardia* and failed to provide an adequate warning for vulnerable populations by neglecting to display prominent warnings for immuno-compromised individuals. Despite the high number of people in San Francisco living with HIV/AIDS, a "*Cryptosporidium* and *Giardia* Information" section of the 2001 report noted that these parasites pose special risks to "some people" but never mentioned the special threats to immuno-compromised people or people living with HIV/AIDS. This section was not highlighted in either the 2000 or 2001 report. The 2001 report directly violated the EPA regulations for these reports by failing to include the required, explicit warning to immuno-compromised people about the hazards of infection from tap water.[5] The 2000 report did include this information.

- The reports did not discuss how the city treats drinking water provided to the public.
- The reports buried in a footnote the information that 4 of 53 tested homes had registered lead readings that exceeded the EPA action level.
- The reports included neither a map nor any detailed narrative noting any specific polluters in its watersheds. EPA and California rules require utilities to name any known or likely sources of any specific regulated contaminant found in tap water.[6]
- The reports did not provide information on the health effects of some contaminants found at levels below EPA standards, but above EPA health goals. Although not legally required, this information would have assisted local citizens in protecting their health and fighting for better protection of their water.

SFPUC Says $3.6 Billion Needed to Restore, Upgrade San Francisco Water System

The San Francisco Public Utilities Commission (SFPUC) approved a long-term capital improvement program in May 2002 with a total cost of $3.6 billion dollars. The SFPUC said that the improvements are needed because:

- Many of the pipes and system components were built in the late 1800s or early 1900s and are decrepit and vulnerable to failure, deterioration, and contamination.[7] For example, state engineers believe the Calaveras Dam near San Jose is unstable, and would be particularly threatened during seismic activity. It is situated a quarter mile from a fault.[8]
- Better treatment is needed to improve water quality. [9]
- Fully 85 percent of the city's water is transported from the Sierra Nevada to San Francisco via 160 miles of tunnels and pipelines. Along the way, the water crosses or runs adjacent to three earthquake faults—the Hayward, Calaveras, and San Andreas faults. SFPUC says a major earthquake could cut off water for 60 days, and yet the city has no backup facilities to provide water in the event that the existing tunnels and pipelines are rendered inoperable by an earthquake.[10]
- Water demand is projected to increase substantially over the next 30 years, necessitating additional improvements, according to the SFPUC.[11] Some experts are concerned, however, that major increases in water supply could trigger environmental harm from sprawl.

Of the total projected cost of $3.6 billion, $2.9 billion would be spent rehabilitating the regional water system.[12] The SFPUC says its 1.6 million customers outside of San Francisco would pay 70 percent of that $2.9 billion, while city and county customers would pay the remaining 30 percent. San Francisco users would also pay $715 million for rehabilitating and improving the water system within the city and county of San Francisco. The SFPUC estimates that water bills in the city would gradually increase to as much as $1 more per day between now and 2015, bringing the average bill to $41 per month from the current $14 per month. [13,14]

The capital improvement proposal has triggered significant controversy, exacerbated by recent assertions by the *San Francisco Chronicle* that San Francisco "looted the region's water system, and diverted millions into city coffers." [15] The *Chronicle* reported that since 1979, city officials have diverted $670 million from the Hetch Hetchy system into the city's general fund, instead of paying for repairs to the system.[16] To pay for the upgrades, San Francisco voters are being asked to approve Proposition A, a $1.6 billion bond to pay for the city's share of the system upgrades. In addition, suburban voters are asked to pay higher rates. Suburban bills have increased from an average of $32 per month to $71 per month to pay for newer water systems still being paid off.[17] While many civic leaders are supporting Proposition A, a coalition of landlords, real estate interests, hotels, and some environmental groups is opposing it.[18]

Environmental groups have split on the issue. The San Francisco League of Conservation Voters and the Green Party support Proposition A, saying the upgrades and investment are needed. However, the Sierra Club, Restore Hetch Hetchy, NRDC, and some other groups argue against it. The environmental opponents say they support funding replacement of aging pipes in the Hetch Hetchy system, but want a study of whether the O'Shaughnessy Dam at Hetch Hetchy can be torn down and returned to its natural state, and want more emphasis on water conservation, before a major multibillion-dollar decision is made on what to do next with the Hetch Hetchy system.[19] They also are concerned about the potential for sprawl to be catalogued by major new infusions of water supply.

This fight has also triggered legislation to subject the SFPUC to more rigorous oversight by the state, and by suburban users of the Hetch Hetchy system (AB1823, Lou Papan, D-Millbrae). Other state legislation would create a regional financing authority to issue $2 billion in bonds to pay for suburban customers' share of the upgrades (SB1870, Jackie Speier, D-Hillsborough), and would create a Bay Area-wide water agency to tackle water conservation and water issues on a regional basis (AB2058, Lou Papan, D-Millbrae).[20]

San Francisco earned a "Threats to Source Water" rating of 2 on a scale of 1 (least threat) to 6 (highest threat).

Eighty-five percent of San Francisco's drinking water comes from the Hetch Hetchy watershed, an area located in Yosemite National Park yielding generally very well protected, high-quality water. The remaining 15 percent of San Francisco's total water supply is provided by the Alameda and Peninsula watersheds, which capture rain, local runoff, and a small amount of groundwater. Water from the Alameda and Peninsula water sources is also fairly well protected, but it faces potential threats from the presence of grazing animals and from human recreational activity, and potential problems from runoff and from possible future development of non-PUC parcels of land in the watershed.[21] As discussed in detail in the source water section below, the overall grade for San Francisco's source water is therefore a 2 on the ranking scale ranging from 1 (least threat) to 6 (highest threat).

KEY CONTAMINANTS FOUND ABOVE NATIONAL HEALTH GOALS

The following contaminants are found in San Francisco's drinking water. For more information on their properties and health effects, see Chapter 2, "Health Concerns for Common Tap Water Contaminants."

MICROBIOLOGICAL CONTAMINANTS

Total Coliform Bacteria

Levels found 1999 2.9% maximum 0.7% average[22]
Levels found 2000 1.3% maximum 0.3% average[23]
Levels found 2001 0.3% maximum 0.1% average[24]
National Standard: 5% in highest month[25]
National Health Goal: 0%—there is no known, fully safe level of coliform bacteria

Total coliform bacteria are a microbial contaminant whose presence is a potential indicator that disease-causing organisms may be present in tap water. Coliform bacteria have been found in San Francisco's water. The highest reported level in any month per year in San Francisco was 2.9 percent of the samples in 1999, 1.3 percent in 2000, and 0.3 percent in 2001. The federal standard allows up to 5 percent coliform-positive samples per month, so the coliform bacteria finding in San Francisco is not viewed as a serious health threat to healthy consumers, although it may indicate some regrowth of bacteria is occurring in the city's water mains.

Two microscopic pathogens, *Cryptosporidium* and *Giardia*, have been found at low levels in San Francisco's source water, as well as in its finished, treated water.[26] *Cryptosporidium* (*Crypto*) is a waterborne microbial parasite that presents human health concerns, especially to immuno-compromised individuals. *Giardia* is another common microscopic protozoan parasite that can cause disease in humans, and is a particular concern for immuno-compromised people. It has caused waterborne disease in the United States, but is somewhat more vulnerable to chlorine than *Crypto.* As with *Crypto,* well-calibrated filtration can reduce its levels in treated tap water.

Turbidity (Cloudiness)

Levels Found 2000 (in Nephelometric Turbidity Units, or NTU)

Hetch Hetchy Water (Tesia Portal)	0.3 average	0.64 maximum
Harry Tracy Water Treatment Plant	0.1 average	0.29 maximum
Sunol Valley Water Treatment Plant	0.1 average	0.1 maximum

Levels Found 2001 (in Nephelometric Turbidity Units, or NTU)

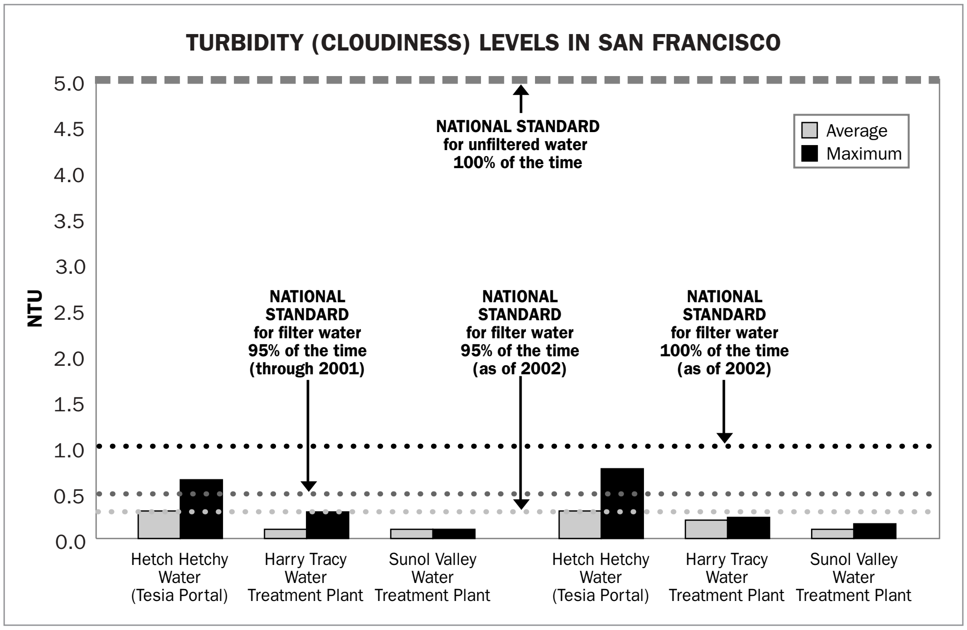
Hetch Hetchy Water (Tesia Portal)	0.3 average	0.76 maximum
Harry Tracy Water Treatment Plant	0.2 average	0.23 maximum
Sunol Valley Water Treatment Plant	0.1 average	0.16 maximum

National Standard (TT)

Filtered water 0.5 NTU, 95% of the time (through 2001)
0.3 NTU, 95% of the time (as of 2002)
1 NTU, 100% of the time (as of 2002)

Unfiltered water 5 NTU maximum, 100% of time

Turbidity is a measure of the cloudiness of water, and is used as an indicator that water may be contaminated with *Cryptosporidium* or other pathogens. In addition, turbidity can interfere with disinfection of the water, because it can impede the effectiveness of chlorine or other chemical disinfectants. San Francisco apparently did not violate the standards for turbidity, but did approach the new standard of



0.3 Nephelometric Turbidity Units in its filtered water occasionally, and had periodic spikes in its unfiltered water from Hetch Hetchy.

ORGANIC CONTAMINANTS

Total Trihalomethanes

Levels Found 1999[27]	75 ppb average	107 ppb maximum
Levels Found 2000[28]	84 ppb average (exceeds standard)	145 ppb maximum
Levels Found 2001[29]	82 ppb average (exceeds standard)	99 ppb maximum

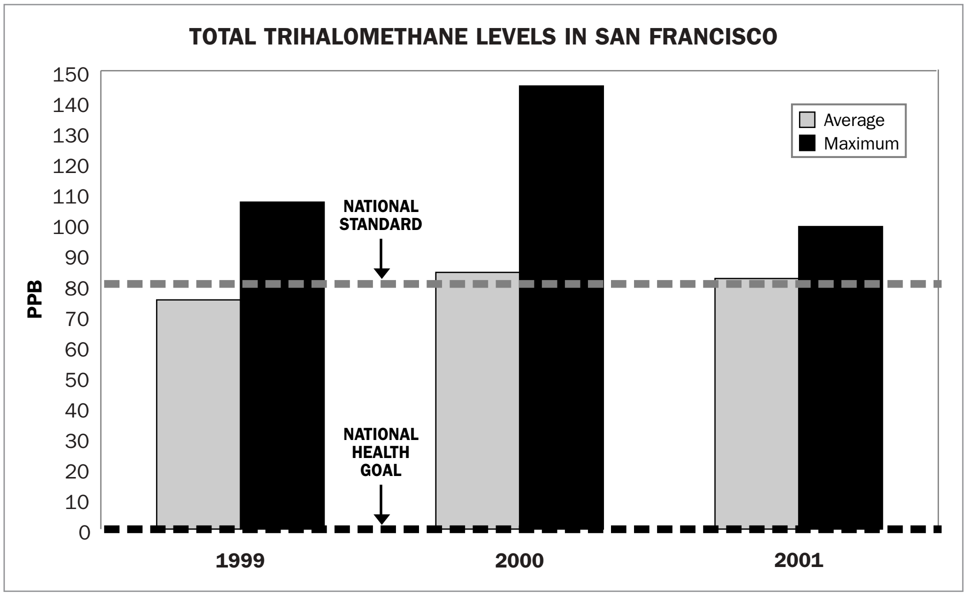
San Francisco reports that it applied for and received a two-year extension of the January 1, 2002 deadline for compliance with the 80 ppb standard for total trihalomethanes. See SFPUC 2001 Water Quality Report, *available online at http://sfwater.org/detail.cfm/MC_ID/10/MSC_ID/51/MTO_ID/NULL/C_ID/718/.*

National Standard (MCL): 80 ppb (average) (effective 2002) (100 ppb effective through 2001)

National Health Goal (MCLG): 0 ppb—there is no known fully safe level of trihalomethanes.

Total trihalomethanes (TTHMs) consist of a sum of the levels of four closely related chemicals—chloroform, dibromochloromethane, bromoform, and bromdichloromethane—which occur together at varying ratios when water is chlorinated. The latter two TTHMs have health goals of zero. The EPA promulgated and then withdrew (after a court decision) a zero health goal for chloroform, and has not yet issued a new goal for chloroform. Dibromochloromethane has a health goal of 60 ppb. Since water systems generally report only the combined TTHM level, and since it is essentially chemically impossible to create one trihalomethane in tap water without some level of the others, we list the health goal for TTHMs as zero.

Total trihalomethanes[30] (TTHMs) are chemical contaminants that result when chlorine used to treat drinking water interacts with organic matter in the water. Many



studies show that these chemicals are linked with cancer, and the EPA has classified some TTHMs as probable human carcinogens. Recent preliminary studies also link TTHMs to miscarriages and birth defects.

The high average TTHM levels in San Francisco tap water pose a cancer concern, and the spike levels reaching as high as 145 parts per billion in 2000 pose a miscarriage and birth defect concern. Because spikes found in San Francisco were similar to those found to pose a risk, and because levels in San Francisco averaged 82 parts-per-billion, women in the first three months of pregnancy should exercise caution.

San Francisco has obtained a two-year extension for complying with the new 80 parts-per-billion EPA standard. It is unfortunate and troubling that the San Francisco Public Utilities commission (SFPUC) allowed this problem to continue into 2002. The EPA announced the reduced standard in 1994 in the *Federal Register* after extensive regulatory negotiations with the water industry. SFPUC was well aware of the negotiations and the final rule, and in fact had a representative at many of the negotiating meetings.[31] The final rule was issued in 1998, and SFPUC had plenty of warning to get a solution in place before that rule was issued.[32] SFPUC's quick-fix solution is to install a system-wide conversion from chlorine to chloramines as a drinking water disinfectant to reduce the formation of disinfection by-products. The target date to complete the conversion to chloramine is in the summer of 2003.

Unfortunately, this solution is short-sighted and temporary. Chloramines will only modestly reduce TTHM levels, and they do essentially nothing to reduce *Crypto* risks. As discussed further below, SFPUC should instead forge ahead with significant improvements in treatment by following the lead of other cities that use unfiltered water, such as Seattle, and installing an alternative primary disinfectant of ultraviolet light or ozone (with chloramines as a secondary disinfectant only). This switch to alternative disinfectants would more substantially reduce TTHMs and other disinfection by-products, and would improve the kill rate of *Crypto* and other chlorine- and chloramine-resistant pathogens in San Francisco's water.

Haloacetic Acids

Levels Found 2001 17 ppb average 29 ppb maximum

National Standard (MCL): 60 ppb (average) (effective 2002; no previous standard)

National Health Goal (MCLG): 0 ppb—there is no known fully safe level of haloacetic acids

Some of the haloacetic acids have national health goals of 0 and others have non-zero goals. For the sake of simplicity and understandability, since there is a single haloactetic acid standard, and because it is essentially chemically impossible under normal conditions in tap water to create one regulated haloacetic acid without creating the others at some level, we have listed the national health goal as 0.

Haloacetic acids, like TTHMs, are by-products of chlorine disinfection. People exposed to haloacetic acids in drinking water over the long-term may be at risk of developing cancer.[33]

INORGANIC CONTAMINANTS

Lead

Levels Found 1999

2 to 160 ppb range; 4 ppb at 90th percentile[34]

3 of 102 residences were over the action level at consumer taps

Levels Found 2000

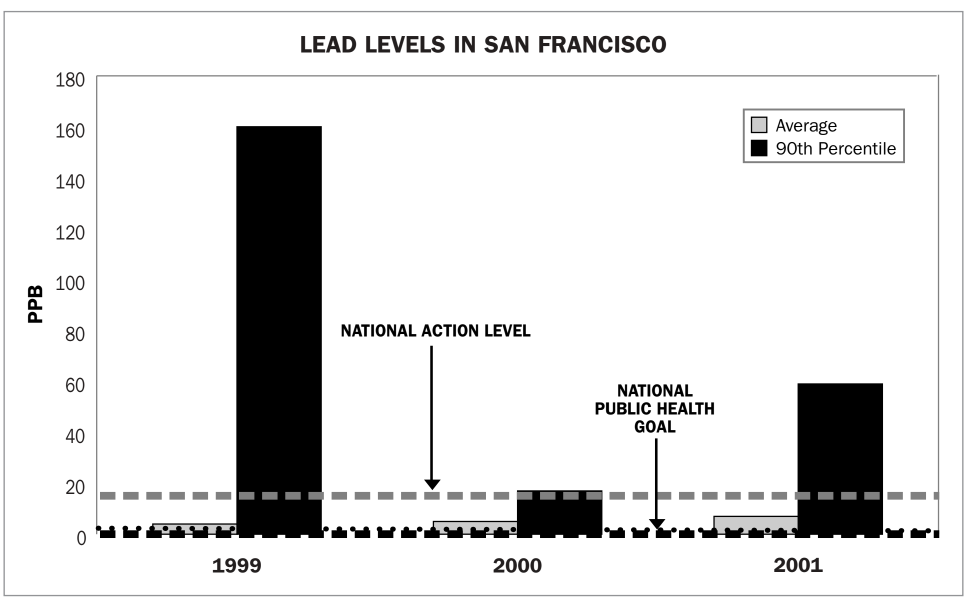
2 to 17 ppb range, 5 ppb at 90th percentile[35]

1 of 53 residences was over the action level at consumer taps

Levels Found 2001

2 to 59 ppb range, 7 ppb at 90th percentile[36]

4 of 53 residences were over the action level at consumer taps



National Standard (TT): 15 ppb (action level)

The action level standard for lead is different than the standard for most other contaminants. Water utilities are required to take many samples of lead in the tap water distribution system. If the amount of lead detected in the samples is more than 15 ppb at the 90th percentile (which means that 90 percent of the samples have 15 ppb or less), then the amount is said to exceed the action level. Under the complex EPA lead rule, a water system that exceeds the action level is not necessarily in violation. If a system exceeds the action level, additional measures such as chemical treatment to reduce the water's corrosivity (ability to corrode pipes and thus its ability to leach lead from pipes) must be taken. If this chemical treatment does not work, the water system may have to replace lead portions of its distribution system if they are still contributing to the lead problem.

National Health Goal (MCLG): 0 ppb—there is no known, fully safe level of lead

Lead is a major environmental threat; no amount is considered safe.[37] Infants, young children, and fetuses are particularly susceptible to the adverse health effects of lead. Lead in San Francisco's water is cause for concern. The EPA's lead rule allows 10 percent of homes tested to exceed 15 parts per billion. In 2001, about 8 percent of the city's tested taps exceeded the action level—just shy of a violation of the rule.

PROTECTING SAN FRANCISCO'S DRINKING WATER

Following are approaches to treating San Francisco's drinking water, as well as a discussion of threats to source water. Also included in this section is information on how individuals can protect drinking water.

TREATMENT OPTIONS AVAILABLE FOR CONTAMINANTS OF GREATEST CONCERN

NRDC offers the following recommendations to the San Francisco Public Utilities commission:

Treatment to Reduce Disinfection By-products (Trihalomethanes and Haloacetic Acids).

San Francisco's disinfection by-product levels are very high compared to most large U.S. cities. SFPUC is now converting system-wide from free chlorine to chloramines as the primary drinking water disinfectant. Chloramine treatment involves the addition of chlorine and ammonia, and will reduce the formation of disinfection by-products somewhat. While a useful interim step, chloramines are not a long-term solution, because they:

- only modestly reduce trihalomethanes and haloacetic acids;
- fail to kill such chlorine-resistant pathogens as *Cryptosporidium;* and
- create N-Nitrosodimethylamine (NDMA), a likely carcinogen.[38]

San Francisco should further reduce its levels of disinfection by-products by using enhanced coagulation and activated carbon at its existing treatment plants, and by following the lead of other large unfiltered water systems, including Seattle's, by switching to an alternative primary disinfectant such as ozone or ultraviolet light for Hetch Hetchy and other water. Chloramines can continue to be used as a secondary disinfectant in the pipes after the water leaves the treatment plant. These alternative disinfectants, particularly ultraviolet light, produce fewer disinfection by-products and, as discussed below, are more effective at killing *Crypto* than is chlorine.

Cross-Connection Issues. San Francisco must also do everything it can to find and remedy any cross-connection problems. San Francisco has two separate water supply systems, one for potable domestic use and one strictly for fire-fighting, the Auxiliary Water Supply System (AWSS). The AWSS contains non-potable, high-pressure water designed for use when the domestic water system is insufficient. In 1999 the SFPUC began a program to ensure that water supply lines had not been inadvertently connected to the AWSS. In response to a state order, SFPUC completed in 2000 a review of thousands of domestic service connections near AWSS mains, verifying that they were not connected to the AWSS. So, while progress has been made, the concern continues. Currently the SFPUC sends a representative to every 2-alarm (or more) fire to assure that no cross-connection problems arise. SFPUC needs a detailed engineering and action plan to resolve this issue permanently.

***Cryptosporidium* and *Giardia*.** San Francisco should do all it can to eliminate *Cryptosporidium* and *Giardia* in its source and finished drinking water. The Hetch Hetchy water supply, which provides about 85 percent of the city's water, is unfiltered. This means that watershed protection and chemical disinfection are the only barriers to waterborne disease in San Francisco. But the city's current and future disinfection method—chlorine and chloramines—are ineffective at killing *Crypto.* In addition, because the water is unfiltered, it can carry more turbidity and organic matter than many filtered water supplies, with potential impacts on the effectiveness of any form of chemical disinfection.

SFPUC must be vigilant about preventing *Crypto* and other pathogens from getting into both Hetch Hetchy and the Alameda and Peninsula sources. Regarding development and recreational activity that may threaten water quality, aggressive prevention is warranted. To avoid contamination of the water supply by cattle and from stables and other human or animal waste, a complete ban on grazing in the watershed or the strictest possible measures are warranted.

The SFPUC is now evaluating its filtration practices at the Harry Tracy and Sunol Water Treatment Plants, with an eye toward optimizing particulate removal. Ultraviolet light disinfection or ozone, perhaps in combination with granular activated carbon (GAC), would offer a measure of additional assurance that *Crypto* and *Giardia* pose no risk to San Francisco. These treatment technologies not only reduce or virtually eliminate many of the riskiest disinfection byproducts, but they are far more effective at killing these and certain other resistant parasites than is chlorine, the disinfectant currently used by San Francisco, or chloramines, the future disinfectant for the city.

The San Francisco Public Utilities Commission reports that its initial studies, however, have shown that the required ozone dose for deactivating *Cryptosporidium* in Hetch Hetchy would "require a much longer reaction time than is conventionally used for ozonation, running the risk of stimulating the growth of opportunistic bacteria in plumbing." [39] This potential problem with organic matter being made available, due to ozonation creating "food" for bacteria in the pipes likely could be resolved by using biologically active GAC filters. (The reason that "much longer" than usual ozone reaction time would be necessary has not been publicly reported, but may suggest ultraviolet light is preferable). In the interim, the RTK report must make it clear that these microbial contaminants can cause serious health risks to persons with compromised immune systems, and that elevated levels of disinfection by-products pose both a cancer risk and a potential risk to pregnant women and their babies.

Lead. San Francisco has many homes whose tap water contains more lead than is desirable, particularly for infants, children under six years old, and pregnant women. The city should evaluate whether additional corrosion control measures may be able to reduce lead levels at the tap.

In addition, the SFPUC should mount a campaign to advise parents and pregnant women to flush their faucets if they have not been used for a few hours (e.g., overnight or when returning home from work) before using water for drinking, cooking, or making baby bottles. Flushing is easy: the customer just runs the water for about 30 seconds to a minute, until the water temperature changes noticeably; this will reduce the lead levels from water that has been sitting in the faucet or pipes that are leaching lead. That first 30 seconds of water flow could be used for watering plants or other household uses. Parents should also consider having their household water tested by a certified lab—generally a $15–$25 expense. To find a state-certified lab to test household water, consumers can check the state's website list of labs at www.dhs.ca.gov/ps/ls/elap/Elapindex.htm.

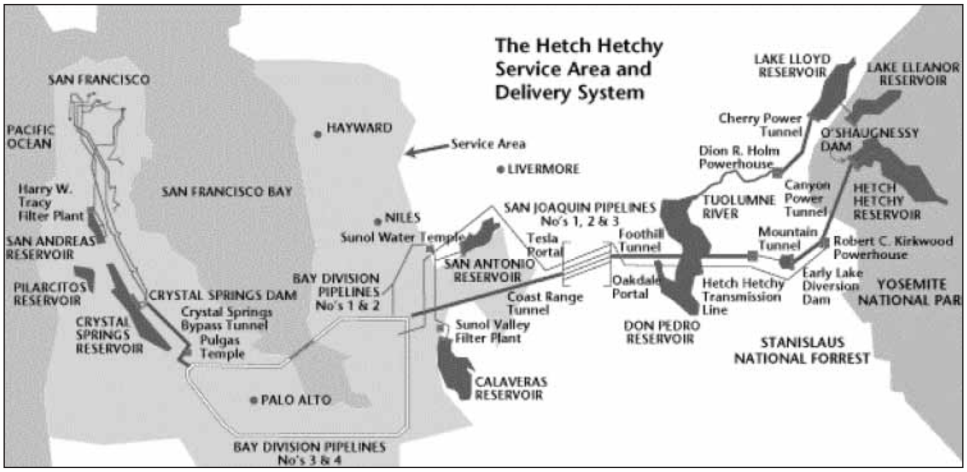
CURRENT AND FUTURE THREATS TO SOURCE WATER

The San Francisco Public Utilities Commission (SFPUC) completed its source-water pollution assessment in 2000. Levels of contaminants have generally been very low in the watersheds, but they are vulnerable to contaminants associated with wildlife and human recreational activity. In addition, the Alameda County system may be vulnerable to contaminants from grazing animals and possible future development of non-PUC owned land. Because people and their activities are a major potential source of water contamination, the SFPUC has an intensive management program to limit human access.

Eighty-five percent of San Francisco's drinking water comes from the Hetch Hetchy watershed, an area located in Yosemite National Park that captures water inflows from the watershed in the Hetch Hetchy Reservoir and snowmelt runoff from the Tuolumne River. As the report indicates, the water in the Hetch Hetchy Reservoir is of high quality. According to the EPA's Index of Watershed Indicators (IWI), the Upper Tuolomne River, which feeds the Hetch Hetchy reservoir, scored a 3 out of 6 (1 is least threatened; 6 is most threatened). In the EPA's words, "The overall IWI score . . . describes the health of the aquatic resources for this watershed. A score of 3 indicates Less Serious Water Quality Problems—Low Vulnerability to stressors such as pollutant loadings."[40]

Figure 2
San Francisco's Hetch Hetchy Service Area and Delivery System

Source: S.F. Public Utilities Commission, 2002



However, NRDC's review of the most recent available information on the Hetch Hetchy area's watershed in the EPA Envirofacts database, and our review of SFPUC, USGS, and other information on the area immediately around and upstream from the reservoir, leads us to rank the Hetch Hetchy as a 2 on the 1-6 scale, using EPA's IWI criteria (high water quality, relatively low vulnerability). Currently, the water is of generally good quality, but it is vulnerable to recreational activities and wildlife in the watershed. The Hetch Hetchy is in Yosemite National Park and abuts Stanislaus National Forest, a largely inaccessible area with little development. However, some recreational activity takes place in the area (at reservoirs and in watersheds, camping areas, septic tanks, and stables, for example), and some turbidity, sediment, and pathogens such as *Cryptosporidium* and *Giardia* have been found in the raw water from the Hetch Hetchy.[41]

The remaining 15 percent of the total water supply is provided by the Alameda and Peninsula watersheds, which capture rain, local runoff, and a small amount of groundwater. The watersheds feeding into the city's reservoirs from Alameda, Santa Clara, and San Mateo counties and the Peninsula are largely SFPUC-owned and managed to protect the city's water, and most of the watershed has very limited public access. However, it could be contaminated by organic material or microbial contaminants from agricultural livestock operations (some cattle are permitted to graze in parts of the watershed), from recreational activity, from runoff from spills along highways crossing the watershed, and from wildlife. In addition, some parcels of land in the watersheds which are not owned and protected by the SFPUC could be developed in the future, posing a potential threat to water quality if not well controlled. In sum, while water from the Alameda and Peninsula water sources are treated and filtered and are generally of good quality, they do face moderate potential threats from the presence of grazing animals, human recreational activity, and runoff.[42]

The SFPUC has outlined a source water protection program that limits access to vulnerable areas and imposes Best Management Practices for livestock grazing and controls for other potential pollution sources. For example, about five years ago, the SFPUC developed Best Management Practices for cattle operations in the Alameda watershed to prevent waterborne pathogens from cattle from getting into city water supplies. The SFPUC reports that the effort has been fairly successful.[43] The source water assessment and initial suggestions for a protection plan are available from the SFPUC by calling (877) 737-8297.

HOW INDIVIDUALS CAN PROTECT SOURCE WATER

You can take steps to protect San Francisco's drinking water by protecting its sources.

Reduce the amount of water you use. Plant drought-resistant plants or "xeriscape" (use plants that need little or no watering), use low-flow shower-heads, shorten your shower time, don't spray down your driveway to clean it, minimize the number of times (and how long) you water your lawn. Consider installing low-flush toilets. If you install one and check in with SFPUC first, you can get a $50 rebate, and you'll save about $90 per year in water bills. Also consider buying a front-loading washer—again, if you check with SFPUC first, you can get a $75 rebate for installing one of these water-efficient washers.

For more tips on water conservation, see:

- SFPUC's brochure, *SF's Water Is Too Good to Waste,* (call phone number above)
- www.nrdc.org/greengate/guides/water.asp
- www.monolake.org
- www.mwdh2o.com/mwdh2o/pages/conserv/save/tentips/tentips01.html

Apply for the rate break San Francisco offers customers who certify that they have installed low-flow shower heads, faucet aerators, and have low-flush toilets (or have taken simple steps to reduce the amount of water used per flush in their standard toilet). For details on these San Francisco water conservation rebates and rate-break programs, see www.sfwater.org or call SFPUC at (415) 923-2676.

Avoid using pesticides in the home or yard, or storing pesticides in the home. Consumer pesticide use in the home leads to runoff into water resources.

Buy organic foods, if possible. Purchasing organically grown food helps prevent the drinking water source contamination from pesticide and herbicide runoff that results from conventional agricultural practices.

SAN FRANCISCO WATER UTILITY INFORMATION[44]

San Francisco Public Utilities Commission
SFPUC Customer Service Bureau
425 Mason Street
San Francisco, CA 94102
Toll-Free Number: (877) 737-8297
http://sfwater.org

Attend meetings of the San Francisco Public Utilities Commission. The SFPUC meets twice a month on the second and fourth Tuesday at 1:30 P.M. Meetings are held at City Hall, Room 400. Inquiries about these meetings can be made by calling the Office of the Commission Secretary at (415) 554-3165.

Learn more from these groups:
- Clean Water Action, www.cleanwater.org
- NRDC, www.nrdc.org
- Waterkeepers, www.waterkeepers.org
- CALPIRG, www.calpirg.org
- Tuolumne River Preservation Trust, www.tuolumne.org
- Restore Hetch Hetchy (Walnut Creek), www.hetchhetchy.org
- Clean Water Network, www.cwn.org.

NOTES

1 Peer Reviewers of the San Francisco report included Gina Solomon and David Beckman, NRDC, and Marguerite Young, California Clean Water Action.

2 The San Francisco Public Utilities Commission serves 2.4 million people in the Bay Area, including 1.6 million customers in Santa Clara, San Mateo, and Alameda Counties, and 790,000 in the City of San Francisco (see service area map later in this report for areas served). San Francisco Public Utilities Commission, www.sfwater.org (last visited September 20, 2002).

3 See EPA Proposed Stage I Disinfection Byproducts Rule, 59 Fed. Reg. 38668 (July 29, 1994).

4 See EPA Final Stage I Disinfection Byproducts Rule, 63 Fed. Reg. 69389 (December 16, 1998).

5 See 40 C.F.R. § 141.154(a): "(a) All reports must prominently display the following language: Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the Safe Drinking Water Hotline (800-426-4791)."

6 See EPA regulations at 40 C.F.R. § 141.153(d)(4)(ix), which provide that the RTK report must include "the likely source(s) of detected contaminants to the best of the operator's knowledge. Specific information about the contaminants may be available in sanitary surveys and source water assessments, and should be used when available to the operator." While EPA allows reliance upon general lists of potential sources where the water system is not aware of the specific source of pollution, where the water system *is* aware of the pollution source, the rules require that polluter to be identified.

7 SFPUC, "Fact Sheet: Proposal to Rebuild San Francisco's Water System," August 2002, available online at www.sfwater.org/detail.cfm/MSC_ID/6/MTO_ID/NULL/MC_ID/7/C_ID/543/holdSession/1.

8 Susan Sward, Chuck Finnie, "S.F. Looted Region's Water System, Diverted Millions into City Coffers: Now $3.6 Billion Sought to Repair and Expand Aging Hetch Hetcy," San Francisco Chronicle, September 15, 2002.

9 See note 7.

10 Ibid.

11 Ibid.

12 Ibid.

13 Ibid.

14 Ibid.

15 Ibid.

16 Ibid.

17 Ibid.

18 Chuck Finnie, Susan Sward, "Foes Vow to Sink SF Water Measure: Unlikely Coalition Opposes $3.6 Billion Hetch Hetchy Upgrade," *San Francisco Chronicle*, September 17, 2002.

19 See ibid.; see also Restore Hetch Hetchy website at www.hetchhetchy.org.

20 Chuck Finnie, Susan Sward, "Brown Depserately Tries to Head Off State Role in Hetch Hetchy Revamp, But Davis Expected to Sign 3 Bills that Would Pacify Frustrated Suburban Customers," San Francisco Chronicle, September 20, 2002.

21 See SFPUC Water Quality Report 2000, June 2001, available online at www.sfwater.org/detail.cfm/C_ID/296); SFPUC, *Cryptosporidium 2*, available online at www.sfwater.org/detail.cfm/MC_ID/10/MSC_ID/51/MTO_ID/NULL/C_ID/445; see also SFPUC Watershed Sanitary Survey, available upon request from SFPUC: call 877-737-8297. See also EPA Enviromapper (showing water pollution sources near Alameda and Peninusla water sources) at http://map2.epa.gov/enviromapper/. For example, to see sources near the Crystal Springs Reservoir, see: http://map2.epa.gov/scripts/.esrimap?name=iwi2&threshold=0.3&zoomFactor=2&layersCode=11111100000001001011&IWIColor=0&queryCode=16&fipsCode=18040009&IndexMap=on&cursorX=136&cursorY=102&Cmd=Pan&CmdOld=Identify&Left=-122.418425166417&Bottom=37.4748421282691&Right=-122.301237666417&Top=37.5627327532691&layer_0=0&layer_1=1&layer_2=2&layer_3=3&layer_4=4&layer_5=5&layer_13=13&layerQuery=16&layer_16=16&layer_18=18&layer_19=19&zoomInScalar=2.0&zoomRadius=0.0&LocationMap=on&zoomOutScalar=2.0&mapOption=Pan&click.x=323&click.y=172.

22 San Francisco Public Utilities Commission, 2000 Water Quality Report, pg. 2 (June 2000) (last visited March 22, 2002).

23 San Francisco Public Utilities Commission, 2000 Water Quality Report, pg. 2 (June 2001), available online at www.sfwater.org/detail.cfm/C_ID/296) (last visited March 22, 2002).

24 San Francisco Public Utilities Commission, 2001 Water Quality Report, pg. 2 (April 2002), available online at http://sfwater.org/detail.cfm/MC_ID/10/MSC_ID/51/MTO_ID/NULL/C_ID/718/ (last visited April 23, 2002).

25 Note that the contaminant levels are presented as a percentage. Total coliform is regulated as a percentage of positive samples that are present in water. The national health standard of 5 percent means that if more than 5 percent of the utility's total coliform samples test positive, then the national health standard has been violated. To say that a sample tests positive is to say that there are total coliform bacteria present in the sample. Therefore, for compliance purposes, the utilities provide the percentage of total coliform samples that tested positive.

26 San Francisco Public Utilities Commission, Water Quality Report, page 2 (June 2001), available online at, www.sfwater.org/detail.cfm/C_ID/296) (visited March 22, 2002); SFPUC, *Cryptosporidium 2*, available online at, www.sfwater.org/detail.cfm/MC_ID/10/MSC_ID/51/MTO_ID/NULL/C_ID/445 (visited March 22, 2002).

27 San Francisco Public Utilities Commission, Water Quality Report, pg. 2 (June 2000).

28 San Francisco Public Utilities Commission, Water Quality Report, pg. 2 (June 2001), available online at www.sfwater.org/detail.cfm/C_ID/296) (last visited March 22, 2002).

29 San Francisco Public Utilities Commission, Water Quality Report, pg. 2 (June 2001), available online at www.sfwater.org/detail.cfm/C_ID/296) (last visited March 22, 2002).

30 Health effects information on disinfection byproducts is summarized from NRDC, *Trouble on Tap* (1995); NRDC, Bottled Water: Pure Drink or Pure Hype? (1999), available online at www.nrdc.org/water/drinking/bw/bwinx.asp; and EPA, Draft Preamble for Stage 2 Disinfection Byproducts Regulation, available online at www.epa.gov/safewater/mdbp/st2dis-preamble.pdf.

31 See EPA Proposed Stage I Disinfection Byproducts Rule, 59 Fed. Reg. 38668 (July 29, 1994).

32 See EPA Final Stage I Disinfection Byproducts Rule, 63 Fed. Reg. 69389 (December 16, 1998).

33 See note 30.

34 Ibid.

35 Ibid.

36 SFPUC, Water Quality Report, pg. 2 (June 2001), available online at www.sfwater.org/detail.cfm/C_ID/296 (last visited March 22, 2002).

37 See EPA, "Consumer Fact Sheets on Lead," www.epa.gov/safewater/Pubs/lead1.html and www.epa.gov/safewater/standard/lead&co1.html, and IRIS summary for lead online at http://www.epa.gov/iris/subst/0277.htm.

38 See California Department of Health Services, California Drinking Water: NDMA-Related Activities, available online at www.dhs.ca.gov/ps/ddwem/chemicals/NDMA/NDMAindex.htm.

39 SFPUC, *Cryptosporidium 2*, available online at www.sfwater.org/detail.cfm/MC_ID/10/MSC_ID/51/MTO_ID/NULL/C_ID/445 (last visited March 22, 2002).

40 EPA Index of Watershed Indicators, available online at www.epa.gov/iwi/hucs/07120003/score.html (last visited March 13, 2002); see also http://map2.epa.gov/scripts/.esrimap?name=iwi2&Cmd=ZoomInByCat&CmdOld=ZoomInByScalar&threshold=360.0&zoomFactor=2.0&layersCode=00011&queryCode=99&IWIColor=0&fipsCode=18040009&click.x=300&click.y=200&IndexMap=on&Left=-126.0&Bottom=23.0&Right=-66.0&Top=50.0.

41 See SFPUC, *Cryptosporidium*, 2 of 2, available online at www.sfwater.org/detail.cfm/MC_ID/10/MSC_ID/51/MTO_ID/NULL/C_ID/445.

42 See note 21.

43 See SFPUC, *Cryptosporidium 2*, available online at, www.sfwater.org/detail.cfm/MC_ID/10/MSC_ID/51/MTO_ID/NULL/C_ID/445.

44 SFPUC, Water Quality Report, page 2 (June 2001), pg. 5.