United States
Environmental Protection
Agency

Office of
Public Affairs (A-107)
Washington DC 20460

December 1986

EPA

You and Your Drinking Water

Reprinted from *EPA Journal*

Volume 12, Number 7, September 1986

Drinking Water in America: An Overview

"When the well's dry, we know the worth of water"- Ben Franklin, *Poor Richard's Almanac*

Safe drinking water is a blessing many Americans take for granted. It's not hard to see why. What could be easier than turning on the tap and getting gallons of drinkable water? But behind each gallon, behind each drop, is the unceasing effort of scientists, engineers, legislators, water plant operators, and regulatory officials. It is their mission to keep this precious resource clear, clean, and—above all—safe.

Our drinking water comes from two different categories of untreated water. About half comes from rivers, streams, and other forms of "surface" water. The other half comes from reserves of water hidden beneath the earth in areas known as "aquifers." Protection of both surface and ground water is vital if we are to have drinking water that is not only safe but plentiful.

Protection at the Source

Concern over the quality of our surface and ground-water supplies is a function of geography as well as the effects of human activity. Water moves constantly, often passing from areas beneath the ground to the surface, and vice versa. The cycles of precipitation and evaporation continue ceaselessly, day in and day out.

Various natural processes—physical, chemical, and biological—occur as water moves above, on, and below the earth's surface. These processes all, to a greater or lesser extent, affect the quality of our water resources. Exactly what effect these processes have is determined by the type and extent of the contact the water has with rock, soil, vegetation, and other substances, both soluble and insoluble.

Several different kinds of contamination can result from natural causes. Undissolved material—known as "suspended matter"—shows up frequently in untreated water, as do dissolved minerals and salts, such as sulfates, chlorides, and nitrates. A well-known toxic metal, arsenic, occurs naturally as an impurity in various minerals and in the ores of certain commercially mined metals. If untreated, arsenic can cause liver and kidney damage when it gets mixed into drinking water supplies.

Another natural contaminant controllable with modern technology is fluoride. This inorganic chemical, which is the seventeenth most abundant substance in the earth's crust, can cause skeletal damage as well as a brownish discoloration of the teeth known as "fluorisis." Fortunately, modern technology is well equipped to manage fluoride and other forms of natural drinking water pollutants.

Today's treatment techniques are also effective against radionuclides. Radionuclides include naturally occurring minerals such as radium and uranium as well as the radioactive gas known as radon. Radon is a particular concern at the present time. This colorless, odorless, tasteless gas poses unique problems. The gas is a decay product of uranium deposits located in various regions of the United States. It enters American homes dissolved in drinking water. When that water is heated or agitated in a shower or washing machine, it becomes a breathable drinking water contaminant that may, in the opinion of scientists, greatly increase the risk of lung cancer. EPA is now considering the proposal of formal controls on radon and uranium.

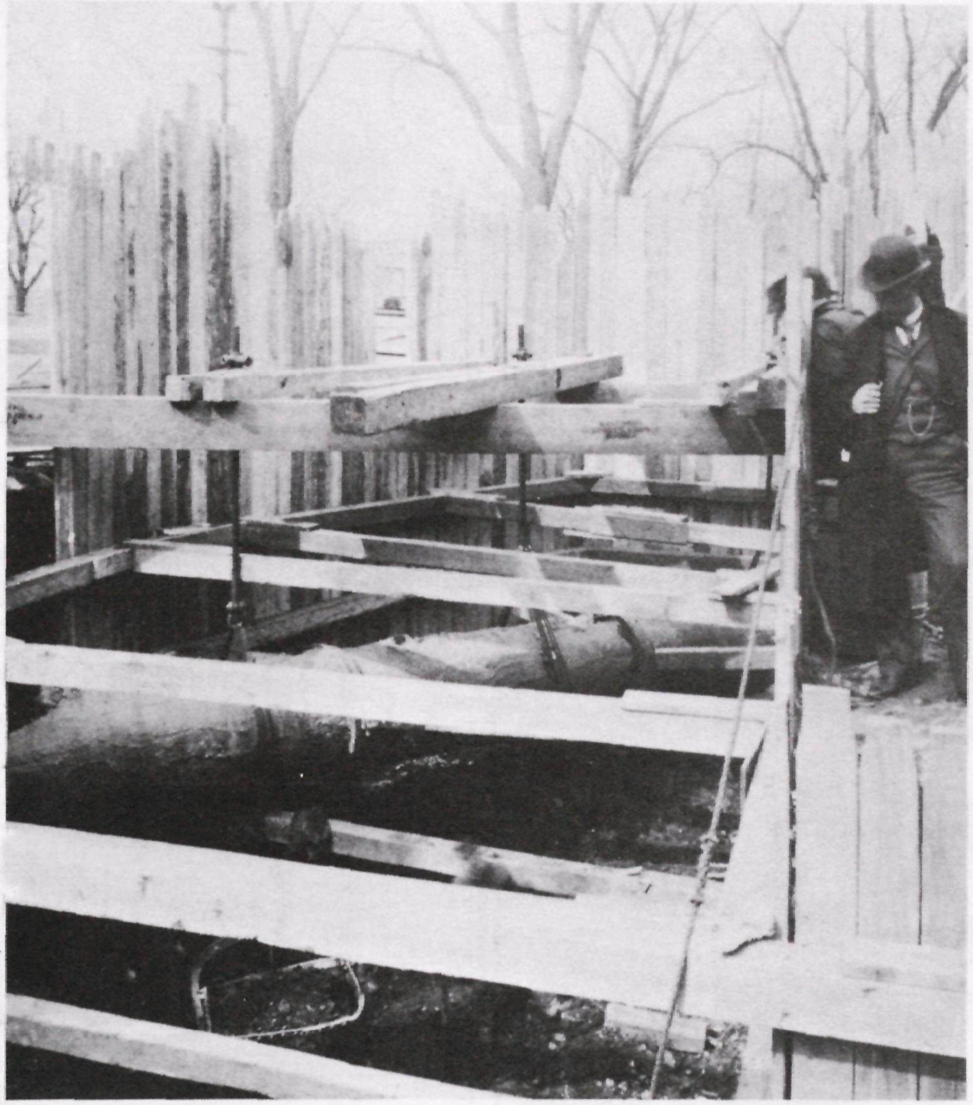
People, too, can have an adverse effect on water quality. Human organic waste has, throughout most of recorded history, posed the greatest threat to the safety of drinking water. Typhoid and cholera epidemics were commonplace for centuries. Cholera was brought under control by the early 1870s, but typhoid was still killing approximately 28,000 Americans a year at the turn of the century.

Typhoid, cholera, and other water-borne infectious diseases could not be fully conquered until U.S. citizens backed serious efforts to improve the quality of our nation's drinking water. Water systems throughout the U.S. adopted chlorination and filtration, sometimes against opposition, and these methods have been remarkably successful.

Pollutants other than bacteria are posing new challenges to the guardians of our drinking water: contaminants such as viruses, protozoa, and toxic chemicals. One chlorine-resistant protozoan, *Giardia*, has caused 38 outbreaks of gastro-intestinal illness that have infected 20,000 people since 1972. Overall, waterborne illnesses afflicted 85,875 Americans from 1971 to 1982.

An analysis of these cases showed that 49 percent were the result of treatment deficiencies. Nearly one-third were found to stem from defective distribution systems. Surprisingly, these figures represent a slight increase over previous years, but most experts attribute this seeming increase simply to more active surveillance.

Whatever their cause—or trend—these figures are clearly justification for sustained vigilance. This is especially true in view of the emergence in recent years of a whole new group of man-made drinking water contaminants. Over 60,000 toxic chemicals are now being used by various segments of U.S. industry and agriculture. These substances range from industrial solvents and pesticides to cleaning



The Bostonian Society

In Boston in 1896, crews work to lay water pipes under Boston Common. In some cities in the eastern U.S., corrosion has caused old water pipes to leak, allowing treated water to escape and contaminants to enter.

preparations and septic tank degreasers. When used or discarded improperly, these chemicals can pollute ground and surface waters used as sources of drinking water.

Subsurface activities can also cause problems. Mining operations, the injection of waste chemicals and brines, and the storage of substances in underground tanks have all been linked to the contamination of ground and surface water.

Not all problems of drinking water quality originate with the surface or ground-water supplies. Sometimes contamination can occur during the treatment process itself. In other cases, it can occur in transit from the treatment plant to your home.

Certain disinfectants used to purify water can create potentially hazardous by-products. A good example is chlorine, which has for many years been the major disinfectant used at U.S. drinking water treatment plants. In the late 1970s, scientists at EPA and in Europe discovered that chlorine can react with natural and man-made chemicals in water to create by-products known as trihalomethanes. One of these by-products—chloroform—has been proved to cause cancer when administered in large doses to laboratory mice. Other disinfectants have also been found to generate undesirable by-products.

After purified water leaves treatment plants, it enters pipes and conduits that may themselves be defective or contaminated. Corrosion by-products from rusting pipes can pollute treated water. So can bacteria and other growths. In some of the older eastern cities, as much as 40 percent of treated drinking water is lost through these leaks caused by corrosion.

Contaminants can enter carefully purified drinking water through these leaks. Furthermore, water passing through lead or lead-soldered pipes can become contaminated with lead, one of the most harmful of metals.

Protection at the Tap

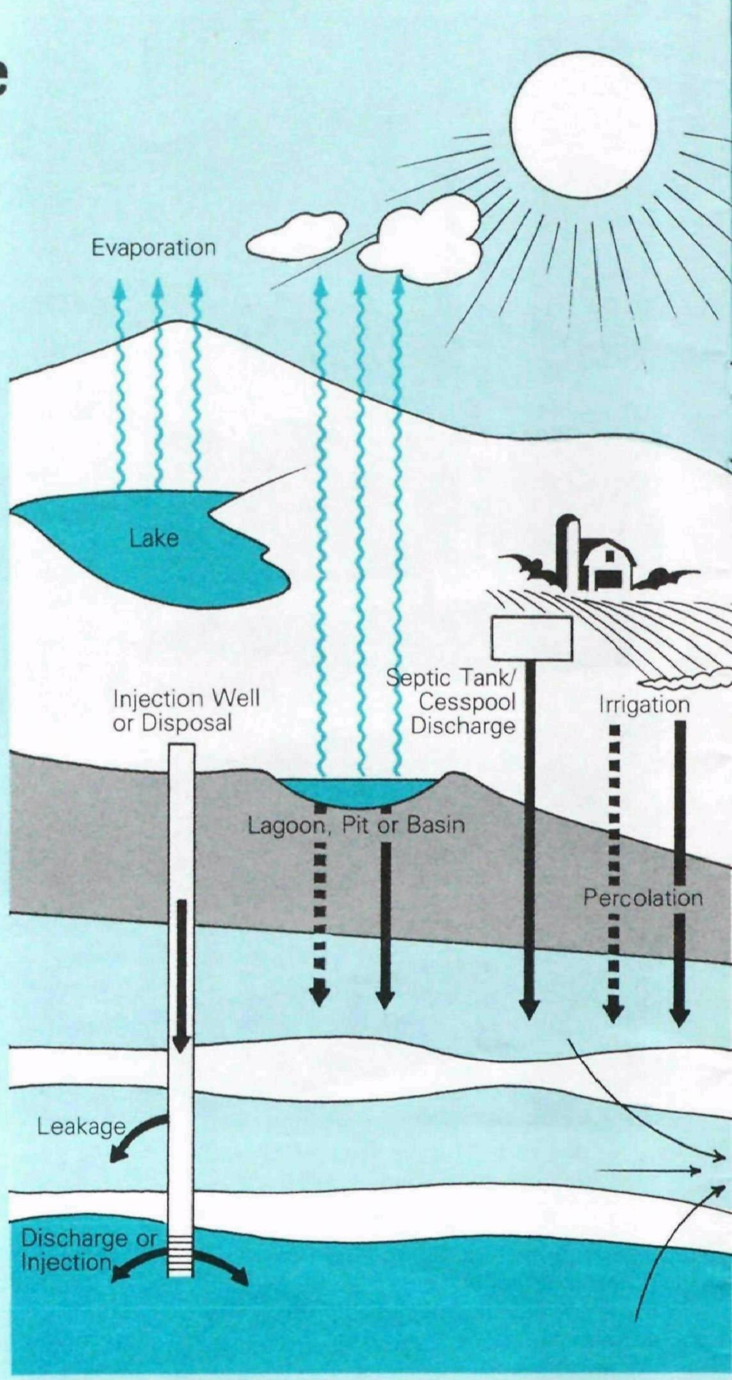
The Safe Drinking Water Act sets a very exacting standard for EPA to follow: it requires the Agency to set primary drinking water regulations for any pollutants that "may" have an adverse effect on human health. In other words, the intent of the law is preventive as well as reactive. EPA is responsible not only for eliminating demonstrated hazards, but also for preventing potential adverse health effects.

The Agency is charged with setting contaminant levels at which "no known or anticipated adverse effects on the health of persons occur and which allows an adequate margin of safety." But the Safe Drinking Water Act also specifies that these levels must be technically "feasible," taking cost into account— that is, achievable in the real world of locally operated public water systems.

Today, as a result of the Safe Drinking Water Act of 1974, the standards governing the treatment of drinking water in the U.S. are more rigorous and uniform than they were a decade ago. As a matter of fact, drinking water has reached a level of regulation in the U.S. stricter than almost any place in the world. Coming years will make measures designed to protect our drinking water even more rigorous, as a result of the 1986 amendments to the Safe Drinking Water Act.

Before we look more closely at what's been accomplished in the past decade—and what lies ahead in the next few years—let's pause to reflect on the broader outlines of progress toward safer drinking water both in the United States and elsewhere in the world. □

Water, Water Everywhere



The human body is mostly water: 55 to 65 percent water for women, 65 to 75 percent water for men. People can survive without food for two months or more, but no one can survive without water for more than a few days.

Only one percent of the water on Earth is fresh and accessible for human use. The remaining 99 percent is either unusable brine or ice.

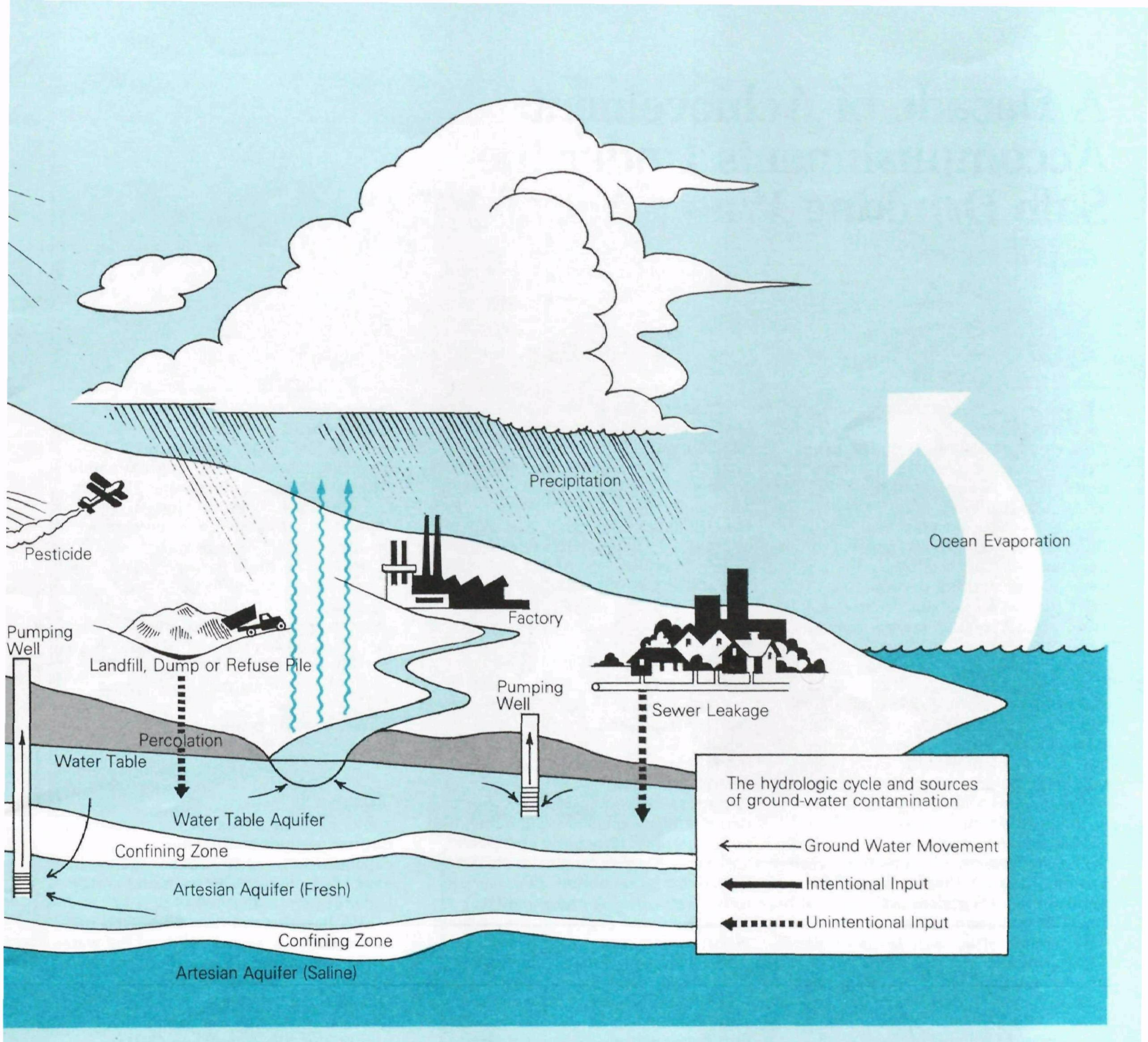
Every day 4.2 trillion gallons of precipitation fall on the U.S. More than half of this huge quantity of water evaporates: 2800 billion gallons. A sizable portion—1200 billion gallons—is carried by rivers and streams across the U.S. border to Canada or Mexico, or out into the ocean. About 61 billion gallons soak into U.S. aquifers.

The U.S. has 2 million miles of streams and over 30 million acres of lakes and reservoirs. In addition, our country has untold huge reserves of fresh water in underground aquifers: 50 times more, in fact, than our supply of surface water.

Ground water supplies over 100 million people—about 50 percent of all Americans—with their drinking water.

The U.S. withdraws about 90 billion gallons of ground water every day for all uses. This includes 12 billion gallons per day for public water supply.

Each day, public water systems supply every person in the United States with approximately 160 gallons of clean water.



The world has a vast quantity of water: 326 trillion gallons. That amount of water remains constant, but the various forms it takes are constantly changing.

The same water recirculates over and over again: first evaporating, then condensing, then falling to the earth again as rain or snow.

This precipitation replenishes supplies of surface and ground water. The pull of gravity draws the water down to coastal areas and the ocean—where it evaporates and sets the cycle in motion once again.

Sources of Drinking Water Contamination

Before Treatment

Natural minerals and salts

Decay products of radon, radium, and uranium

Human and animal organic waste

Defective storage tanks

Leaking hazardous waste landfills, ponds, and pits

Intrusion of salt water into depleted aquifers near the seashore

Agricultural run-off (fertilizers, pesticides, etc.)

Surface run-off (overflowing storm sewers, rainwater from oil-slicked or salt-treated highways, etc.)

Underground injection of industrial waste

During Treatment

Disinfection by-products

Other additives

After Treatment

Corrosion of piping materials, including lead and asbestos

Bacteria and dirt from leaking pipes

Cross connections (incorrect pressure gradients that can suck polluted water into pipes instead of pushing it out)

A Decade of Achievement: Accomplishments Under the Safe Drinking Water Act of 1974

"Dangerous" water According to a study completed in 1970, that's what an estimated 360,000 Americans were drinking. According to the same study, while 59 percent of the U.S. public was drinking "good" water, an alarming 41 percent was drinking "inferior" water. Fifty-six percent of water systems, especially smaller ones, were not constructed or operating properly. Seventy-seven percent of water plant operators lacked sufficient training in microbiology, and 79 percent of water systems had not been inspected by federal officials in over two years.

With the exception of limited regulations governing water supplies serving interstate carriers, the United States had no enforceable national standards for drinking water. Each state set its own standards, and these varied in range and rigor from state to state.

This was the situation in 1972 when the Clean Water Act became law. The United States set 1983 as its goal for ensuring that all surface water would be "fishable and swimmable." In 1974, with passage of the Safe Drinking Water Act, "drinkable" water joined "fishable and swimmable" water on the national agenda. Over the past ten years, the U.S. government has spent approximately $42 billion in pursuit of these goals.

The first regulations under the Safe Drinking Water Act took effect in 1977. Unfortunately, there is no benchmark data from that year, so it is hard to quantify the exact impact the law has had. But it is clear that substantial progress has been made over the past ten years.

The enforcement universe of the Safe Drinking Water Act consists of the 58,000 community water supply systems in the United States that serve 25 or more people, or have 15 or more service connections. Also subject to the Safe Drinking Water Act are approximately 160,000 non-residential water suppliers.

Water from both these sources reaches the drinking glasses of 200 million Americans—83 percent of the U.S. population.

Today 87 percent of these 58,000 water systems in the United States are in compliance with Safe Drinking Water Act maximum contaminant levels (MCLs). MCL standards are laid out in the regulations that EPA has promulgated over the past decade for 26 important drinking water pollutants: two microbiological contaminants, four radionuclides, 10 organic chemicals, and 10 inorganic chemicals.
During the same period, EPA has set sodium monitoring and reporting requirements to deal with the problem of salt in drinking water, as well as monitoring and distribution system composition requirements for corrosion.

Responsibility for enforcing these standards originally resided with EPA. But 95 percent of the states have qualified for what is known as "primacy" in the enforcement of EPA-promulgated maximum contaminant levels. Primacy means responsibility for enforcing standards at least as stringent as those set by EPA. As of August, 1986, only the District of Columbia and the states of Wyoming and Indiana do not yet have Safe Drinking Water Act primacy.

Recent data show that the states are rising to the challenge of their enforcement responsibilities. In fiscal year 1985, 72 percent of all public water systems met EPA's monitoring and reporting requirements. Approximately 89 percent of all public water systems met all national microbiological MCL standards, while nearly 95 percent were in full compliance with turbidity MCLs.

Fewer than three percent of water systems were found to be "persistent violators" of turbidity and microbiological MCL requirements. A persistent violator is one who has been out of compliance with federal standards for four months or longer during the year.

EPA does more than simply promulgate drinking water standards for states to enforce. The Agency also tries to help the states become more effective in exercising primacy. EPA has awarded grants to many states for the purpose of improving their testing and analytical capabilities. In addition, the Agency has expanded programs to train and certify water system operators.

EPA has also sponsored research into many different aspects of drinking water pollution, including important research on organic chemicals and radionuclides. One of the most significant EPA-funded research initiatives uncovered the problem of trihalomethane (THM) contamination. Further EPA action helped to bring this potentially dangerous group of chlorination by-products under control. THMs are now being monitored and regulated by approximately 93 percent of U.S. surface water systems.

EPA is also responsible for ensuring that its own officials and those of states with "primacy" notify the public in the event that contaminant levels exceed

George Beach, Inc.

A water treatment operator opens a drain valve for a settling basin. EPA has expanded programs to train and certify water system operators.

federal water quality standards. These notices of violation must explain the health significance of the violation in non-technical terms. This important requirement is a keystone of EPA's efforts to assure compliance with the national drinking water regulations and to protect public health. It also fosters awareness of the importance of safe drinking water and encourages the public to assist in solving water quality problems. □

Other Laws Protecting Drinking Water Supplies

- The **Clean Water Act** sets water quality standards for all significant bodies of surface water, requires sewage treatment, and limits the amount of industrial effluents that can be discharged into the nation's surface waters.

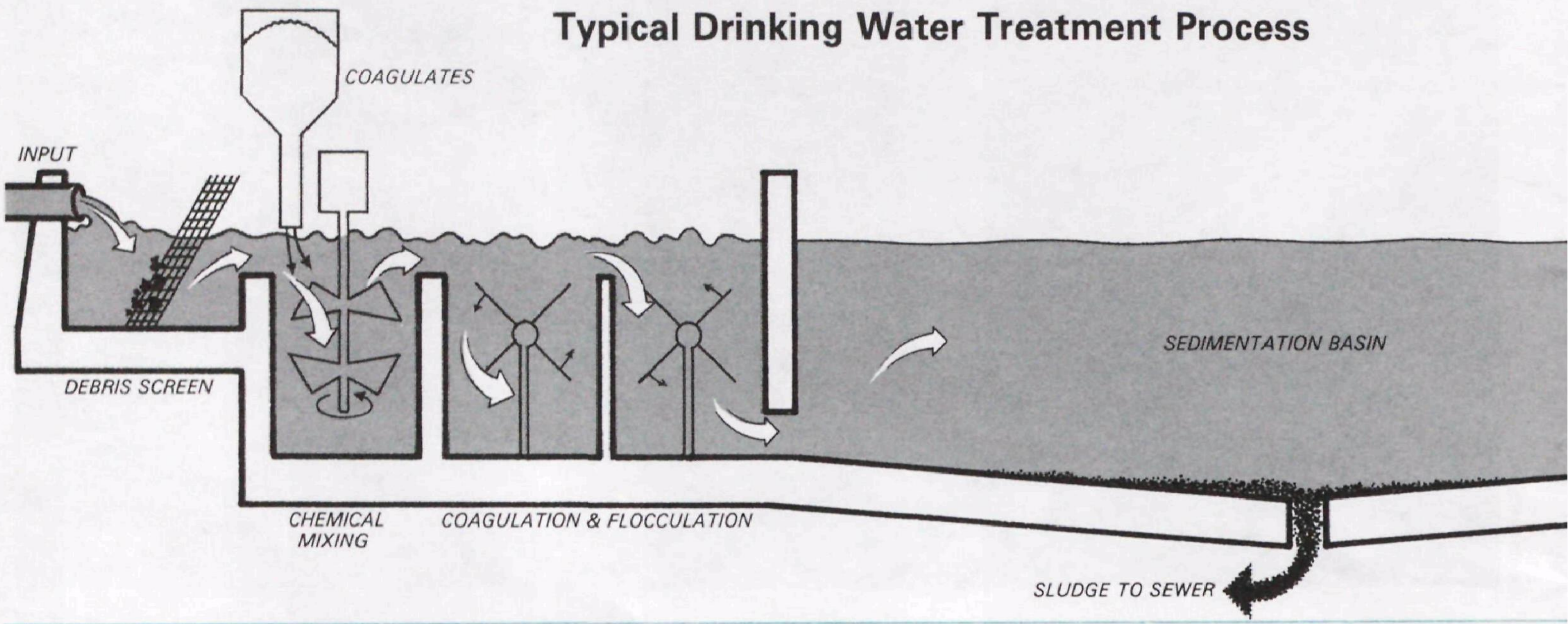
- Under the **Resource Conservation and Recovery Act (RCRA)**, EPA has developed "cradle to grave" regulations governing the generation, storage, transport, treatment, and disposal of hazardous wastes. RCRA gives EPA the power to protect all sources of ground water from contamination by hazardous waste. This law also prohibits pollution of surface water and air by hazardous waste sites.

- The **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)**, better known as "Superfund," is used to clean up existing hazardous waste sites that pose a threat to water or other resources.

- The **Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)** and the **Toxic Substances Control Act (TSCA)** give EPA the power to regulate pesticides and toxic substances that may have an adverse effect on the environment, including ground water and other sources of drinking water.

Drinking Water Treatment Process

Typical Drinking Water Treatment Process



Who Keeps Your Water Safe Drinking

Local Water Systems:

- Site wells and intakes (pipes that suck water into drinking water systems)
- Treat water to meet standards
- Sample water and maintain test records
- Notify the public if problems arise

Local Pollution Control Agencies:

- Protect surface water
- Protect ground water from contamination by controlling contaminating sources
- Monitor ground water and detect contaminants

State Drinking Water Programs:

- 95 percent of the states have primary enforcement responsibility, obtained by establishing state drinking water standards at least as stringent as the national standards
- Train staff of local water systems
- Inspect systems and maintain records
- Take enforcement action against systems that violate monitoring and reporting regulations or drinking water standards
- Regulate underground injection wells if primacy in that sphere has been granted by EPA

State Ground-Water Protection Agencies:

- Develop comprehensive ground-water protection strategies
- Develop programs and laws to control contaminating sources and activities
- Conduct statewide monitoring of ground water

EPA Drinking Water Program:

- Retains primary enforcement responsibility in three areas that have not attained "primacy": Wyoming, Indiana, and the District of Columbia.
- Sets primary and secondary drinking water standards
- Establishes monitoring and reporting requirements

What Happens to Your Water Before It Comes Out of the Faucet?

1 EPA and the states work to protect the quality of ground and surface water needed to keep the United States supplied with safe drinking water.

2 Water is moved from surface and ground-water sources to storage areas. Sometimes copper sulfate is added to control algae growth.

3 Water is strained to remove debris.

4 A chemical such as alum is added to coagulate particles.

5 Water moves slowly through sedimentation basins while solid particles sink to the bottom.

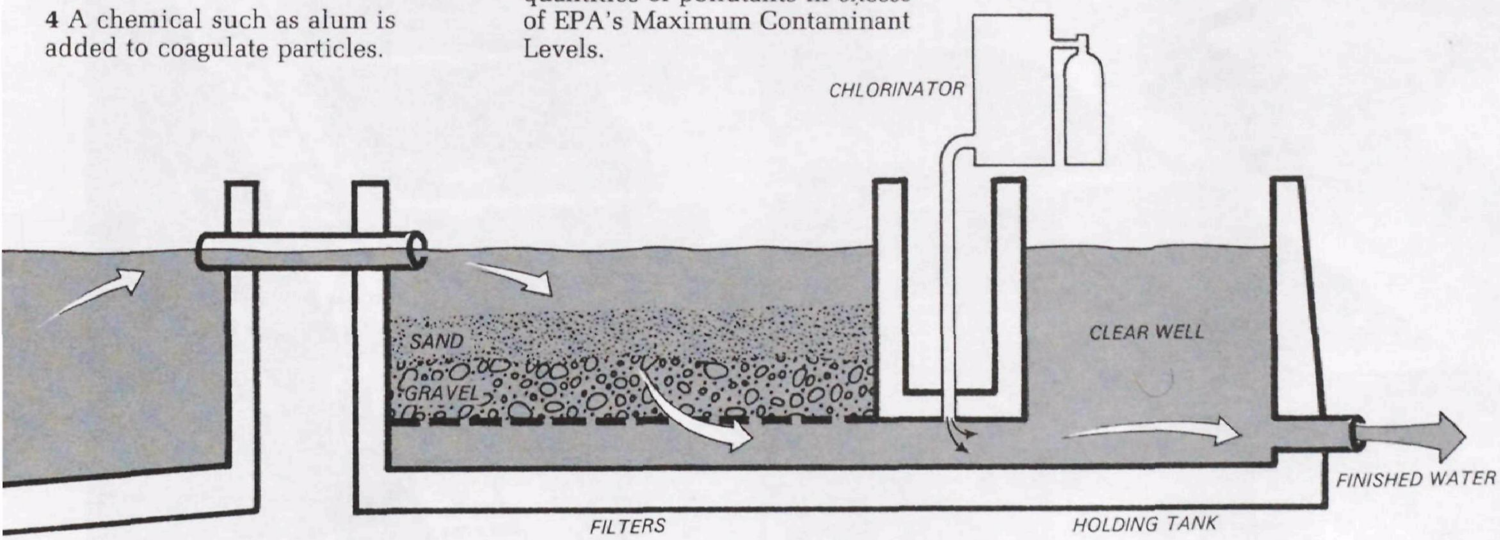
6 Water then flows through beds of gravel and sand for final filtering.

7 Chlorine or other disinfectants are added as a final treatment to kill bacteria.

8 Water is then tested for purity to ensure that it does not contain any quantities of pollutants in excess of EPA's Maximum Contaminant Levels.

9 Treated water goes to reservoirs or holding tanks. In some cases, it goes directly into the water system.

10 Drinking water comes gushing out of the faucet in your kitchen or bathroom.



In Milwaukee, WI, in February 1985, Governors James Blanchard of Michigan (left) and Anthony Earl of Wisconsin join other Great Lakes Governors and Canadian provincial governors in signing the Great Lakes Charter. They pledged to cooperate in managing and protecting the Great Lakes, drinking water source for 28 million people in the region.

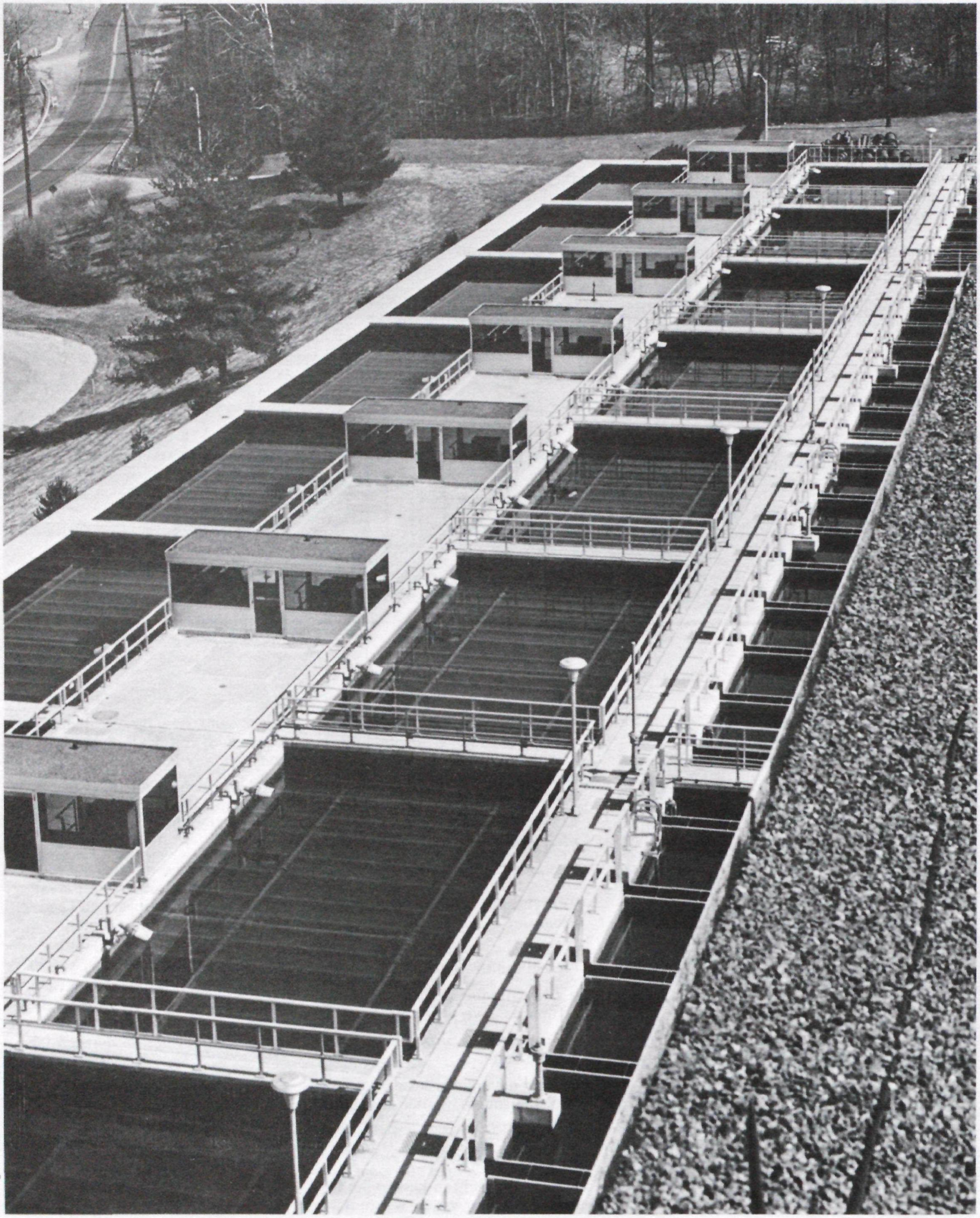
- Provides funds and technical assistance to the states, including Health Advisories on unregulated contaminants; steps in to help during emergencies
- Sets rules for operation of underground injection wells
- Conducts research

EPA Ground-Water Protection Program:

- Manages EPA Ground-Water Protection Strategy
- Assists states in developing comprehensive programs
- Focuses EPA programs on ground water
- Administers wellhead protection and sole-source aquifer protection programs

You, the Citizen:

- Have the right to know who is supplying your water, where it comes from, how it is treated, how it is tested, and what its quality level actually is
- When necessary, lend political and financial support to efforts to improve the quality of drinking water
- Should follow results of drinking water tests in your area; attend public hearings; and keep track of other developments relating to the quality of your drinking water
- Should exercise your right to bring civil suits when your local water system, your state, or your federal officials fail to do their job
- Should be aware of potential sources of ground and surface contamination; also, support efforts aimed at protecting these vital resources


Washington Suburban Sanitary Commission

View of a water filtration plant in Maryland.

Drinking Water Milestones

We have come a long way since the days when water-borne diseases such as cholera and typhoid were deadly killers. To appreciate what vast progress has been made toward safer drinking water, it helps to take a backward glance:

2000 BC: Sanskrit manuscript observes that "It is good to keep water in copper vessels, to expose it to sunlight, and filter it through charcoal."

Circa 400 BC: Hippocrates emphasizes the importance of water quality to health and recommends the boiling and straining of rainwater.

1832 AD: The first municipal water filtration works open in Paisley, Scotland.

1849: Dr. John Snow discovers that the victims of a cholera outbreak in London have all used water from the same contaminated well in Broad Street.

1877-1882: Louis Pasteur develops the theory that disease is spread by germs.

1882: Filtration of London drinking water begins.

1890s: The Lawrence Experiment Station of the Massachusetts Board of Health discovers that slow sand filtration of water reduces the death rate from typhoid by 79 percent.

Late 1890s: The Louisville Water Company innovates by combining coagulation with rapid sand filtration. This treatment technique eliminates turbidity and removes 99 percent of bacteria from water.

1908: Chlorination is introduced at U.S. water treatment plants. This inexpensive treatment method produces water 10 times purer than filtered water.

1912: Congress passes the Public Health Service Act, which authorizes surveys and studies of water pollution, particularly as it affects human health.

1914: The first standards under the Public Health Service Act are promulgated. These introduce the concept of maximum permissible safe limits for drinking water contaminants. The standards, however, apply only to water supplies serving interstate means of transportation.

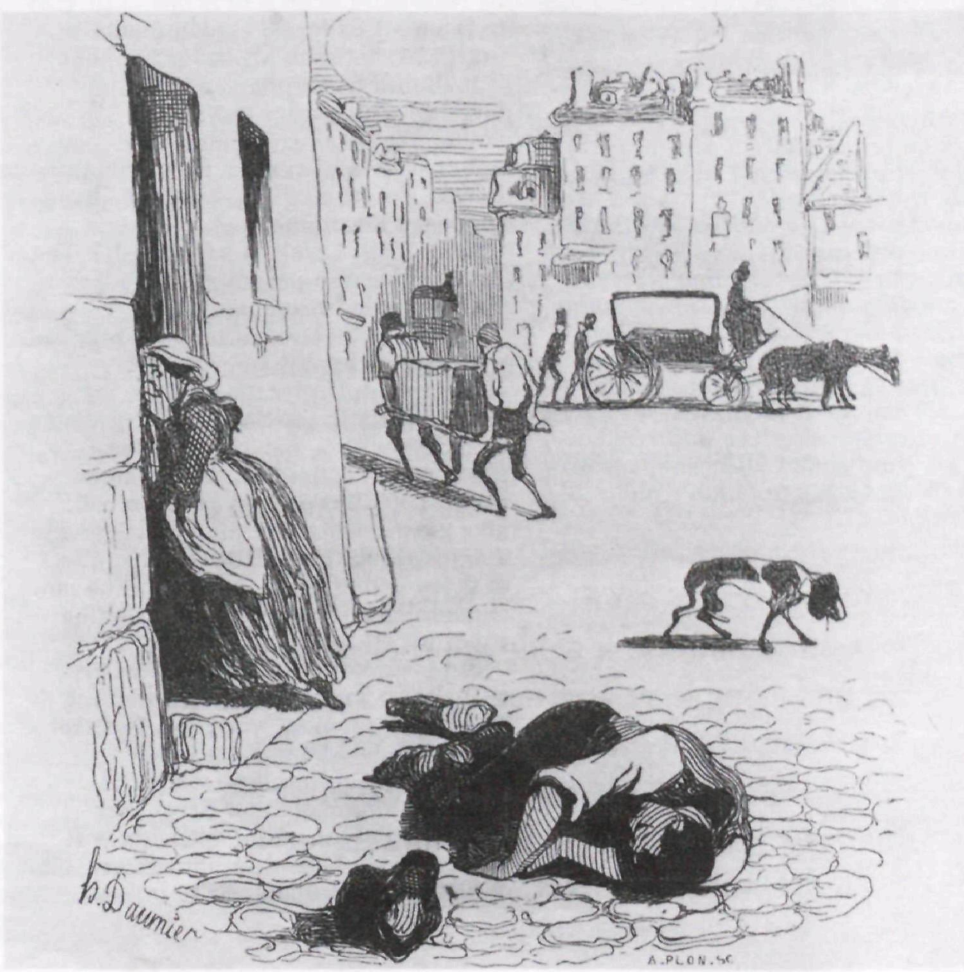
1948: Congress approves a Water Pollution Control Act. Its provisions, too, are restricted to water supplies serving interstate carriers.

1972: The Clean Water Act, a major amendment to the Federal Water Pollution Act, contains comprehensive provisions for restoring and maintaining all bodies of surface water in the U.S.

1974: The Safe Drinking Water Act is passed, greatly expanding the scope of federal responsibility for the safety of drinking water. Earlier Acts had confined federal authority to water supplies serving interstate carriers. The 1974 act extends U.S. standards to all community water systems with 15 or more outlets, or 25 or more customers.

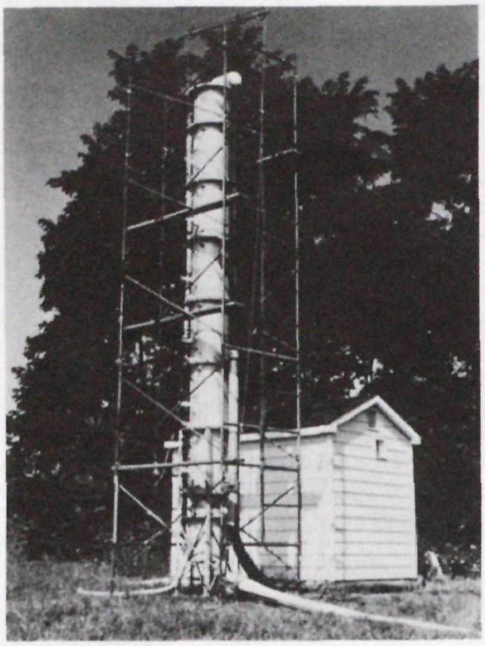
1977: The Safe Drinking Water Act is amended to extend authorization for technical assistance, information, training, and grants to the states.

1986: The Safe Drinking Water Act is further amended. Amendments set mandatory deadlines for the regulation of key contaminants; require monitoring of unregulated contaminants; establish benchmarks for treatment technologies; bolster enforcement powers; and provide major new authorities to promote protection of ground-water resources.



In this 19th century woodcut, a cholera victim lies unattended in the street. In the background, men carry the casket of another victim to burial. A few years after this woodcut was done, a British scientist established a link between cholera and contaminated water.

What Lies Ahead: Our Nation's Agenda Under the Safe Drinking Water Act of 1986



Mike Cummins

In Washington, NJ, a pilot decontamination system removes trichloroethylene from a drinking water supply well in an adjacent shed. The system, known as a packed column air stripping process, mixes volatile organic compound (VOC)-contaminated water with uncontaminated air, transfers the VOCs from the water to the air, then disperses the VOCs to the atmosphere. The Office of Drinking Water has tested the ability of the mobile pilot system to remove trichloroethylene and vinyl chloride from water, and next year will evaluate its ability to remove radon from water.

Let's do more to protect the quality of our drinking water, and let's do it faster: that's the message of the new amendments to the Safe Drinking Water Act. Signed into law in June 1986, these amendments change and strengthen the Safe Drinking Water Act in many important ways.

Protecting Drinking Water Quality

Accelerated regulation of contaminants is probably the single most important provision of the new law. During the first 12 years of the Safe Drinking Water Act, EPA developed final Maximum Contaminant Levels (MCLs) for 26 contaminants. Under the new amendments, the Agency must speed up its regulatory efforts. EPA has until 1989 to issue MCLs for 83 contaminants, and until 1991 to issue MCLs for 25 more.

It should be emphasized that the target of 83 includes the 26 contaminants already subject to enforceable Maxmimum Contaminant Levels. For 43 of these, EPA has already proposed Recommended Maximum Contaminant Levels (Health Goals). The Agency has also proposed MCLs for eight volatile organic chemicals.

Having more contaminants to regulate will put a premium on effective enforcement. Under the new amendments to the Safe Drinking Water Act, EPA will be better able to take enforcement action against violators. Stiffer penalties against violators will give greater weight to these enforcement actions when they occur. The net effect of these and other provisions of the new amendments should be safer drinking water for all Americans.

But even with this head start, EPA will need a major increase in funding to meet its heavy new workload. In fiscal year 1986, $63.59 million was appropriated to implement the Safe Drinking Water Act. For fiscal year 1987, the Reagan Administration will make a much higher authorization request: approximately $170 million.

Increased funding will go farther with a slightly streamlined process for promulgating Maximum Contaminant Levels. The amended Safe Drinking Water Act enables EPA to eliminate one stage in the process required by the old law. Under the old law, EPA issued Recommended Maximum Contaminant Levels (RMCLs) prior to promulgating final MCLs. From now on, EPA will propose Maximum Contaminant Level Goals (MCLGs)—the new term for the old RMCLs—at the same time MCLs are set. This will make it somewhat easier for EPA to issue regulations, from a procedural standpoint. But all of the same technical assessments will still need to be done—with less time to do them.

Moreover, enforcing all these new MCLs—plus the old ones—will be both difficult and expensive. In most cases (95 percent), the states have primary responsibility for enforcement. Many states will find their resources strained once the number of regulated drinking water contaminants more than triples.

Local water systems will have to scramble to monitor and control all of these newly regulated contaminants. Simply finding laboratory facilities adequate to handle increasingly sophisticated and numerous procedures will be difficult. Drinking water systems will also face another burden: mandatory monitoring of unregulated contaminants at least once every five years.

The added cost of all this extra work will, most likely, be passed along to American consumers, who currently enjoy much cheaper water than their neighbors in Europe and eastern Asia.

Under the revised Safe Drinking Water Act, it will be easier for EPA to ensure that the states take enforcement action swiftly and effectively. The new law gives the Agency added authority to take action against public water systems found to be in violation of SDWA standards. EPA can also impose heavier fines on violators.

Effective enforcement is vital to the success of the amended Safe Drinking

Water Act. At present, small water systems pose the greatest challenge. Lack of resources and expertise often impede small systems in their efforts to meet federally mandated drinking water standards. To alleviate such problems, EPA will provide technical assistance to such systems over the next three years.

Even large systems will have trouble meeting some of the requirements of the revised Safe Drinking Water Act. For example, one amendment mandates that granular activated carbon filtration—a highly regarded but also expensive technology—should be considered to be the best available technology for controlling synthetic organic chemicals.

Two other technological provisions of the amended law will also force water systems, both large and small, to invest in new equipment. One of these—designed as a safeguard against *Giardia* and other forms of contamination—requires filtration of surface supplies of drinking water that are not otherwise adequately protected against contamination. The other mandates the disinfection of all drinking water supplies: a practice long under way in large communities but not in many small ones.

Several other key provisions of the amended Safe Drinking Water Act include:

- An immediate ban on all future use of lead pipe and lead solder. Lead contamination of drinking water has been a source of growing concern in the United States. It is hoped that a ban on future use of lead pipe and lead solder will help to reduce the risk of lead poisoning in the years ahead.

- A requirement for EPA to evaluate methods of monitoring Class I (industrial and municipal disposal) underground injection wells. Rules for the monitoring of these deep man-made wells already exist, but Congress has asked EPA to investigate the best methods of performing required monitoring.

- The stipulation that EPA may now deal with Indian reservations as sovereign entities in all matters pertaining to drinking water and ground water. In the past, EPA has safeguarded the quality of drinking water on Indian reservations. Now, if Indian tribes can meet the same criteria as states that have attained "primacy," they too can exercise primary authority in this sphere. If primacy is granted, EPA will provide grant money to qualified tribes. The Agency will also distribute development grants to tribes seeking to attain primacy.

In a major initiative unrelated to passage of the 1986 Safe Drinking Water Act amendments, EPA is also considering whether to undertake the regulation of the 20,000 non-community water systems supplied with water from private sources. These systems provide the drinking water for public places, such as schools, offices, and factories. Such facilities are already subject to Safe Drinking Water Act standards in areas where drinking water is drawn from public water supplies.

Protecting Ground-Water Quality

Ground water, which supplies half of U.S. drinking water, will get its own special protection under the new Safe Drinking Water Act. Our dependence on this source of water is growing greater by the day. Two provisions of the new Safe Drinking Water Act are specifically designed to protect ground water:

- States are to develop programs for preventing contamination of surface and subsurface areas around public water wells.

EPA will cover from 50 to 90 percent of the cost of these "wellhead protection" programs, including determining the area to be protected, inventorying sources of contamination, and designing protection programs.

- EPA will administer a grant program to demonstrate innovative methods of protecting the critical aquifer areas of designated sole-source aquifers. These are areas in which ground water is the sole or principal source of drinking water for a large population and the ground water is particularly vulnerable to contamination. Support will go to states or local agencies for this effort, which will highlight both technical and institutional means of protecting sole-source aquifers.

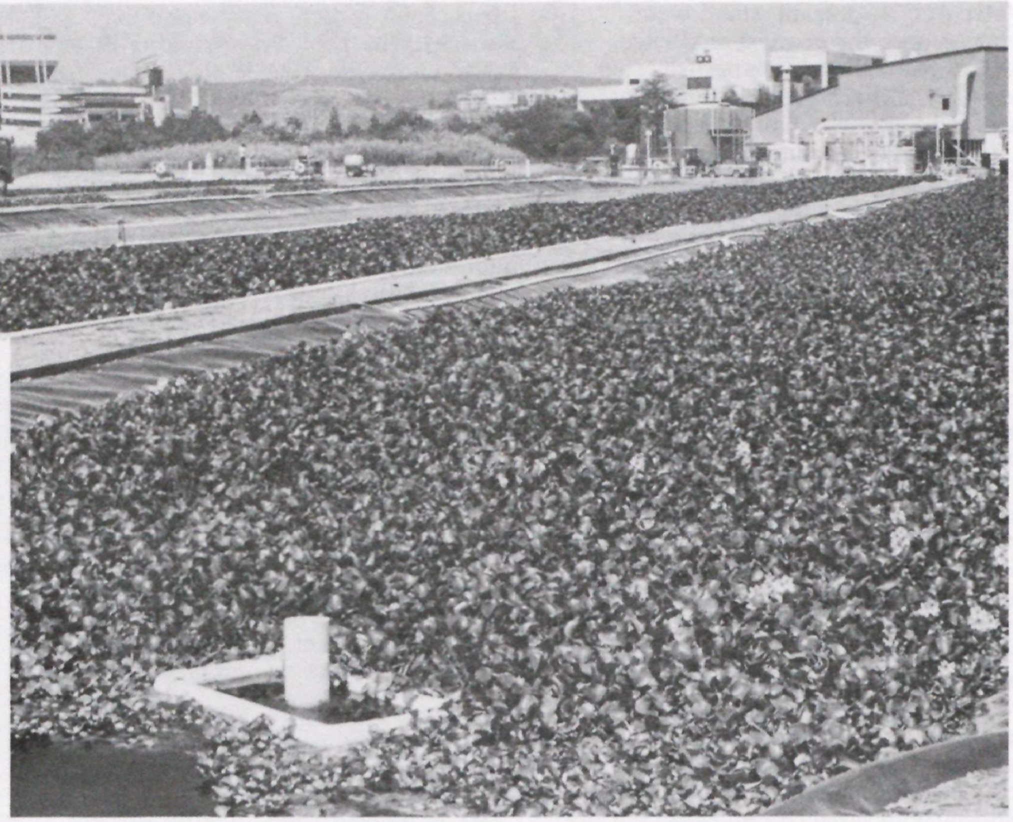
EPA will implement the new ground-water provisions of the SDWA as part of its Ground-Water Protection Strategy. This strategy, developed in 1984, calls for better coordination of all federal and state efforts aimed at the protection of ground water. Specific goals of the strategy are to:

- Build and enhance state ground-water protection strategies and programs.

- Expand controls over currently uncontrolled sources of contamination.

- Achieve greater consistency in ground-water protection and cleanup.

On Osage Indian lands in Pawhuska, OK, geological technician Andrew Yates records information from pressure test of injection well. Recent amendments to the Safe Drinking Water Act state that EPA may now deal with Indian tribes as sovereign entities in drinking water and ground-water matters.



Don Jones & Bob Ballard

Drinking water of the future? At San Diego's Aquaculture Plant, water hyacinths pull nutrients from sewage which flows through ponds hundreds of feet long (foreground). In closeup, Yvonne Rehg of the San Diego Water Utilities Department holds two dramatically different water samples. The cloudy water in the cone on the left contains untreated sewage. The other cone contains water from which 90 percent of the pollutants have been removed by water hyacinths. Department employees hope that further treatment will render this water safe to drink.

- Strengthen EPA's nationwide organization for ground-water protection.

EPA is developing classification guidelines for use in defining different types of ground water. These will enable the Agency to tailor its protection efforts to the usage patterns of aquifers, and their vulnerability to contamination. EPA also has a grant program to support state ground-water protection efforts.

You, the American Citizen

What about you, the average U.S. citizen and consumer of drinking water? Some of the revisions in the 1986 Safe Drinking Water Act will improve your access to key information about the quality of your drinking water supply.

EPA and state authorities now have the flexibility to devote the lion's share of their attention to keeping the public informed of truly serious health risks and truly persistent violators. Previously, time and resources were wasted on routine notification of minor violations.

Notification of Maximum Contaminant Level violations posing a serious health risk must now occur within 14 days of their detection. Such notification must explain to the public:

- What the violation was
- What adverse health effects it is likely to have.
- Steps that are being taken to correct the violation.
- The need for alternate water supplies.

When violations are continuous, such notification must also continue every three months. For less serious violations, only annual notification is now required.

Congress has presented EPA and the nation with a major challenge. Making a reality of the stricter provisions of the 1986 Safe Drinking Water Act will require redoubled efforts by all those involved in protecting your drinking water: local, state, and federal officials, scientists, engineers, and water plant operators.

But once these provisions are a reality, we will all reap the benefits and reassurance of even safer drinker water than we already enjoy. And no one can exaggerate the importance of safe drinking water to the health and prosperity of the United States. □

Regulated Contaminants and Their Health Effects

Drinking water regulations fall into two basic categories: primary and secondary.

Primary regulations determine how clean drinking water must be to protect public health.

Enforceable primary regulations are known as Maximum Contaminant Levels (MCLs). These must be set as close to generally more stringent Recommended Maximum Contaminant Levels (RMCLs) as is "feasible." Feasible means consistent "with the use of the best technology, treatment techniques and other means, which the Administrator (of EPA) finds . . . are available (taking cost into consideration)."

To retain "primacy," states must adopt laws that are at least as strict as EPA's primary drinking water regulations. They also must meet certain reporting and monitoring requirements.

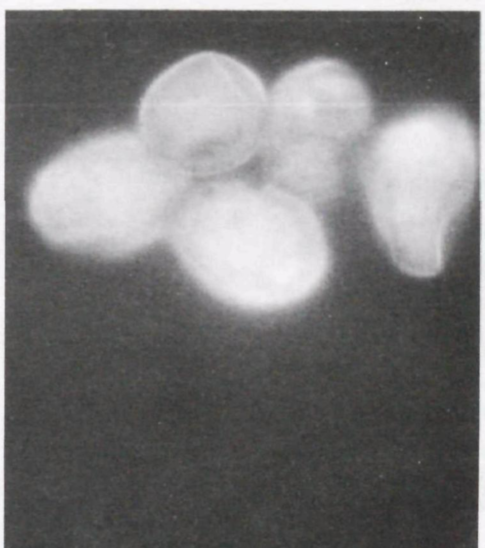
In addition to interim Maximum Contaminant Levels, most of the contaminants listed below have a proposed Recommended Maximum Contaminant Level (RMCL). One of them, fluoride, has a final RMCL.

What is an RMCL? An RMCL is an ideal health goal, which is not enforceable. As a result of the 1986 amendments to the Safe Drinking Water Act, they will be known henceforward as Maximum Contaminant Level Goals (MCLGs). Here we will refer to them by their old name: RMCLs.

RMCLs have been proposed at levels that, in the opinion of EPA, present no known or anticipated health effect with a margin of safety. They set goals for contamination compatible with virtually zero risk of cancer and and other major illness. The purpose of Recommended MCLs—like that of the new MCL Goals—is to serve as targets for the revision of interim MCLs, the enforceable drinking water standards. "Health Goals," whether RMCLs or MCLGs, are set without regard to technical feasibility or cost.

Secondary drinking water regulations are not health-related. They are intended to protect "public welfare" by offering unenforceable guidelines on the taste, odor, or color of drinking water, as well as certain other non-aesthetic effects. Water systems are not required to comply with secondary standards. EPA recommends them to the states as reasonable goals for the aesthetics of drinking water.

EPA also issues guidance documents called Health Advisories, which assist the states in the implementation of their drinking water programs by identifying potentially hazardous contaminants and their health effects, along with available analytical measurement techniques and technologies for controlling the contaminants.



Dr. Judith F. Sauch, EPA/HERL, Cincinnati

Giardia lamblia cysts taken from a human donor but similar to those found in contaminated water.

Primary Regulations

Over the past 10 years, EPA has set interim Maximum Contaminant Levels for 26 drinking water contaminants. These MCLs are called "interim," because the 1974 Safe Drinking Water Act stipulated that EPA was to issue its MCLs on an interim basis and then periodically to revise them. Thus far, only the MCL for fluoride has been issued in final revised form.

Listed below, with their health effects, are the 25 drinking water contaminants with interim Maximum Contaminant Levels, plus the twenty-sixth regulated contaminant, fluoride, which is the only one thus far that has a final revised Maximum Contaminant Level. The contaminants are divided by category.

Also listed here are two other drinking water regulations promulgated by EPA since 1974: one governing the monitoring and reporting of sodium; the other establishing rules for monitoring distribution systems to see if they are corroded or have other problems.

Under the heading "Proposed Regulations," you will find a complete list of Maximum Contaminant Levels and Recommended Maximum Contaminant Levels that were proposed by EPA prior to the passage of the 1986 Safe Drinking Water Act amendments. None of these is yet in force.

Existing Standards

MICROBIOLOGICAL CONTAMINANTS

Microbiological organisms were the first drinking water contaminants to arouse concern. The first federal standards to control these "microbials" date back to 1914. Cholera has been under control in this country since the 1870s, and typhoid since about 1910. Two types of microbial-related contaminants are now subject to regulation under the Safe Drinking Water Act.

Interim Maximum Contaminant Levels in Force:	Principal Health Effects:
Total Coliforms (Coliform bacteria, fecal coliform, streptococcal, and other bacteria)	Although not necessarily in themselves disease-producing organisms, coliforms can be indicators of organisms that cause assorted gastro-enteric infections, dysentery, hepatitis, typhoid fever, cholera, and other diseases of surface water; also interferes with the disinfection process

INORGANIC CHEMICALS

Most inorganic chemicals, such as arsenic and fluoride, are present naturally in water from geological sources. Others, such as lead, enter the water as the result of human intervention.

Interim MCLs In Force For:	Principal Health Effects:
Arsenic	Dermal and nervous system toxicity effects
Barium	Circulatory system effects
Cadmium	Kidney effects
Chromium	Liver/kidney effects
Lead	Central and peripheral nervous system damage; kidney effects; highly toxic to infants and pregnant women
Mercury	Central nervous system disorders; kidney effects
Nitrate and Nitrite	Methemoglobinemia ("Blue-Baby Syndrome")
Selenium	Gastro-intestinal effects
Silver	Skin discoloration (Argyria)

Final Revised MCL In Force For:	Principal Health Effects:
Fluoride	Skeletal damage

ORGANIC CHEMICALS

The organic chemicals listed here—except trihalomethanes, a chlorination by-product—fall into two main categories: synthetic organic chemicals (SOCs) and volatile synthetic organic chemicals (VOCs). In scientific terms, "volatile" means capable of being readily vaporized, evaporating readily at normal temperatures.

Synthetic Organic Chemicals

SOCs are synthetic organic compounds used in the manufacture of a wide variety of agricultural and industrial products. The best-known SOCs are pesticides and herbicides.

Interim MCLs In Force For:	Principal Health Effects:
Endrin	Nervous system/kidney effects
Lindane	Nervous system/liver effects
Methoxychlor	Nervous system/kidney effects
2,4-D	Liver/kidney Effects
2,4,5-TP Silvex	Liver/kidney effects
Toxaphene	Cancer risk

Volatile Organic Chemicals

VOCs are a broad class of synthetic chemicals used commercially as degreasing agents, paint thinners, varnishes, glues, dyes, and pesticides. They are most commonly used in urban industrial areas, where they can contaminate ground water if improperly disposed.

No interim MCLs are yet in force for VOCs, but RMCLS (now known as MCL Goals) have been promulgated, and MCLs have been proposed.

Other Organics (Disinfection By-Products):

Interim MCLs In Force For:	Principal Health Effects
4 Types of Trihalomethanes	Cancer risk

RADIONUCLIDES

Radionuclides are radioactive compounds sometimes found in drinking water. Radionuclides get into drinking water drawn from ground-water wells. On occasion, these wells can become contaminated by uranium and radon deposits that occur naturally in the soil of various regions. In a few cases, man-made radionuclides—from radioactive waste—can be the source of contamination. Like other drinking water contaminants, radionuclides pose a threat to human health when ingested.

Interim MCLs In Force For:	Principal Health Effects:
Gross alpha particle activity	Cancer
Beta particle and photon radioactivity from man-made radionuclides	Cancer
Radium-226	Bone cancer
Radium-228	Bone cancer

MISCELLANEOUS

Monitoring Regulations In Force For:	Health Effects:
Sodium monitoring and reporting	Hypertension
Monitoring of distribution systems for corrosion and other problems	*Lead poisoning and other problems*

SECONDARY

Non-enforceable secondary standards exist for the following:

Contaminant:	Effects:
pH	Water should not be too acidic or too basic; must fall between 6.5 and 8.5 on the pH scale
Chloride	Taste; corrosion of pipes
Copper	Taste; staining of porcelain
Foaming agents	Aesthetic
Sulfate	Taste and laxative effects
Total dissolved solids (Hardness)	Taste; possible relation between low hardness and cardiovascular disease; Also an indicator of corrosivity (Lead problems); can damage plumbing and limit effectiveness of soaps and detergents
Zinc	Taste
Fluoride	Dental fluorosis (A brownish discoloration of the teeth)
Color	Aesthetic; consumers turn to alternative supplies
Corrosivity	Aesthetic; also health related
Iron	Taste
Manganese	Taste
Odor	Aesthetic

Proposed Standards

EPA already has a head start on many of the regulatory tasks mandated in the 1986 amendments to the Safe Drinking Water Act.

Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs, formerly known as Recommended Maximum Contaminant Levels—or RMCLs) have been proposed for a whole range of drinking water contaminants.

MCLGs, like RMCLs before them, are to be set at a level at which, in the judgment of the EPA Administrator, "no known or anticipated adverse effects on the health of persons occur and which allows an adequate margin of safety." MCLGs and RMCLs are known as "Health Goals" both because they are unenforceable and because they do not take feasibility factors, such as cost and available technology, into account.

MICROBIOLOGICAL CONTAMINANTS

RMCLs Proposed:	Principal Health Effects:
Giardia lamblia	Gastro-enteric disease (Giardiasis; sometimes known as "Backpacker's Disease")
Viruses	Gastro-enteric and other disease

INORGANIC CHEMICALS

RMCLs Proposed:	Principal Health Effects:
Arsenic	Dermal and nervous system toxicity effects
Asbestos	Possible cancer
Barium	Circulatory system effects
Cadmium	Kidney effects
Chromium	Liver and kidney disorders
Copper	Gastro-intestinal disturbances
Lead	Central and peripheral nervous system damage; kidney effects; highly toxic to infants and pregnant women
Nitrate	Methemoglobinemia ("Blue Baby Syndrome")
Nitrite	Methemoglobinemia ("Blue Baby Syndrome")
Selenium	Selenosis (Liver damage from very high doses; other effects from lower doses)

ORGANIC CHEMICALS

Volatile Organic Chemicals

MCLs Proposed For:	Principal Health Effects:
Benzene	Cancer
Carbon tetrachloride	Possible cancer
p-Dichlorobenzene	Possible cancer
1,2-Dichloroethane	Possible cancer
1,1-Dichloroethylene	Liver/Kidney effects
1,1,1-Trichloroethane	Nervous system effects
Trichloroethylene	Possible cancer
Vinyl chloride	Cancer

RMCLs Proposed:	Principal Health Effects
Chlorobenzene	Nervous system/liver effects
Trans-1,2-dichloroethylene	Liver/kidney effects
Cis-1,2-dichloroethylene	Liver/kidney effects

Final RMCLs In Place For:	Principal Health Effects:
Benzene	Cancer
Carbon Tetrachloride	Possible cancer
1,1-Dichloroethylene	Liver/kidney effects
1,2-Dichloroethane	Possible cancer
Trichloroethylene	Possible cancer
1,1,1-Trichloroethane	Nervous system effects
Vinyl chloride	Cancer

Synthetic Organic Chemicals

RMCLs Proposed For:	Principal Health Effects:
Acrylamide	Possible cancer
Alachlor	Possible cancer
Aldicarb, aldicarb sulfoxide, and aldicarb sulfone	Nervous system effects
Chlordane	Possible cancer
Carbofuran	Nervous system effects
Dibromochloropropane (DBCP)	Possible cancer
1,2-Dichloropropane	Liver/kidney Effects
Epichlorohydrin	Possible cancer
Ethyl benzene	Liver/kidney effects
Ethylene dibromite . . .	Possible cancer
Heptachlor	Possible cancer
Heptachlorepoxide	Possible cancer
Pentachlorophenol	Liver/kidney effects
Polychlorinated biphenyls (PCBs)	Possible cancer
Styrene	Liver effects
Toluene	Nervous system/liver effects
Xylene	Nervous system effects

RADIONUCLIDES

EPA is now considering proposal of a Maximum Contaminant Level for the most significant of all the radionuclides linked to the contamination of drinking water: radon.

This colorless, odorless, tasteless gas occurs naturally in several types of rock and soil found in certain parts of the U.S. These can contaminate adjacent ground water with radon. Wells pump this radon-laden water into homes. When it is heated or agitated by showers or washing machines, this dissolved gas can be released into the air.

This presents a health problem, especially in air-tight dwellings, because the inhalation of radon gas may greatly increase the risk of lung cancer. Thus, radon is a drinking water contaminant that is dangerous not when drunk, but when breathed. And preliminary health data suggest that it may be one of the most harmful to human health.

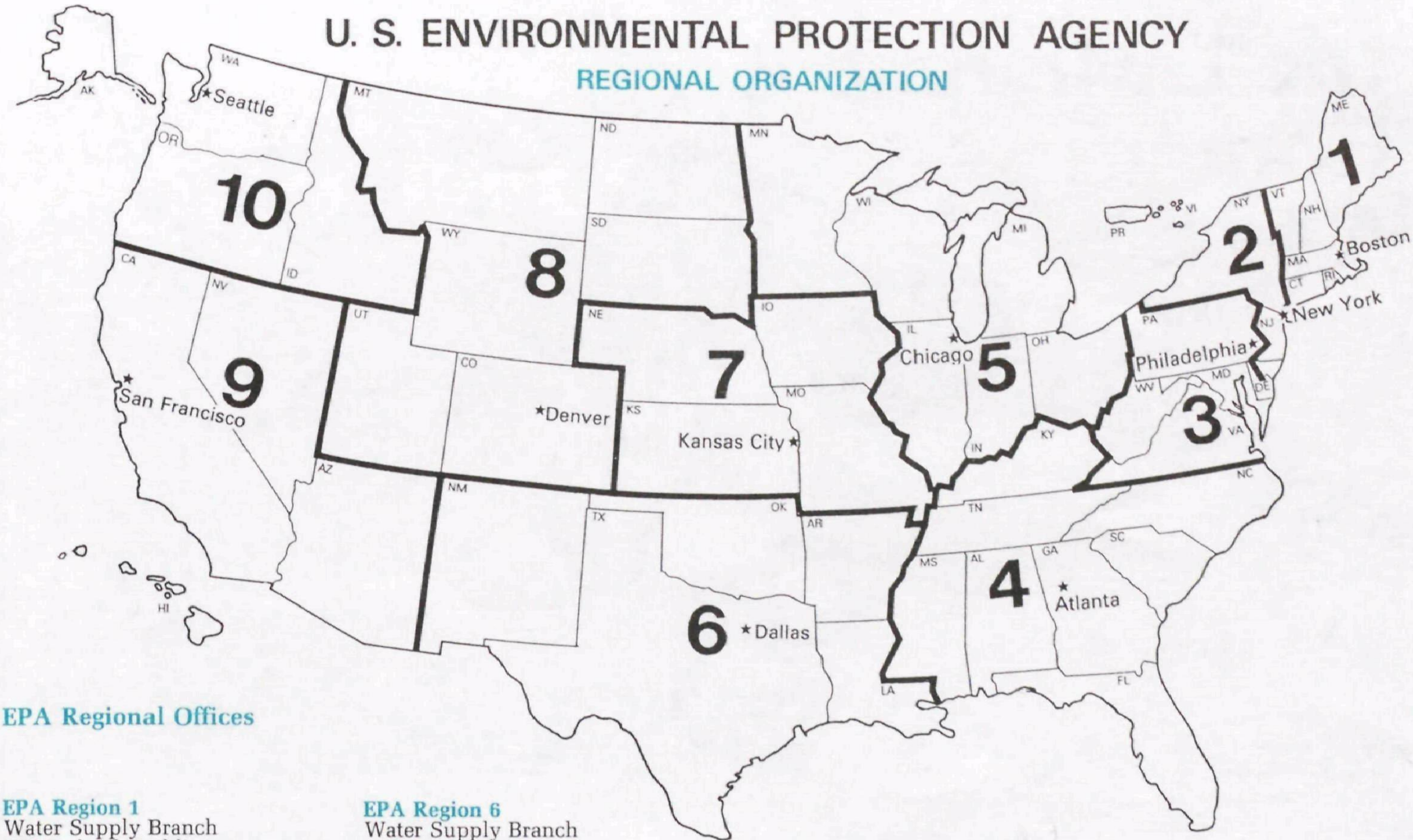
A Maximum Contaminant Level for uranium is also under consideration.

Also on EPA's agenda is revision of its existing interim MCLs for other radionuclides, including radium-226 and radium-228.

All of EPA's interim MCLs for other categories of contaminants will be subjected to a similar process of review and updating.

U. S. ENVIRONMENTAL PROTECTION AGENCY

REGIONAL ORGANIZATION



EPA Regional Offices

EPA Region 1
Water Supply Branch
JFK Federal Building
Boston, MA 02203
(617) 853-03610

Connecticut, Massachusetts, Maine, New Hampshire, Rhode Island, Vermont

EPA Region 2
Water Supply Branch
26 Federal Plaza
New York, NY 10278
(212) 264-1800

New Jersey, New York, Puerto Rico, Virgin Islands

EPA Region 3
Water Supply Branch
841 Chestnut Street
Philadelphia, PA 19107
(215) 587-8227

Delaware, Maryland, Pennsylvania, Virginia, West Virginia, District of Columbia

EPA Region 4
Water Supply Branch
345 Courtland Street, N.E.
Atlanta, GA 30365
(404) 881-8731

Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee

EPA Region 5
Water Supply Branch
230 South Dearborn Street
Chicago, IL 60604
(312) 353-2650

Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin

EPA Region 6
Water Supply Branch
1201 Elm Street
Dallas, TX 75270
(214) 767-2618

Arkansas, Louisiana, New Mexico, Oklahoma, Texas

EPA Region 7
Water Supply Branch
726 Minnesota Avenue
Kansas City, KS 66101
(913)236-2815

Iowa, Kansas, Missouri, Nebraska

EPA Region 8
Water Supply Branch
One Denver Place
999 18th Street, Suite 1300
Denver, CO 80202-2413
(303) 293-1413

Colorando, Montana, North Dakota, South Dakota, Utah, Wyoming

EPA Region 9
Water Supply Branch
215 Fremont Street
San Francisco, CA 94105
(415) 974-0912

Arizona, California, Hawaii Nevada, American Samoa, Guam, Trust Territories of the Pacific

EPA Region 10
Water Supply Branch
1200 Sixth Avenue
Seattle, WA 98101
(206) 442-4092

Alaska, Idaho, Oregon, Washing ton

☆ U.S. GOVERNMENT PRINTING OFFICE: 1987 - 716-002 - 1302/60562

The Environment From A to Z

From acid rain to zooplankton, whatever the environmental issue, you can count on the EPA JOURNAL for current, comprehensive coverage.

Published 10 times yearly by the U.S. Environmental Protection Agency, the EPA JOURNAL hones in on emerging issues as well as perennial problems that beset the world we live in.

Biotechnology. Wastewater treatment. The "greenhouse effect." Hazardous waste cleanups. Pesticides. The protection of ground water. The EPA JOURNAL provides in-depth analysis of all these topics and many more.

The EPA JOURNAL is available by subscription from the U.S. Government Printing Office. If you'd like to become a regular reader, fill out the form below (or a photocopy, if you prefer). Send the form and your check or money order for $11, payable to the "Superintendent of Documents," to:

Superintendent of Documents
U.S. Government Printing Office
Washington DC 20402-9371

Superintendent of Documents Subscriptions Order Form

Order Processing Code: *6203

☐ **YES,** I'd like to stay up to date on protecting the Nation's land, air and water systems with a subscription to the *EPA JOURNAL* for $11 a year (EPAJ)

1. The total cost of my order is $ ______ . All prices include regular domestic postage and handling and are subject to change. International customers please add 25%.

Please Type or Print

2. ____________________
(Company or personal name)

____
(Additional address/attention line)

____
(Street address)

____
(city, State, ZIP Code)

(   ) ____________________
(Daytime phone including area code)

3. **Please Choose Method of Payment:**

☐ Check payable to the Superintendent of Documents
☐ GPO Deposit Account ☐☐☐☐☐☐☐–☐
☐ VISA, CHOICE or MasterCard Account
☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

____
(Credit card expiration date)

Thank you for your order!

____
(Signature)

10/86

4. **Mail To:** Superintendent of Documents, Government Printing Office, Washington, D.C. 20402-9371

Cut on dotted line