# Drinking Water

## a community action guide

Concern, Inc.

## About CONCERN

CONCERN, Inc. is a non-profit, tax-exempt organization, founded in 1970, that provides environmental information to individuals and groups and encourages them to act in their communities. The primary activity of this organization is the publication and distribution of reports which define key environmental issues and contain suggestions for individual and group action. Further support is offered through an active community outreach program. CONCERN's projects are supported by private grants and individual contributions.

CONCERN, Inc.
1794 Columbia Road, NW
Washington, DC 20009
202-328-8160

## About This Booklet

This booklet is written for individuals and groups who are concerned about drinking water in their communities. It is a general introduction to the complex issues of water management and protection with guidelines for public participation. Wherever more information is needed, CONCERN's Community Outreach program will respond to questions by providing more resources and recommending other groups who are working on similar issues. Please send us any information about drinking water issues in your community so that we can share it with others who are interested.

This is the fourth in CONCERN's Community Action Guide series, which includes *Hazardous Waste* (out-of-print), *Groundwater, Pesticides,* and *Farmland.*

Special bulk rates are available for non-profit private organizations and citizen groups. Single copies are three dollars.

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Editors: Susan Boyd, Adelyn Jones, Andy Knaus, Cynthia McGrath

# Drinking Water
## a community action guide

Photo: Maggie Knaus

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# Contents

# The Issue

Most Americans take the safety of their drinking water for granted, whether it comes from a well or a municipal treatment plant. In the twentieth century water-borne diseases such as typhoid and cholera have been almost eliminated. Improved methods of testing water, however, have revealed many new threats to this resource, mainly in the form of man-made chemicals. The proliferation of toxic substances that make their way into our water supplies is just beginning to be addressed. While much of US drinking water is still safe for consumption, protecting its quality and assuring its availability are becoming increasingly difficult.

The 1974 Safe Drinking Water Act (SDWA) was designed to ensure uniform health standards for water quality nationwide and to address the problem of water contamination by synthetic chemicals. Under the act, the Environmental Protection Agency (EPA) is responsible for setting standards based on scientific testing and recommendations from scientists and water treatment experts. Primary standards, technically called Maximum Contaminant Levels (MCLs), are intended to be set at levels to protect human health and to be enforced by monitoring and reporting requirements. Secondary standards deal with esthetic considerations such as taste and odor and are not mandatory. However, since 1974 EPA's progress in setting standards has been slow. The number actually set has been inadequate to regulate the hundreds of contaminants now being found in drinking water. Certain provisions of the 1986 amendments to the act seek to rectify this situation by setting standards for additional contaminants.

Water supplies can no longer be taken for granted either. The sources—surface water from lakes, rivers, and streams, and groundwater drawn from aquifers lying under the earth's surface—are generally abundant, but water use does not always coincide with availability. Although demand and scarcity are more pronounced in the West, shortages are occurring in other parts of the country as well, especially where rapid commercial and residential development have failed to take water supplies into account. Our laws, policies, planning, and pricing do not encourage intelligent water use. Nor is there a unified water management policy. The number of agencies, bureaus, and institutions involved in water management in even one state has made coordinated planning almost impossible.

Serious contamination or shortages have forced some communities to take action to clean up or protect their water supplies. Because of such problems, other communities are beginning to address the necessity for long-range comprehensive planning: watersheds must be protected, pesticide use curtailed, wastes reduced and properly disposed of, water systems modernized and carefully maintained, and development permitted only where there are adequate water supplies. Communities now have the opportunity to correct many past errors and to take the precautions necessary to assure an ample, clean water supply for the future.

# Quality and Protection

The number and types of contaminants in drinking water have been growing faster than our institutional ability to set and enforce standards and our technical ability to detect and treat them. Every state has reported pollutants in drinking water. Until 1986, only 22 of the 700 contaminants found in drinking water were regulated by the Safe Drinking Water Act (SDWA). Even now, deficiencies in existing laws make protection from contamination uncertain.

Contaminants enter water from "point" sources, such as industrial or municipal discharge pipes, or "nonpoint" sources, such as farmland, urban runoff, disposal and construction sites. Controls on point source contamination through the Clean Water Act have led to more disposal on land resulting in groundwater pollution. Insufficient data about the presence, movement, and persistence of these substances have hindered efforts to prevent their entry into drinking water sources.

## Sources of Contamination

Substances such as bacteria, nutrients, minerals, salts, trace metals, and organic matter are normally found in water. At elevated levels some of these, such as salt, selenium, fluoride, and radionuclides (radioactive elements), become contaminants. At a minimum, they can make the water unsightly and unpalatable; at certain levels, they become toxic.

### Industrial

Certain *common industrial operations*, such as mining, drilling, construction, and forestry, can contaminate water as part of their "normal" activities. In the West, strip-mining and, in the Southwest, uranium mining have degraded groundwater. In the

East, almost half the streams in EPA's Region III have severe water quality problems from sedimentation and acid mine drainage. In southern states, brine, a by-product of oil drilling, has polluted aquifers.

The *disposal of industrial waste* into landfills, pits, lagoons, deep injection wells, and dumps has caused widespread contamination of drinking water sources. In this country over 71 billion gallons of hazardous waste are disposed of annually. This is the consequence of a regulatory system that permits waste generation and governs the disposal of such wastes with standards based primarily on the availability and the economics of disposal methods with little regard for health effects.

*Landfilling*, the most widely used method, has resulted in groundwater contamination from over one-third of the hazardous waste sites studied by EPA in 1982. Contamination is suspected at another one-third. All landfills, regardless of the most advanced safeguards, are subject to leaks.

As controls on liquid disposal in landfills have tightened, *underground injection* of wastes into deep wells has become more prevalent. Concern over contamination of aquifers has led to bans on the injection of hazardous waste in most southern and all New England states and to strict controls on this practice in California.

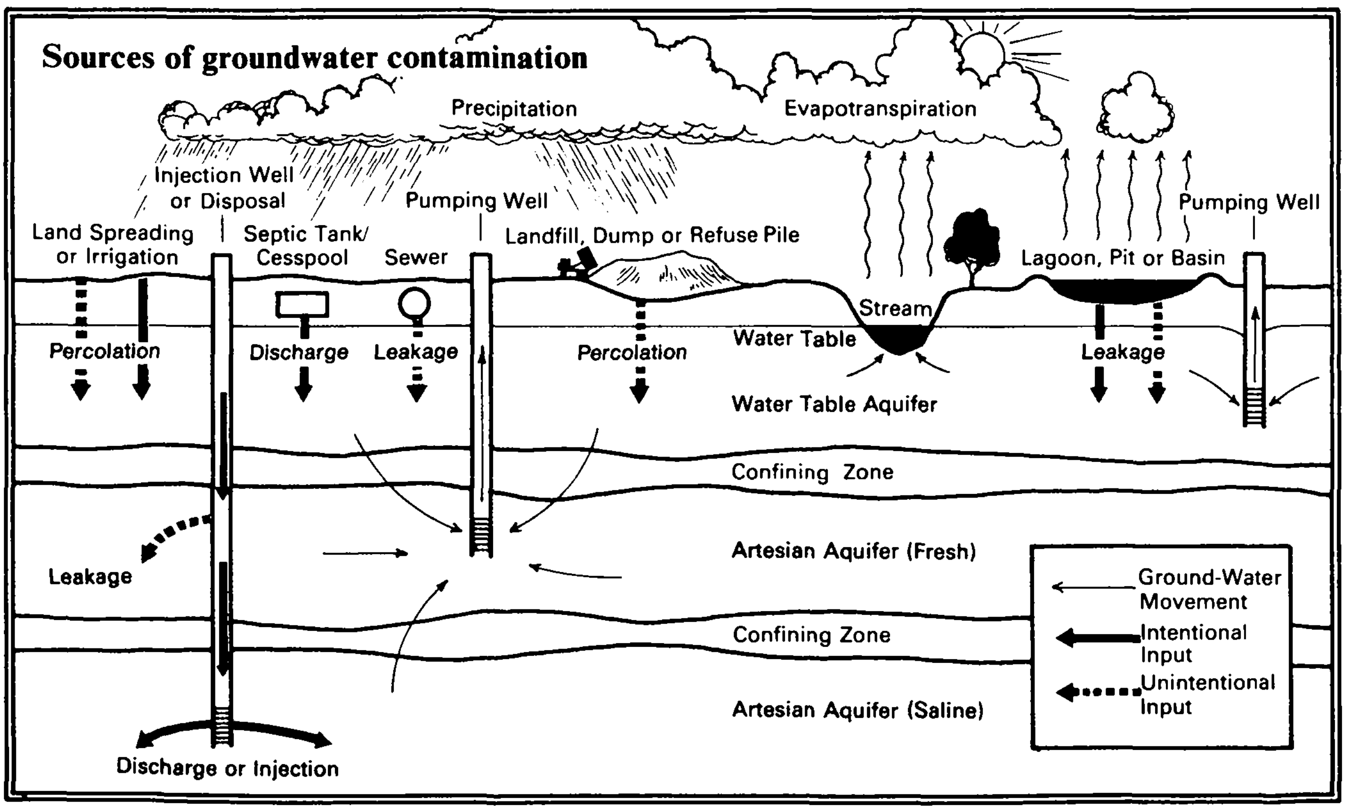
Industrial *effluents* containing pollutants that exceed levels permitted under the Clean Water Act commonly enter surface waters. A 1982 General Accounting Office (GAO) study found that violations were "widespread, frequent, and significant" with 80% of dischargers out of compliance. A 1984 study in New York, for example, reported that every day 3000 pounds of heavy metals were entering the Niagara River, a source of drinking water for 380,000 people.

Disposal of *radioactive waste* presents serious problems. The volume of high-level radioactive waste from nuclear power plants is expected to quadruple in the next 15 years. The US has no permanent repository for these high-level wastes.

## Agricultural

Agricultural *pesticides and fertilizers* have been detected in wells from Connecticut to California. In 1984 EPA found 12 different kinds of pesticides in groundwater in 18 states; two years later, 17 agricultural pesticides were found in 23 states. The true extent of pesticide contamination of drinking water is only beginning to be revealed. It varies with

**Sources of groundwater contamination**




Source: US Environmental Protection Agency soil conditions, types of crops and irrigation practices, weather, hydrogeological conditions, and the solubility and persistence of the substances themselves.

Eroding soil carries accumulated nutrients and pesticides into streams, rivers, and lakes, causing contamination and sedimentation. Because there are few requirements to test for them, most of the chemicals go undetected by water treatment plants.

The practice of applying fertilizers and pesticides to crops through center-pivot irrigation (chemigation) can contaminate groundwater through normal operations, especially if valves are absent or faulty, causing back-siphoning of chemicals through wells into groundwater. Further contamination can come from flood irrigation, which causes salinization or the leaching of salt into the soil, and from feedlots and other areas where animal waste is collected or stored.

## Municipal

Municipal *landfills* designed to accept solid, not toxic, wastes do receive many toxic materials from household, municipal, commercial, and even industrial wastes, which then leach into water supplies. Annually, roughly 200 million pounds of pretreated industrial wastes end up in *sewage treatment plants*. When operated incorrectly, these plants release toxic materials into surface waters. *Water treatment plants* and distribution systems introduce trihalomethanes and other contaminants into drinking water supplies. (See Treatment.)

Over half the nation's river basins are affected by *urban runoff* which may contain heavy metals such as cadmium and lead, inorganic chemicals, petroleum products, de-icing salts, pathogens, and animal wastes. The runoff washes untreated into water sources, and, in areas where wastewater and stormwater systems are combined, the problem can be severe.

*Underground storage tanks* present an insidious threat to drinking water because of their location in populated areas and their propensity to leak. Over five million tanks store fuels and industrial chemicals. One-third may be leaking. Gasoline has over 100 different hydrocarbon components, of which benzene, toluene, and xylene readily dissolve into water and are toxic. One gallon of gasoline can pollute water supplies for 50,000 people.

Pesticide contamination of water is not limited to agriculture. *Spraying* of parks, trees, golf courses, and along roads and rights-of-way is common. This is frequently done routinely without consideration of actual need or potential impact on lakes, rivers, or groundwater.

Small businesses, such as photo processors and dry cleaners, handle toxic materials daily. Those who generate under 100 kilograms of waste per month are not required by federal law to use, monitor, or dispose of these materials in any prescribed manner.

**Pollutants Reported As Known or Suspected Groundwater Contaminants**

| | Number of States Reporting | | |
|---|---|---|---|
| Pollutant | Known | Suspected | Common Sources |
| Nitrates | 34 | 4 | Fertilizer from agricultural practices. |
| Petroleum | 24 | 4 | Leaking storage tanks and spills. |
| Other Organic Chemicals | 31 | 4 | Chemical spills, leaking storage tanks, and land disposal sites. |
| Bacteria | 24 | 7 | Septic systems. |
| Inorganic Chemicals | 23 | 2 | Abandoned mining sites and land disposal sites. |
| Pesticides | 21 | 7 | Agricultural activities. |
| Salinity | 16 | 3 | Saltwater intrusion and road salt storage and distribution. |

Credit: Association of State and Interstate Water Pollution Control Administrators

## Household

Further contamination of drinking water is caused by the *use and improper disposal* of household cleansers (metal, oven, septic tank, rug, furniture, bathroom), automotive products (oil, antifreeze, rust removers), paint removers and solvents, and lawn and garden products. Pest control products for the home and garden, for example, are assumed by many people to be environmentally safe. However, many of these, if they do not evaporate or degrade, may end up in water supplies. If poured down a drain or toilet or put into the trash, they can leach from septic tanks or landfills, or pass through sewage treatment plants which are not equipped to remove them.

About one-quarter of all homes in rural and newly urbanized areas have *septic tanks*. Many were built before regulations for design and installation were established. Through faulty design, improper maintenance, or cleaning with trichloroethylene (TCE, a toxic chemical), these tanks can leach nitrates or chemicals into groundwater. One cup of TCE can contaminate three million gallons of water.

## Government Operations

For decades billions of gallons of metal-plating solvents, spent fuel, heavy metals and other toxic chemicals have been stored unsafely and dumped regularly at federal sites from Alaska to Florida. The military generally has underestimated the extent and severity of the resulting water contamination and its contribution to it. National security regulations have made it difficult for states to make accurate on-site investigations and to assess the causes of contamination outside installation boundaries.

Past disposal of chemicals and explosives at the Army's Aberdeen Proving Ground, where chemical weapons have been tested, illustrates the problem. Toxic materials including nerve gas were buried here from the 1930s to the late 1960s. Severe groundwater contamination of neighboring civilian areas and pollution of a creek flowing into the Chesapeake Bay resulted.

The Department of Defense (DOD) alone annually generates 500,000 tons of hazardous wastes at 333 installations. A GAO study reported that, as of 1985, most of these installations were out of compliance with federal requirements, over 50% with violations which seriously threaten the environment. As many as 500 individual sites at Department of Energy (DOE) installations producing nuclear weapons may be contaminated. Cleanup is difficult because of the presence of both toxic and radioactive materials.

Both DOD and DOE have the authority to manage their hazardous waste. Each installation is responsible for its own cleanup and is subject to all environmental regulations. DOD estimated in 1985 that total costs to the taxpayer could reach $10 billion, but this figure may be low.

# Protection

Communities throughout the country are becoming increasingly aware of the importance of preventing water pollution but there is still an acute need for public education and action. The examples given here represent only a few of the many steps that must be taken.

*Industry* must give the highest priority to waste minimization. In the past, the federal government has given little direction and few incentives for waste reduction because the emphasis has been more on waste management. New initiatives must now be taken. Each year over a ton of hazardous waste is generated per person. Government spending to manage it amounts to $70 billion; less than 1% of that sum is spent to reduce waste. Many companies have voluntarily eliminated the use of certain toxic substances and have incorporated waste reduction, reuse, and recycling into management decisions to reduce costs and increase efficiency. The 3M Corporation has cut hazardous waste generation by 50%, saving $292 million since 1975.

Lacking leadership from the federal government, many state and local governments have adopted waste control programs for industry. In Suffolk County, New York, for example, waste minimization is part of the review process to meet effluent permit requirements.

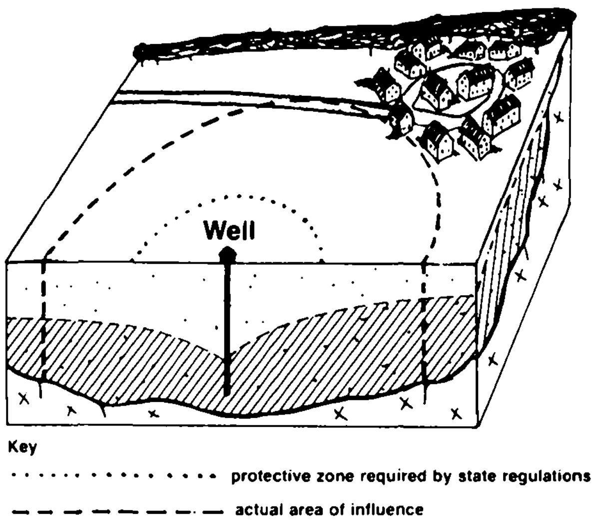
In *agriculture* farmers are adopting methods to protect their drinking water sources. To reduce pesticide contamination, they are diversifying crops, using Integrated Pest Management, drip irrigation, and controls on chemigation, and recycling pesticide containers. To control nitrate infiltration, they are switching to plant or animal manure in concentrations that can be totally absorbed by plants. To control erosion, they are changing to farming practices that conserve soil and water resources.

*Municipalities* are using a variety of water protection measures, especially those involving land use controls. Areas that need special protection, such as those overlying aquifers particularly vulnerable to contamination, are being mapped and existing sources of pollution charted. Citizens are using right-to-know ordinances to obtain information on what is being manufactured and disposed of at various sites. New siting is controlled through permits for and bans on polluting activities. Frequent monitoring, detailed and accurate recordkeeping, and strict enforcement at these sites and those that have been closed is being given high priority.

Other measures include:

- subdivision controls on septic tanks;
- restrictions on the number and location of underground storage tanks and controls on their installation, monitoring, and inspection;
- "amnesty days" for the collection and recycling of household toxics and mobile treatment vans for the treatment of wastes from small businesses;

- requirements for the retention or channeling of urban runoff;
- land acquisition and conservation easements to protect aquifer recharge and wellhead areas (surface or subsurface areas through which contaminants can reach a public well);
- jurisdictional cooperation among communities within a watershed to provide more comprehensive management.




Credit: Massachusetts Audubon Society

The best way to protect a well is to keep development out of the area of influence by zoning or purchase of the land or by conservation restrictions. Cluster development can also be used to guide development away from the area of influence.

# Health

The following are some of the most commonly found pollutants having potentially serious health effects:

### Bacteria and Viruses

In spite of the use of chlorine there are still numerous bacteria-caused outbreaks of acute water-borne disease in the US, mainly giardiasis and dysentery. From 1971 to 1983, for example, there were 427 reported outbreaks affecting 106,000 people in the US. Water-borne diseases caused by viruses such as hepatitis A also seem to be increasing. There is evidence that viruses may be proven to be the cause of most of the water-borne disease now of unknown origin. At this time better detection methods are needed to determine to what extent they are present in water. Improved drinking water treatment for viruses is also necessary.

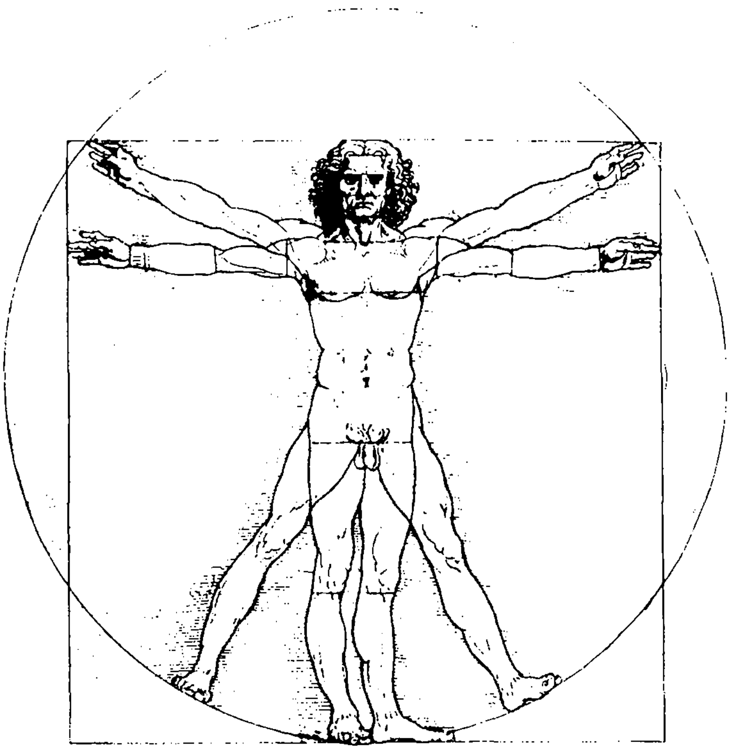
### Synthetic Organic Chemicals

Literally hundreds of synthetic organic chemicals (SOCs), man-made compounds which contain carbon, have been detected in drinking water throughout the US. Some of these are volatile organic chemicals (VOCs) which easily become gases at normal temperatures and are therefore liable to be inhaled in showers and baths, or while washing clothes or dishes. They can also be absorbed through the skin, sometimes the primary route of exposure. Tests have shown that one VOC, trichloroethylene, a widely used industrial solvent, causes cancer of the liver and kidneys in animals. Benzene is another solvent for which there is strong evidence of carcinogenicity. EPA published standards for eight VOCs in July 1987.

In the 1970s it was discovered that chlorine, when combined in drinking water with natural organics such as decaying leaves and animal matter, reacts to form trihalomethanes (THMs), the best known of which is chloroform, an animal carcinogen. Epidemiological studies in New Orleans and elsewhere demonstrated increased risks of death from cancers of the colon, rectum, and bladder associated with drinking surface water containing high levels of THMs. While some of these studies have been questioned because of the large number of variables involved, they provided enough evidence for concern and were in part the impetus for enactment of the SDWA. Animal studies have demonstrated that some THMs are mutagenic as well as carcinogenic.

In 1979 EPA established a standard of 100 parts per billion (ppb) for THMs in drinking water. Much further study is needed both of THMs and other chlorinated organics, but there is general agreement among scientists, environmentalists, and EPA that the standard for THMs is not strict enough to protect public health adequately. European countries have established much lower levels: Germany and Switzerland, for example, have standards of 25 ppb. The European Economic Council's proposed standard is 1 ppb.

Pesticides, some of which are volatile, have potentially very damaging health effects. Chlordane, commonly used for termite control, has contaminated drinking water in many areas of the country. Tests indicate that chlordane is mutagenic, carcinogenic, and toxic to the central nervous system.



Approximately 65% of the human body is water.

Residents of communities where water has been contaminated by SOCs have suffered a range of health effects from skin rashes to terminal illnesses. High rates of miscarriages and birth defects have also been observed in some of these communities. While tests cannot always prove scientifically the causal relationship between specific contaminants and community illnesses, the severity of the reactions and the number of examples nationwide demonstrate the importance of keeping drinking water free of suspect organic chemicals.

Problems and symptoms vary according to the type of chemical and the sensitivity of the individual. The initial symptoms produced by organic chemicals in drinking water are sometimes difficult to distinguish from those of flu: nausea, headache, dizziness, fatigue, stomach aches, and diarrhea. Other symptoms include blurred vision, numbness, and speech difficulty. Little is known about the long-term health effects. Many SOCs have not been tested enough to show that they are *not* mutagenic, teratogenic, or neurotoxic. Generally, those most at risk are pregnant women, infants, and young children.

## Nitrates

Nitrates in drinking water are of particular danger to the very young. In the infant intestinal tract they are reduced to nitrites which oxidize the hemoglobin in the blood, making it unable to carry oxygen. The resulting condition is called methemoglobinemia, or "blue baby" disease, which can result in brain damage or death. Nitrates and nitrites can also form nitrosamines which are toxic, mutagenic, teratogenic, and carcinogenic in animals. Epidemiological studies have demonstrated links between high nitrate levels and stomach cancers in humans.

In the corn-growing areas of Iowa and Nebraska pesticide and fertilizer use is high. Studies have linked the higher-than-average rates of leukemia in farmers of those regions with heavy pesticide use. The possibility that nitrates are involved has also been suggested. Recognizing the threat to human health, Nebraska has adopted a Groundwater Management and Protection Act to control the use of nitrogen and other potential contaminants.

## Radon

Radon is a radionuclide which occurs naturally in water from the decay of uranium. It is widespread in groundwater, perhaps affecting as many as half the communities in the US. It is particularly dangerous when water is agitated and heated, as in a shower, where it becomes a gas and can be inhaled. EPA is concerned that radon in drinking water may be a serious health problem, although the threat from air-borne radon appears to be much more significant. Estimating that it could cause an additional 30-600 cancer cases a year, EPA has completed the first step in the process of setting standards for radon and several other radionuclides which may be found in drinking water.

## Fluoride

A level of 0.7-1.2 mg/L of fluoride in drinking water is generally regarded as the optimum balance to reduce dental decay without producing dental fluorosis (mottling of the teeth). There is also some evidence that levels of fluoride over 1 mg/L are helpful in preventing a loss of bone density in the elderly. On the other hand, long-term chronic ingestion at higher levels can lead to a condition called skeletal fluorosis which has symptoms resembling those of arthritis.

In some areas fluoride occurs naturally and may exceed desirable amounts. In response to pressure from states with high levels of naturally-occurring fluoride such as South Carolina, EPA has raised its standard to 4 mg/L despite evidence that even the current standard of 2 mg/L may produce dental fluorosis in some children. EPA's justification for this change is based on the Surgeon General's determination that fluorosis is a "cosmetic condition." Rather than raising the standard, because of the risk of fluorosis it might have been preferable to help those communities with high natural fluoride levels to find affordable treatment systems.

## Lead

Lead is a cumulative poison and in relatively small amounts can cause brain, kidney, or nerve damage, anemia, or death. It is a particular threat to children, causing behavioral problems and mental retardation. Pregnant women are also at risk in that the fetus is affected. The SDWA amendments of 1986 ban the future use of lead pipe and solder in all public drinking water systems because of the possibility of leaching. This is especially a problem in areas where water is soft and therefore more corrosive. A recommended method of avoiding ingestion of significant amounts of lead from tap water is to run the water for several minutes after periods of non-use (first use in the morning, for example).

A 1986 EPA report estimates that at the current standard of 0.05 milligrams per liter (mg/L), 38 million people are at risk from excess lead. It may be causing neurological damage in over 140,000 children and accounting for other serious effects such as hypertension, stroke, and pregnancy complications. Seven states were found to have lead levels higher than the proposed new standard of 0.02 mg/L, and one state, Illinois, had levels over four times higher. Many feel that the final standard should be more stringent.

**Recommendations to Lower Lead Intake from Tap Water**

- Check to see if lead pipes, solder, or flux have been used in plumbing that provides tap water. Until recently, most copper pipes had been joined with lead solder. If no lead materials were used in the water delivery system, home plumbing, or in pipes connecting homes to the water mains, then it is unlikely that lead will be a problem in the drinking water.

- Contact the local drinking water supplier or health agency to learn if the water is corrosive or is known to have a lead problem. The local authorities may be willing to test water from home taps. If not, qualified water testing labs may be listed in the local telephone book.

- If you suspect or confirm high lead content in your drinking water, run the water from the kitchen tap for three to five minutes in the morning and evening and after any other period of several hours of disuse before drawing water to drink or cook. Running the water will flush out water that has been in contact with lead pipe or solder in the home for a long time and will significantly reduce exposure.

- Don't drink, prepare baby formula, or cook with hot tap water. Hot water dissolves lead from pipe and solder more than does cold water and increases the lead content of water.

- Be sure that new plumbing repairs use lead free materials. For example, tin-antimony solder is a good substitute for tin-lead solder.

Source: USEPA Office of Drinking Water, "What is EPA Doing About Lead?/What You Can Do," 11/6/86.

# How Drinking Water Standards Are Set

The SDWA and its 1986 amendments require EPA to set standards for contaminants in drinking water which may pose a health hazard. EPA, after consultation with the National Academy of Sciences, must propose a non-mandatory Maximum Contaminant Level Goal (MCLG, formerly called RMCL or Recommended Maximum Contaminant Level). It is set at a level designed to prevent any known or anticipated adverse health effects. At the same time, EPA must propose a Maximum Contaminant Level (MCL). This is a mandatory drinking water standard, set as close to the MCLG as is technologically and economically feasible.

The process of setting standards is slow, complex, imperfect, and ultimately based on difficult qualitative judgments. Cancer and other chronic effects are considered. The approach for suspected cancer-causing substances is based on the assumption that *any* exposure poses a risk, whereas that for other substances is based on the assumption that there is a level of exposure which should cause no adverse health effects. Assessments are determined principally by animal experiments and epidemiological studies both of which have weaknesses. Questions about variations in sensitivity to toxics between species and among individuals, the degree to which effects are reversible, and the often long latency period between exposure and the onset of disease complicate the process. In addition, the effects of exposure to diverse contaminants in combination over a long period of time have barely been addressed.

The intent of the SDWA is to prevent adverse health effects, but some feel that EPA has not set standards which adequately protect health. For example, EPA has made a distinction between routes of exposure to toxics. Because of lack of evidence from animal testing, asbestos is not considered a carcinogen when it is in water, but is considered one when it is in the air. More importantly, it has been generally agreed that MCLGs for carcinogens are to be set at zero, but in the cases of cadmium, arsenic, and asbestos, for instance, EPA has proposed setting the MCLGs above zero, citing limited evidence as justification. Some suggest that lack of evidence, however, does not exonerate a substance but indicates that further testing is needed. Finally, critics also have suggested that an overemphasis on economic considerations has weakened health protection.

| SELECTED CONTAMINANTS | MCL (mg/L) | MCLG (mg/L) |
|---|---|---|
| **Microbiologicals** | | |
| Total coliforms | 1 per 100 milliliters | *0 |
| *Giardia lamblia* | —— | *0 |
| Viruses | —— | *0 |
| **Inorganics** | | |
| Arsenic | 0.05 | *0.050 |
| Asbestos | —— | *7.1 mil fibers/L |
| Cadmium | 0.010 | *0.005 |
| Lead | 0.05 | *0.020 |
| Nitrate | 10 | *10 for nitrate *1 for nitrite |
| **Organics** | | |
| Alachlor | —— | *0 |
| Aldicarb | —— | *0.009 |
| Benzene | 0.005 | 0 |
| Carbon tetrachloride | 0.005 | 0 |
| Chlordane | —— | *0 |
| Dibromochloropropane (DBCP) | —— | *0 |
| Ethylene dibromide (EDB) | —— | *0 |
| Trichloroethylene (TCE) | 0.005 | 0 |
| 2,4-D | —— | *0.07 |
| Vinyl chloride | 0.002 | 0 |
| **Radionuclides** | | |
| Radon-222 | no standard set: proposed standard will probably be 0 | |

*proposed

| PRINCIPAL HEALTH EFFECTS | SOURCES OF CONTAMINATION |
|---|---|
| | |
| indicate the presence of organisms which cause gastro-enteric infections, dysentery, hepatitis, typhoid fever, cholera | human, animal fecal matter |
| gastro-enteric disease, giardiasis | human, animal fecal matter |
| gastro-enteric and other disease | human body fluids; human, animal fecal matter |
| | |
| dermal and nervous system toxicity effects, possible cancer | geological sources, pesticides residues, smelting operations, and industrial waste |
| possible cancer | corroding asbestos-cement pipes in distribution systems; production of cement products, floor tiles, paper products, paint, and caulking |
| kidney effects | geological sources; mining and smelting |
| brain and nerve damage, kidney effects; highly toxic to infants and pregnant women | leaching from lead pipes and lead soldered pipe joints; disposal of used storage batteries and other products |
| methemoglobinemia ("blue baby syndrome") | fertilizers, sewage, feedlots, geological sources |
| | |
| possible cancer | agricultural use: primarily on corn, soybeans, and peanuts |
| impaired central nervous system | agricultural use: to control insects, mites, nematodes, primarily on citrus fruits and potatoes |
| cancer | leaking fuel tanks; industrial effluents; solvent in the manufacture of pesticides, dyes, plastics, paints, and pharmaceuticals |
| possible cancer | industrial wastes from manufacture of coolants, aerosol propellants, and cleaning agents |
| liver and nerve damage, possible cancer | pesticide used for control of termites (since 1977, banned for agricultural and home garden use) |
| possible cancer, anti-fertility effects | agricultural use (until recent cancellation): to control nematodes on crops |
| possible cancer, central nervous system effects, reproductive toxicity | agricultural use: as a pesticide and as a soil and stored grain fumigant (most uses cancelled in 1984); leaded gasoline additive |
| central system damage, possible cancer | industrial effluent: waste from disposal of dry cleaning materials and manufacture of pesticides, waxes, paints, and varnishes; metal degreasing; paint stripping |
| liver and kidney effects | herbicide use: to control broadleaf weeds in agriculture, forestry, on range and pasture lands, and in gardens; to control aquatic weeds |
| cancer | polyvinylchloride (PVC) pipes and solvent used to join them; industrial waste from the manufacture of plastics and synthetic rubber |
| | |
| cancer | decay of naturally-occurring uranium |

Sources: *EPA Journal*, September 1986
*Federal Register*, November 13, 1985, Parts III and IV

# Drinking Water Treatment

Under the Safe Drinking Water Act public water systems are defined as those which provide drinking water to at least 25 people or 15 service connections for a minimum of 60 days a year. There are two categories: "community" water systems which provide year-round service, and "non-community" systems which provide service for less than a year (as in a campground). While most public systems are small, serving less than 500 people, the majority of the population gets drinking water from medium-sized or large systems. Treatment practices currently vary widely from small systems which simply distribute water without treatment to large plants with multi-step, advanced treatment processes. In most conventional plants basic treatment consists of the following stages:

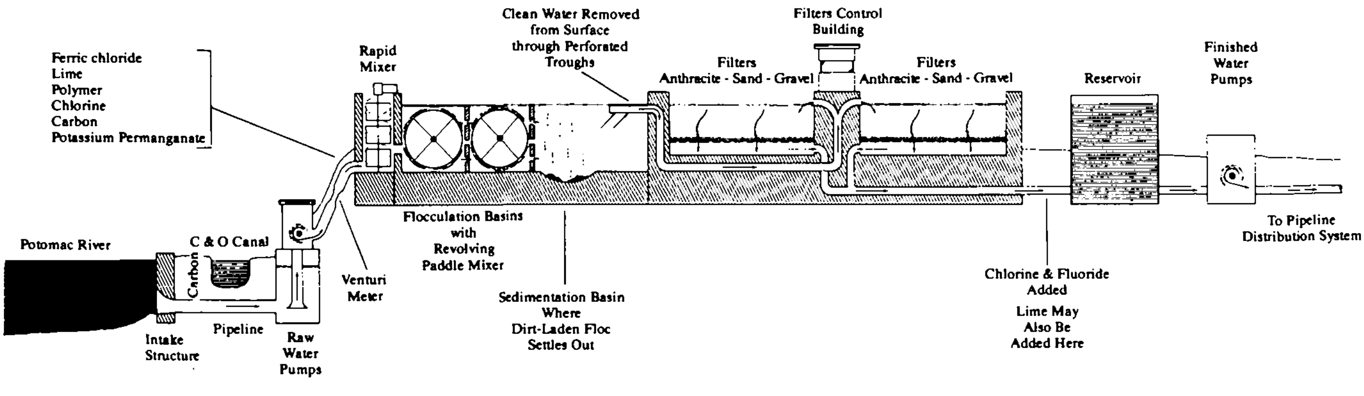
- coagulation—a chemical such as aluminum sulfate (alum) or ferric chloride is added to create small gelatinous particles (floc) which gather dirt and other solids;
- flocculation—gentle mixing of the water causes floc particles to join and form larger particles;
- settling—floc and sediment fall to the bottom and are eventually removed as sludge;
- filtration—the water is passed through granular material such as sand or crushed anthracite coal;
- disinfection—chlorine is generally added to kill bacteria and other microbes;
- corrosion control—chemicals such as quicklime can be added to reduce acidity in water and prevent corrosion in city and household pipes;
- fluoridation—fluoride is added in many municipal treatment facilities to prevent tooth decay.

Water must be monitored and tested regularly throughout the treatment and delivery system. Properly trained personnel are essential for the correct operation and maintenance of any facility.

Monitoring and water testing for contaminants regulated by the SDWA are the responsibility of the individual treatment facility. Coliform bacteria and turbidity must be measured regularly as indicators of water treatment efficiency and of deterioration of water quality in the distribution system. Coliform bacteria come from human and animal wastes and may indicate the presence of other disease-causing organisms. Turbidity, or cloudiness, caused by small particles of silt, clay or other matter can interfere with disinfection, allowing pathogenic organisms to survive. These contaminants can cause immediate illness.

Frequency of testing varies according to the contaminant and the size and type of system. For example, monitoring frequency for bacteria ranges from 500 samples per month in community systems serving more than 4.7 million people to one sample per month for those serving 25-1000 people. Non-community systems must test in each calendar quarter during which the system operates, unless an individual state requires greater frequency.

## Potomac River Filtration Plant




Credit: Washington Suburban Sanitary Commission

Less frequent testing is required for organic and inorganic chemicals. Requirements vary depending on whether a system uses surface water or groundwater. A community system using groundwater, for instance, is required to test only once in three years for inorganics and need not test for organics other than THMs unless required to do so by the state. (Only those systems using a disinfectant and serving more than 10,000 people are required to test for THMs.) While some systems do test more frequently, many do not and, given the growing number of instances of chemical contamination, this requirement hardly seems adequate.

Public water systems must report test results to the state. States in turn are responsible for periodic surveys to assure that water system tests have been performed correctly. (See Water Management for a description of state responsibilities.)

## Technology for Removing Contaminants

The 1986 amendments to the SDWA require revision of standards for some contaminants and setting of standards for an additional 61 contaminants currently being found in drinking water but which have not been routinely tested for or generally removed by conventional treatment. Many plants built before the 1974 SDWA will need additional equipment in order to provide potable water. A careful assessment of the characteristics of the water source and the specific contaminants found is necessary before deciding what treatment option to choose. To date there is no one solution to all contamination problems. Technology must be site-specific.

EPA is preparing a summary of treatment technologies based on efficiency, availability, and cost to be published in 1988. This study will provide information on technologies which will deal with a number of contaminants and will be appropriate for long-term use so that facilities will not have to make frequent and expensive changes.

### Removal of VOCs

Studies on the removal of VOCs have already been completed. EPA considers the best methods for removal of these contaminants to be filtration with granular activated carbon and packed tower aeration. In some cases both technologies may be used together.

**Granular activated carbon** (GAC) beds are made of carbonaceous substances characterized by their surface area, size and distribution of pores, and their ability to adsorb organic molecules. The most commonly used are lignite, natural coal, and coke. GAC beds have been in use in the US since the 1960s for control of taste and odor and are now being used in approximately 60 plants. GAC is typically used after coagulation, sedimentation (which may remove some organics), and sand filtration. GAC beds are capable of removing some pesticides and all VOCs except vinyl chloride but need careful monitoring and maintenance. A disinfectant is usually required after filtration to destroy bacteria in the filters, and the beds must be cleaned or replaced after a period of time (generally one to two years) to prevent "breakthrough" of organic chemicals. Used GAC must be disposed of at an approved site.

Because VOCs evaporate easily, they can be removed from water by **aeration.** This process consists of passing either air through water or droplets of water through air. Many types of aeration exist and of these packed tower aeration has been found to be the most effective to date in the removal of VOCs. Some inorganics are also removed. In this system, contaminated water is pumped to the top of the tower, then flows down through packing material. At the same time, clean air is drawn up through the packing material and VOCs are transferred from water to air. Generally, 90%-99% of the VOCs are removed in the process.

Systems need to take precautions to make sure that neither indoor nor outdoor air quality standards are violated by emissions during aeration. Most installations have found no measurable impact on air in the immediate vicinity of the plant. Michigan, however, requires GAC filters for emissions from aerators.

Packed tower aeration is generally less expensive than GAC unless additional treatment of emissions is needed, in which case the cost may be doubled.

### Removal of THMs

Trihalomethanes (THMs) formed by the reaction of chlorine and natural organic matter in water pose another problem for many water treatment facilities. Because chlorine is relatively inexpensive and easy to use, attempts to prevent THM formation or to find alternative disinfectants have lagged behind improved methods for detection. Many facilities are still not meeting the current standard of 100 ppb. Systems serving fewer than 10,000 people have not been required to comply. This variance leaves an estimated 46 million people without protection. However, some conventional plants have shown that it is possible to reduce THMs by reducing organic matter in the coagulation, sedimentation, and filtration processes, chlorinating later in treatment, and using less chlorine. If permissible levels of THMs are reduced in the future, as many water experts believe they should be, additional techniques such as GAC or aeration may be needed.

Several other disinfectants are now available which do not form THMs: ozone, chlorine dioxide, chloramines, and ultraviolet light. Based on current experience, ozone and chlorine dioxide seem to be the most promising alternatives.

Ozone, an active form of oxygen, destroys bacteria, parasites, and viruses in water and also removes many organic and inorganic pollutants by oxidizing them. The disadvantage of ozone as a disinfectant is that it is short-lived and may allow bacteria to grow in the distribution system. It is being used successfully in Europe, generally in conjunction with a small amount of chlorine or chlorine dioxide as an additional disinfectant. There are now approximately 26 plants and 12 pilot projects using ozonation in the US. A plant in Strasburg, Pennsylvania, has been disinfecting water with ozone since 1973. Critics of ozonation maintain that energy and operating costs are higher than those required for chlorine treatment. Proponents point out that many small, energy-conscious European communities have found it practical to use ozonation. Also, ozonation can perform more than one function in a system, acting both as a disinfectant and as an oxidant.

## Distribution

The distribution system, that network of pipes which delivers water throughout a community, has an important influence on the quality and cost of water. In many areas this infrastructure has not been maintained for many years, resulting in rusting, deteriorating, and leaking pipes. Three hundred thousand people went without water for three days when an 80-year-old aqueduct ruptured in New Jersey in 1982. Short-term budget savings in delaying routine repairs can result in very high costs.

Leak detection can save communities water and money.

Credit: Tennessee Valley Authority

Water quality problems may also result from the way pipes have been laid out or connected. "Cross connections" are permanent or temporary links between drinking water and wastewater pipes which may, under certain conditions, allow contaminated water into the drinking water supply. Such infrastructure problems contribute to an increase in pathogenic microbes in water.

The materials used in pipe construction can also cause contamination of water supplies. Not only are lead service pipes still in use in some cities (75% of the service lines are made of lead in Newark, New Jersey), but lead solder has often been used to join copper pipes. Asbestos cement pipe has been used in many areas and is now decaying, releasing asbestos fibers into drinking water. This is a cause for concern since air-borne asbestos is a known carcinogen. Because acidic water is particularly corrosive, one solution to reduce the lead or asbestos in water is to reduce acidity during treatment.

Plastic pipes, used for distribution to many new homes, may also be dangerous because they can be permeated by hazardous chemicals in the soil. A study funded by the California Pipe Trades Council found that gasoline, chlorinated solvents, and several pesticides penetrated polybutylene and polyethylene pipes. Pipes made of polyvinyl chloride, ductile iron, and asbestos are also permeable. A further problem is that carcinogenic chemicals may leach from plastic pipes into water standing in them. In spite of these hazards, plastic pipe sales are growing because of their competitive prices.

## Problems of Small Systems

The majority of the drinking water systems in the US serve fewer than 500 people. These include public systems serving small towns, and privately owned systems for institutions, small subdivisions, and trailer parks. Eighty-seven percent of these use groundwater as their supply. Many use chlorine as their only treatment; some do not treat at all; most have only part-time, untrained plant operators.

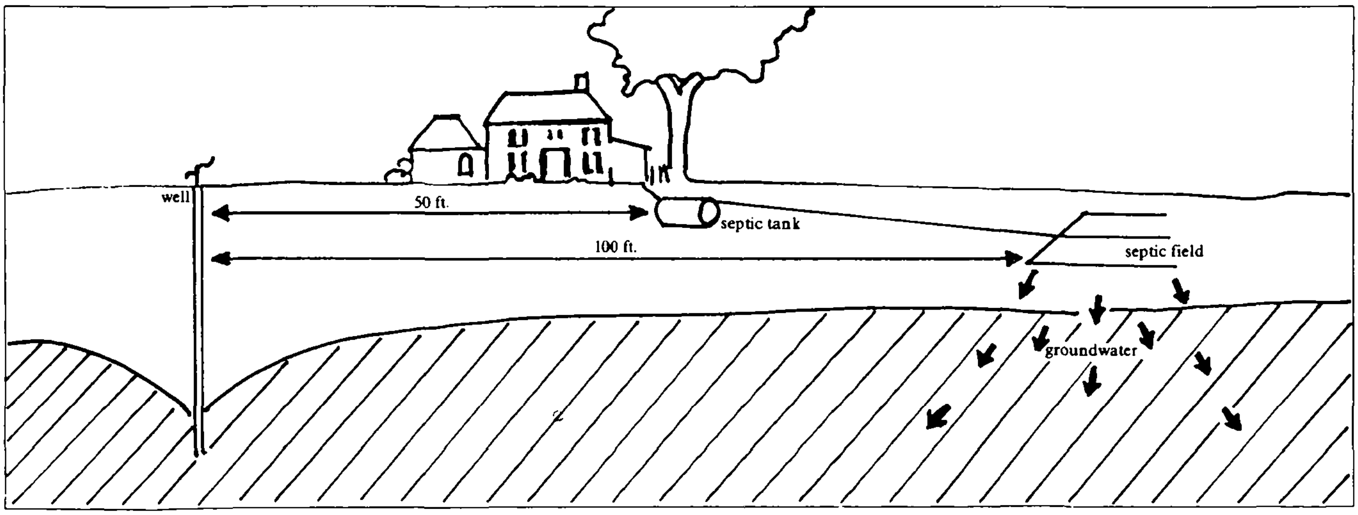
The extent to which water supplied by these systems is contaminated is not known, but there are some unsettling indications. A 1984 EPA study reported that 63% of rural drinking water supplies contained excessive amounts of pesticides and other contaminants. No system serving fewer than 10,000 people is ever required to meet or even test for the standard of 100 ppb for THMs. Small systems generally cannot afford to improve their technology or to hire full-time personnel. Revenues usually do not cover costs, and communities may resist raising water rates. Few state or federal loans or grants are available to small public systems and they are not available at all to private systems.

One solution to all these problems seems to be for small systems to merge, or at least to form cooperatives with neighboring systems. A New Jersey law now permits the state to order a system which is not in compliance to be taken over by a public or private utility. The state of Washington encourages voluntary cooperation in its Public Water System Coordination Act of 1977 which describes a process for establishing a satellite support system. Small systems may choose to transfer ownership to a larger utility or may contract with a larger system for services such as repairs, monitoring, and maintenance. Connecticut is considering a similar plan, dividing the state into water supply management areas, grouping towns with similar problems.

Small systems which do not face major problems of supply or quality may not have to merge. Assistance is available through organizations such as the Rural Assistance Community Program and the National Rural Water Association whose "circuit rider" program provides technical assistance with operation, management, bookkeeping, bill collection, and technical problems such as finding other sources of supply.

## Private Wells

Approximately 40 million people get their water from private wells, which are not covered by the SDWA. As many as two million of these, generally in rural areas, have completely inadequate drinking water and sanitation facilities. People without the resources to drill new wells and to construct adequate septic fields may seek assistance through state or private organizations. The Rural Assistance Community Program and the National Demonstration Water Project, two non-profit organizations with national networks, are trying to help rural communities in a variety of ways such as providing expertise in finding new water supplies or building community treatment plants.




Groundwater can be protected through the proper design and location of septic systems. The illustration above represents minimum distance requirements in Massachusetts.

Source: Massachusetts Audubon Society

# Supply and Conservation

While water treatment and prevention of contamination are essential in determining water quality, planning and conservation are equally important in protecting an adequate water supply. Water use in the US has generally been extravagant, reflecting the assumption that our supplies are limitless. The US consumes more water and pays less for it than any other industrialized country. Water use per capita is two to four times greater in the US than in Europe.

The availability of water varies widely, however. Some areas have an abundance of both surface water and groundwater while others are depleting their supplies. In some states water is being withdrawn from aquifers more rapidly than they can be replenished. These overdrafts can result in permanent reduction of the size of the aquifer, as the land surface sinks to fill empty space, or in contamination by salt water intrusion. River and stream flow are also adversely affected by large withdrawals or diversion.

Federal water projects generally have been politically determined, neglecting long-term planning, conservation and reuse, and focusing instead on finding new sources of water for agriculture and natural resource extraction. Many costly and questionable projects have been built to transfer water from one area to another. One example is the Central Arizona Project which will divert water from the Colorado River Basin to Phoenix and Tucson to compensate for the groundwater depletion caused by irrigation.

## Agriculture

Approximately 40% of all the water withdrawn daily in the US is used for agriculture, much of this for irrigation in the West where crops have frequently been grown on land which is too arid for them. Generous government subsidies for irrigation have resulted in extraordinarily wasteful practices such as the flooding of entire fields. Traditional western water rights have also encouraged waste.

Significant changes can be made, however, with existing knowledge and technology, such as improved irrigation techniques. Other measures by which states can conserve are to tax pumping from aquifers and to provide subsidies for conversion to less water-intensive crops.

Arizona, for example, has developed comprehensive legislation: the 1980 Groundwater Act limits the pumping of groundwater, requires registration of wells, levies fees on water withdrawn, and requires farmers to improve irrigation efficiency by 2005 (or the state can buy and retire the land). Other states have started to plan water consumption by ranking uses, placing residential and municipal demands before agricultural use.

## Industry

Industrial water use can have a dramatic effect on the quality and quantity of a region's water. Four industries currently use the most water: paper, chemical, petroleum, and coal. As an indirect result of the Water Pollution Control Act of 1972, which requires industry to treat wastewater to meet certain standards before discharging it, many companies have already started to conserve water by reusing it. However, more companies need to recycle water as well as to find ways to conserve it through new manufacturing techniques.

## Municipal and Residential

Cities, particularly in the Northeast, lose much treated water from old, poorly maintained distribution systems. Boston, for example, loses as much as half of its processed water each day. Leak detection and repair are among the most cost-effective conservation efforts cities can make and are as important as the development of new supplies. Water conservation programs often result in reduced operation and maintenance costs for drinking water and wastewater treatment plants, thus delaying the need for new supplies and for expanded purification and distribution facilities.

Residential water-saving fixtures and devices can also conserve significant amounts of water. Toilets waste the most household water, using as much as 19 liters each time one is flushed. Manufacturers have now developed more efficient models. Reducing the amount of water by just 6 liters would cut total residential water needs by at least 10%. Other water-saving devices such as low-flow faucets, showerheads, and washing machines are now available. Some states have adopted building codes requiring the use of water-saving fixtures in new buildings. If federal standards were adopted, all

**Potential Water Savings with Available Water-Efficient Household Fixtures in the US**

| Fixture | Water Use | Water Savings Over Conventional Fixtures |
|---|---|---|
| Toilets | (liters/use) | (percent) |
| Conventional | 19 | — |
| Common low-flush | 13 | 32 |
| Washdown | 4 | 79 |
| Air-assisted | 2 | 89 |
| Clothes Washers | | |
| Conventional | 140 | — |
| Water recycle | 100 | 29 |
| Front-loading | 80 | 43 |
| Showerheads | (liters/minute) | |
| Conventional | 19 | — |
| Common low-flow | 11 | 42 |
| Flow-limiting | 7 | 63 |
| Air-assisted | 2 | 89 |
| Faucets | | |
| Conventional | 12 | — |
| Common low-flow | 10 | 17 |
| Flow-limiting | 6 | 50 |

Source: In Lester R. Brown et al., *State of the World—1986*. New York: W.W. Norton & Company, 1986.

household appliances could be made more efficient and would be improved more quickly. A report from the US Department of Housing and Urban Development estimates that modest water-saving standards could reduce residential water consumption by enough to supply the annual household needs of nearly 10 million people. Much treated drinking water is wasted because it is used for all city and residential needs, such as watering lawns and washing cars. Some communities have discovered that wastewater can be used for these purposes if treated sufficiently to make it safe for inadvertent consumption.

One method is by using dual piping systems: one set of pipes delivers high quality drinking water, another supplies non-potable water for all outdoor and industrial uses. The largest dual distribution system in the US is in St. Petersburg, Florida. Near Denver a new residential and commercial development, planned for 100,000 people, will deliver potable and nonpotable water to each home and building. Although there are presently no federal standards for recycled water quality, several western states have developed criteria. California has established standards which may provide a useful model for other states.

## Financial Incentives

Water pricing can be an effective tool in water conservation programs. Where water is metered, consumption is generally half what it is in other areas. Many communities have devised rate schedules to further encourage conservation. Dallas successfully formulated a rate structure to encourage lower average residential use and lower consumption during periods when demand is usually highest. Denver has taken a unique approach in providing improved financing for homeowners who install water and energy conservation features in their homes.

In areas where water is particularly scarce, communities or constituencies are beginning to consider new ways of buying or selling water, creating a free market which may facilitate transfer of water from one area or use to another. Water trade has positive aspects because it reflects the value of water, promotes cooperation in that both consumers and sellers can profit from transactions, and encourages water efficiency. However, a free water market raises some difficult questions. Who has the right to sell water and make profits? How would uses without commercial value, for wildlife, for example, be protected? How could short-term, profit-motivated uses be controlled? Some government regulation will be needed to ensure appropriate long-term water use.

## Public Education

The most important component of a successful water conservation program is a community-wide, multi-media public education program. During periods of drought, communities nationwide have demonstrated that they are capable of saving even more than they have been asked to without dramatic changes in life styles. As a result of careful planning and public education, the city of Tucson has cut its per capita use of water by 25% since the 1970s. Madison, Wisconsin, has been able to postpone construction of a new supply facility because of voluntary conservation stimulated by extensive public education.

# Water Management

Federal water management has been hampered by the conflicting legal, regulatory, and administrative actions of numerous agencies. There is no single body to coordinate water management.

Data collection and assessment of water supply and quality is handled by the US Geological Survey, whereas responsibility for the regulation of water quality and quantity and the management of supplies is divided among many different agencies. EPA has primary responsibility for regulating pollution control and water quality, but the Federal Food and Drug Administration regulates bottled water and water used in food packaging and processing. Of the 25 agencies managing water supplies, the Army Corps of Engineers, the Department of Interior's Bureau of Reclamation, the Department of Agriculture's Soil Conservation Service, and the Tennessee Valley Authority have dominant roles.

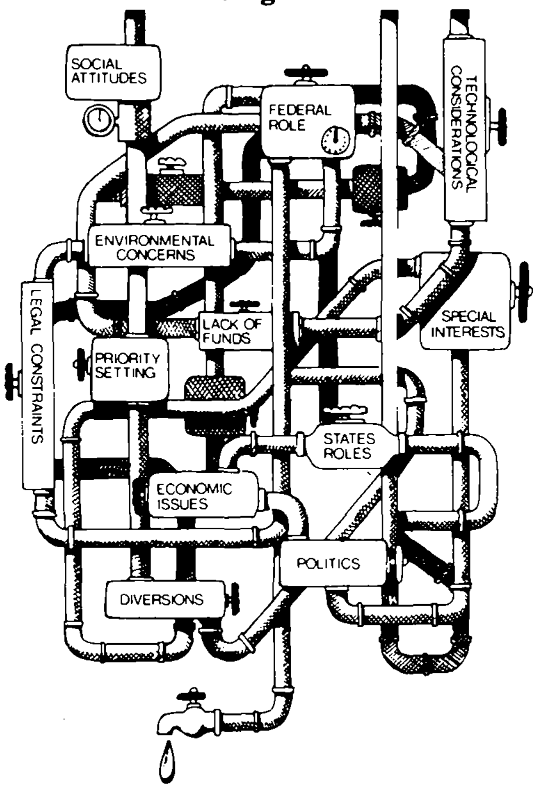
Most state agencies that manage federal programs mirror those at the national level. Some have large staffs; others rely on limited federal assistance and resources, often compromising on enforcement. State responsibility is further complicated by the number of agencies above and below the state level which are involved in water management.

In Minnesota, water resource management is shared by more than 3000 organizations:

8 federal executive agencies
4 federal independent agencies
1 Executive Office of the President
? special federal boards and committees
6 interstate associations and commissions
18 intrastate commissions and boards
15 state agencies and boards
2 lake conservation districts
3 drainage and conservancy districts
3 lake improvement districts
5 rural water user districts
5 port authorities
7 sanitary districts
37 watershed districts
63 Farmers Home Administration county committees
90 Agricultural Stabilization Conservation Service county committees
92 Soil and Water Conservation Districts
87 counties
855 municipalities
1,795 townships

Information courtesy of Freshwater Foundation, *The Journal of Freshwater*, Volume Seven/1983.

**Water Management Maze**




Freshwater Foundation/Kevin Pedersen
Reprinted Courtesy of Freshwater Foundation

With federal funding and technical assistance declining, state and local agencies are devising innovative ways to guarantee, manage, and fund future water supplies. Some states have set drinking water standards more stringent than those at the federal level, including additional standards for SOCs, such as pesticides. Many have some form of groundwater protection program in place. Most states have groundwater protection regulations for hazardous waste disposal and landfills.

Water systems will have to pay more for monitoring, treatment, or replacement because of new federal and state regulations. The question arises as to where the necessary funds will come from: the polluter, the user, the general taxpayer, the state or federal government.

State aid to localities can be used in a variety of ways as leverage to encourage good management practices, conservation, and local cooperation. For example, Massachusetts offers 50% matching grants for leak detection and rehabilitation of public water systems. Oklahoma has set up an insured state revenue bond program that can be used to upgrade water systems. This program passes the credit risk on to the insurer while enabling localities to borrow at low interest rates.

Because water crosses political boundaries, management in one state affects another. Questions of water quality or allocation are resolved through judicial review, congressional action, and interstate compacts. One example of interstate cooperation and planning is the regional utilities operation and cost-sharing program for the Washington, DC, metropolitan area adopted in 1982, assuring an adequate water supply for the next fifty years and saving an estimated quarter of a billion dollars. Maryland, Virginia, and the District of Columbia share capital and operating costs. To avoid the risk of inadequate supplies during drought conditions, the agreement provides for coordination between utilities for releases and withdrawals of water.

# Federal Legislation

The Safe Drinking Water Act is intended to protect drinking water through the setting, monitoring, and enforcement of standards and, to a certain extent, to prevent contamination of underground water supplies. Other federal laws address the protection of water supplies through controls on the contamination of surface water, disposal of toxic substances, and use of chemical pesticides. Regulations target contaminating activities where they occur, for example, in the air, on the land, or in the water, but this fragmented approach simply shifts the disposal of toxics to the area of least regulation. In general, our laws address the management and control of pollutants rather than emphasizing the importance of their overall reduction. Their effectiveness has been limited by budgetary constraints, slow regulation, lax enforcement, and limited interaction among the institutions responsible for implementing them.

The **SAFE DRINKING WATER ACT (SDWA)** of 1974 regulates public water systems and certain activities that can affect underground water sources. It requires EPA to set national primary drinking water standards, known as MCLs or Maximum Contaminant Levels. These are based on health risk assessments and the feasibility (including cost considerations and treatment technologies) of attaining those standards. Revised standards which were to have been issued in 1977 will finally go into effect as a result of the 1986 amendments to the SDWA. An additional 61 substances (synthetic organic, volatile organic, inorganic, radionuclide, and microbiological) are to be regulated during the next three years.

If a locality cannot meet these standards even using the best available technology, a variance may be granted. If certain economic conditions prevent compliance, an exemption may be allowed. In each case, the decision is made by the state or EPA, and compliance deferred only if it will not result in an unreasonable health risk and if a schedule for compliance is submitted. Some technical assistance for small systems is available. By early 1988 filtration for many systems using surface water will be required; by mid-1989 disinfection for all systems to control bacteria and viruses will be mandatory, although these too may be subject to variances or exemptions.

Monitoring for contaminants is to be carried out on a regular, specified basis. (See Treatment.) Public notification of any violations of maximum contaminant levels or any others posing a serious health risk must be made within 14 days. Notices must explain the violation, the potential adverse health effects, remedial action being taken, and plans for alternative water supplies, if necessary. A mandatory monitoring program to detect unregulated contaminants is outlined under the 1986 amendments. States may exempt certain systems from this requirement, with EPA approval, if the presence of contaminants is unlikely.

**National Primary Drinking Water Standards**

| Constituent | MCL |
|---|---|
| Arsenic | 0.05 |
| Barium | 1.00 |
| Cadmium | 0.01 |
| Chromium | 0.05 |
| Lead | 0.05 |
| Mercury | 0.002 |
| Nitrate (as N) | 10.00 |
| Selenium | 0.01 |
| Silver | 0.05 |
| Fluoride | 4.00 |
| Endrin | 0.0002 |
| Lindane | 0.004 |
| Methoxychlor | 0.10 |
| Toxaphene | 0.005 |
| 2,4 - D | 0.1 |
| 2,4,5 - TP Silvex | 0.01 |
| Coliform bacteria | <1/100 mL |
| Total trihalomethanes | 0.10 |
| Radionuclides | |
| Radium 226 & 228 (total) | 5pCi/L |
| Gross alpha particle activity | 15pCi/L |
| Gross beta particle activity | 4 mrem/yr |
| Turbidity | 1-5 tu |

Data are given in milligrams per liter (mg/L) unless otherwise specified; mL = milliliters, tu = units of turbidity, pCi/L = picocurie per liter, mrem = millirem (one thousandth of a rem).

Source: USEPA

Enforcement of standards is strengthened under the 1986 amendments. Most states have primary enforcement powers, or primacy, if they have standards at least as strict as those at the federal level and certain capabilities for monitoring, inspection, emergency preparedness, and reporting. These powers have not been fully exercised in the past. A 1982 GAO report found widespread noncompliance by community water systems in many states and enforcement action ranging from "none to minimal." Of the 146,000 violations recorded in 1980, only 16,000 were publicly reported and very few were acted upon by the states. Under the new act, if states fail to act within 30 days of being notified of a violation, the EPA Administrator must take enforcement action.

The protection of underground sources of drinking water is extended in the 1986 amendments. Currently, underground injection of hazardous waste is controlled through a permit system. By 1988 additional monitoring for groundwater contamination at wells which inject hazardous waste will be required.

Provisions for the protection of sole source aquifers are specified and include the possibility for state or local governments to apply for participation in a program with EPA, sharing costs equally.

By mid-1989 states may submit protection plans for wellhead areas around public wells which are vulnerable to the leaching of contaminants into groundwater supplies. All potential sources of manmade contamination must be identified and protection plans must be developed, including a provision for alternative sources of supply. EPA must develop guidelines for these plans by mid-1987.

## Deficiencies in the law

- Private wells, which serve over 40 million people, are not covered.
- Systems serving under 10,000 people are not required to monitor for trihalomethanes (THMs).
- Underground injection of certain brines from oil and gas mining are exempted from some regulatory provisions.
- No support for research on alternative treatment technologies which could eliminate contamination is provided and very little technical assistance or funding is available to the states to carry out the law, a particular problem for small systems.

The **CLEAN WATER ACT** as amended is designed to restore and maintain the quality of surface waters. States have been required to develop water quality standards for their rivers and streams. Contaminant levels in effluents discharged directly into these bodies are regulated by a permitting system, the National Pollutant Discharge Elimination System (NPDES), on a basis of "best technology generally available" for municipalities and industries. For effluents discharged by industries into public sewer systems, pretreatment standards are required. However, thousands of companies have expired NPDES permits. These and thousands more who are discharging illegally into public sewer systems need to be brought into compliance.

The **RESOURCE CONSERVATION AND RECOVERY ACT (RCRA)** regulates the storage, transportation, treatment, and disposal of hazardous wastes to assure minimal effects on human health and the environment. A manifest system is responsible for tracking waste from "cradle to grave." Treatment, storage, and disposal facilities must have permits and must state the potential for public exposure to hazardous waste. Certain restrictions on the disposal of liquid waste in landfills were adopted when the law was reauthorized in 1983. Each federal agency must inventory its own hazardous waste sites, past and present. Specifications for 30-year post-closure care of facilities to prevent contamination, including groundwater monitoring, are required but have rarely been enforced.

Underground storage tank provisions address groundwater contamination from underground tanks storing motor fuels and any chemical on the Superfund list of toxic substances, including 125 pesticides. Owners must notify states of the existence, location, and condition of tanks. Performance standards and frequent leak monitoring requirements for all underground tanks are under consideration.

EPA has given enforcement powers to most of the states which then have responsibility for conducting site inspections annually or biannually, depending on the facility, and for enforcing regulations. With certain exceptions, citizens may sue the responsible agency for lack of enforcement.

There are numerous deficiencies in the enforcement of this law. Many facilities that treat, store, or dispose of hazardous wastes have not been inspected. In 1984 only 1% of 8000 facilities had been sufficiently inspected to receive permits. Inadequate monitoring of groundwater and poor siting, design, and operation of facilities is the rule rather than the exception.

The **COMPREHENSIVE EMERGENCY RESPONSE, COMPENSATION, AND LIABILITY ACT (CERCLA or Superfund)** authorizes government cleanup of chemical spills and inactive hazardous waste sites that may pose threats to human health or the environment. Since 1980, only 14 of 888 priority sites have been "cleaned up." According to the Office of Technology Assessment, 10,000 sites will need priority attention. EPA's total list numbers 26,000, but not all potential sites have even been identified. EPA estimates that between 34,000 and 52,000 municipal landfills (most closed) and hundreds of thousands of underground storage tanks are not represented in current data. Seventy-five thousand on-site industrial landfills, which may have accepted hazardous waste in the past, have not been inspected for inclusion in the list.

Even the current "cleanups" are more stopgaps than permanent solutions, and available sites for disposal of Superfund waste are lacking. For this reason the 1986 Superfund amendments require cleanups that necessitate permanent solutions and compliance with other environmental laws.

Limited state funding for the construction and maintenance of sites, inadequate provisions for public participation, and insufficient congressional appropriations have hindered effectiveness.

The **FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDE ACT (FIFRA)** is intended to protect public health and the environment through the regulation of pesticide registration, reregistration, marketing, and use in the US. EPA recognizes that pesticide residues in groundwater present a potential risk to human health. When evaluating a pesticide's risks, EPA takes into consideration both its inherent toxicity and the potential routes of human exposure to the compound and is now considering cancellation of products that pose an unreasonable risk due to their occurrence in groundwater. In the registration of new pesticides EPA requires information on the leaching potential of pesticides. In the reregistration of pesticides in use those suspected of leaching are subject to further testing by manufacturers, and those proven to be leachates may be subject to restrictions or cancellation.

Loopholes have allowed the use of pesticides which have not been completely tested for health and safety data. Slow implementation of testing requirements for reregistration has also weakened the law's ability to protect drinking water sources.

## Contaminants to be Reviewed for Regulation*

**Microbiologic and Turbidity**

*Giardia lamblia*
*Legionella*
Standard plate count
Total coliforms
Turbidity
Viruses

**Inorganics**

Aluminum
Antimony
Arsenic
Asbestos
Barium
Beryllium
Cadmium
Chromium
Copper
Cyanide
Lead
Mercury
Molybdenum
Nickel
Nitrate
Selenium
Silver
Sodium
Sulfate
Thallium
Vanadium
Zinc

**Volatile Organic Chemicals**

Benzene
Carbon tetrachloride
Chlorobenzene
Dichlorobenzene(s)
1,2-Dichloroethane
1,1-Dichloroethylene
cis-1,2-Dichloroethylene
trans-1,2-Dichlorethylene
Methylene chloride
Tetrachloroethylene
Trichlorobenzene
1,1,1-Trichloroethane
Trichloroethylene
Vinyl chloride

**Organics**

Acrylamide
Adipates
Alachlor
Aldicarb
Atrazine
Carbofuran
Chlordane
Dalapon
Dibromomethane
Dibromochloropropane (DBCP)
1,2-Dichloropropane
Dinoseb
Diquat
2,4-D
Endothall
Endrin
Epichlorohydrin
Ethylene dibromide (EDB)
Glyphosate
Hexachlorocyclopentadiene
Lindane
Methoxychlor
PAH's
PCB's
Pentachlorophenol
Phthalates
Pichloram
Simazine
2,3,7,8-TCDD (Dioxin)
Toluene
Toxaphene
2,4,5-TP
1,1,2-Trichloroethane
Vydate
Xylene

**Radionuclides**

Beta particle and photon radioactivity
Gross alpha particle activity
Radium 226 and 228
Radon
Uranium

*Includes contaminants currently regulated.

Source: Safe Drinking Water Act Amendments, Conference Report; May 5, 1986

# Innovative State Programs

## Florida: Water Quality Assurance

Florida, a state where over 90% of the population depends on groundwater, has one of the most comprehensive water pollution control programs in the country. The 1985 Water Quality Assurance Act prohibits hazardous waste landfills in Florida, sets up a groundwater quality monitoring network, establishes a new pesticide monitoring council, requires local governments to identify generators of hazardous waste in their areas and inform them of proper management and disposal, and limits the number of septic tanks per acre. To increase public awareness of the need to dispose of hazardous waste carefully, the law authorizes "amnesty days" during which small industries and households can dispose of such wastes at specified sites free of charge. The law also prohibits discharges of carcinogens, teratogens, mutagens, and toxins into all groundwater except confined aquifers not expected to be used for drinking water. The program is funded by a Water Quality Assurance Trust Fund provided by the state. When the fund falls below $3 million, an automatic two cents per barrel tax on pollutants is triggered to restore the fund to $12 million.

In 1984 the State Environmental Regulatory Commission adopted rules which established MCLs for eight synthetic organic chemicals (SOCs) in community water systems and required testing for 118 SOCs in these systems every three years.

Florida has organized water management into five districts, divided by watersheds. An appointed, unsalaried board governs each district and has substantial taxing authority. The districts' responsibilities have grown from flood control projects to groundwater regulation, issuance of use permits, and management and storage of surface water.

Legislation passed in 1986 covers a number of aspects of the water program. One bill places a 10 cent tax on each barrel of oil coming into the state. The revenue will go to the cleanup of leaking underground gasoline storage tanks. Another tackles the problem of rapid personnel turnover by improving the pay scale of state environmental scientists.

One very important project is designed to develop a further refinement of Florida's groundwater classification rule incorporating protection of wellheads, high recharge areas, aquifers for future wellfields, and aquifers which are one area's sole source of drinking water (sole source aquifers). This would be Florida's first preventive as opposed to reactive rule.

## New Jersey: Recycling Program

New Jersey is the first state to enact a comprehensive statewide recycling program. Over six million tons of solid waste are generated per year in that state, or 17,000 tons per day, most of which has gone into landfills. The New Jersey Energy Department's Office of Recycling has been funded to assist with program planning and educational grants to start or


Credit: Sacramento County, CA

expand recycling. Funding comes from landfill surcharge revenues. In 1970, 20 of New Jersey's 567 communities recycled their wastes; in 1984, 363 did. A mandatory recycling program has been enacted.

## Minnesota: Comprehensive Monitoring

A nationwide groundwater survey conducted by EPA in 1980-81, which found that over 20% of the water tested had VOCs above detectable levels, was the impetus for a comprehensive VOC survey in Minnesota. Two out of three Minnesotans use groundwater as drinking water. Concerned over a possible threat to health and suspicious of widespread contamination, the Minnesota Department of Health was prompted to undertake a statewide survey, one of the first such surveys in the country.

All community water supply wells in the state—some 1800 wells—are now tested for 48 VOCs. When they are detected, the Health Department issues advisories and assists in finding alternate supplies.

The Department of Health also recently received funding to investigate pesticide contamination of selected water systems. Water is to be tested before and after seasonal application of pesticides.

## Massachusetts: Water Supply Initiatives

A 1982 report on water resources in Massachusetts predicted water shortages in approximately 130 communities by 1990. The state acted by appropriating $107.5 million for management plans. Water conservation is promoted through grants for water-conserving devices in public buildings and for homeowners, leak detection programs, and the upgrading of old water systems. Groundwater supplies are protected by land acquisition and the publication of a comprehensive atlas showing water supplies and potential sources of contamination; monitoring for pesticide contamination in agricultural areas; and an area-wide management study of Cape Cod. Cleanup of contaminated water supplies is also planned.

## Wisconsin: An Integrated Approach

Well-monitoring in 1981 in Wisconsin revealed the presence of aldicarb, a pesticide used for potato pest control, in 18% of the samples. Severe restrictions on its use were instituted and in 1985 a moratorium was declared on a 36,000 acre area.

In 1984 a groundwater protection bill was passed introducing enforcement standards and preventive action limits designed to determine pesticide use and to trigger preventive measures. Provisions for groundwater monitoring, regulation of the storage of bulk fertilizers and pesticides, and a fund to compensate those whose wells are contaminated are also included in the bill. These programs are financed by fees on activities which have the potential to contaminate groundwater (license fees for pesticide manufacturers, for example) and general revenues.

Related programs include a Cooperative Extension Service education program on the relationship of land use practices and groundwater, an economically attractive Integrated Pest Management program for potato growers, and a study by the University of Wisconsin of methods to reduce leaching of pesticides through careful timing of application and irrigation.

## California: Underground Injection Control

In 1985 the state enacted its own underground injection control program. California's Toxic Injection Well Control Act of 1985 requires that anyone using an injection well file a statement with and pay a fee to the state. No discharge of hazardous waste is permitted into new injection wells after January 1986 and none into existing wells after January 1988 if a drinking water source is within one half mile. Permits depend on submission of detailed hydrogeological data, and inspections and testing are required.

**Ongoing State Water Conservation Programs**

| | Number of States |
|---|---|
| Drought emergency plans by suppliers | 17 |
| Everyday conservation plans by water suppliers | 8 |
| Conservation plans or programs as state permit conditions | 16 |
| Water pricing for conservation | 3 |
| Leak controls in distribution systems | 11 |
| Leak controls by water consumers | 1 |
| Water saving plumbing | 11 |
| Tax breaks for household conservation devices | 1 |
| Water pressure management for conservation purposes | 5 |
| Public education | 18 |
| Conservation in public buildings | 9 |
| Master water meters | 17 |
| Customer water meters | 9 |
| Omnibus conservation legislation | 5 |

Credit: New York State Senate Research Service Task Force on Critical Problems

# Community Action Guide

It is up to us as community members to participate creatively, responsibly, and persistently in identifying and solving the problems of our community and state, keeping in mind that prevention costs less than cleanup.

Officials at all levels need to know of our desire for clean drinking water and that we expect strict enforcement of the laws. The following suggestions are offered as general guidelines for public action.

## Form a small working group

- Include representatives from business, health, and environmental interests.
- Enlist professionals for technical and legal advice.
- Ask a college or high school class to help with surveys or other information gathering.
- Meet with the environmental staff members from the offices of your congressional representatives. Ask for ways to initiate legislative action and for a list of other concerned individuals and groups. Ask to be kept informed about congressional activities on environmental protection.
- Contact other groups with shared concerns.

## Learn about water conditions in your community

- Contact your local planning and zoning boards, town or city council, and other officials in charge of water resources. Your group can act as a link between government officials, planners, and citizens.
- Ask your state environmental agency, US Geological Survey regional office, or county extension agent for information on water quality and supplies. They may have maps or other materials showing the location of aquifers, sensitive recharge areas, watersheds, underground storage tanks, and industrial and disposal sites.
- Your regional EPA may be able to provide information about problems and solutions in other communities.
- A community suspecting a specific problem can get an independent assessment of its water. The state health department laboratory or state university laboratory may be helpful here; however, since the cost of testing for several contaminants can be quite high, a local television or radio station or a newspaper may consider coordinating and financing such a project.

## Learn about your public water system

- What is the source of your supply (river, lake, aquifer)?
- Does your state have a training course for plant operators? Are the operators licensed and adequately paid?
- What is the history of investment in maintaining the water system? What were the most recent expenditures for new treatment equipment?
- What conservation measures are being practiced (leak detection and repair, pressure reduction, pricing, regulation, and education)?
- Are state standards stricter or more comprehensive than those at the federal level?
- Does your utility monitor for unregulated contaminants, particularly those which are likely to be found in your area?
- Has your system complied with drinking water standards and all monitoring and reporting requirements of the SDWA? Has enforcement action been taken where violations have occurred? Request monitoring data and test results from the last 2-3 years from the utility, public works department, the monitoring agency (the name of which you can get from your regional EPA), or your state health or environmental management department.
- What testing is required of your system?
- If the utility has been granted a variance or exemption, what is the schedule for compliance? Which contaminants are involved and what treatment options are available for lowering the concentrations of the problem substances? What type of monitoring is being conducted until compliance is achieved?
- What public notification requirements exist?

## Gather information about household systems

### Private wells

- Ask the local health department about laws governing the siting, drilling, and inspection of private wells and whether wells must be tested in a property sale. Ask what testing the department will do and if there is a charge.
- Before purchasing a home with a private well obtain written proof of the safety of the water and specific data on the construction and siting of the well (and any treatment system attached), piping, and septic tank. Have the well tested for all primary drinking water contaminants and any others that you suspect might be in the water. (Refer to section: How to Get Your Water Tested.)
- Test your well water at least once a year for bacteria and nitrates and any other substances as warranted by local conditions. Dug (shallow) wells are more vulnerable to contamination than drilled wells.
- Are you using chemical fertilizers and pesticides in ways that could contaminate your water supply?
- Do not dispose of toxic materials at home (such as paint thinners, solvents, pesticides, medicines, and certain cleaning materials). If poured down the drain, they may end up in the water supply.

### Septic system

- Know the location, age, and condition of your septic system.
- Inspect and pump out your septic tank once a year. Do not use cleaners: many are toxic and non-biodegradable; some contain trichloroethylene (TCE) or benzene.
- Ask your county Soil Conservation Service extension office or municipal health department for information about septic system maintenance and for maintenance records from the previous owner.
- Have your cistern water tested if you suspect contamination from lead solder dissolved by rainwater and roofing material, such as asbestos.

## Evaluate potential sources of contamination and preventive measures

- What municipal practices such as storage and use of de-icing salts, road construction materials, and municipal and county roadside spraying should be improved? Are pesticides used on or near water, to control aquatic or bank-side weeds, or around reservoirs?
- What types of pesticides and fertilizers are used in your area? How much and how often? (Ask your neighbors and local extension service.)
- Do area businesses and industries have public or environmental affairs staffs with whom you can discuss your concerns?
- Do local service stations regularly monitor inventory and check storage tanks for leaks or spillage?
- Is local industry storing, using, transporting, and disposing of toxic materials in a safe manner?
- How are small businesses disposing of their toxic wastes?
- Are there storm or agricultural runoff problems?
- What current mining operations and abandoned mines are located in your area?
- Determine the location and condition of area storage and waste facilities, such as: sewer lines, septic tanks, sewage treatment facilities; underground storage tanks (gasoline, home heating oil, industrial chemicals); injection wells for disposal of toxic materials; municipal landfills, dumps, and abandoned waste sites.
- Ask your state natural resource agency what naturally-occurring substances such as radon, sulfur, calcium, fluoride, or minerals are found in your area.
- Learn about your sewage treatment plant. Check with the regional EPA to find out whether your plant is in compliance with the Clean Water Act. Is its permit up to date? Have there been violations? If so, have enforcement actions been taken? How is the plant financed? How would improvements be financed? Can it handle an increase in population?
- Is effluent from local industries adequately pretreated?

## Find out about local and municipal practices, ordinances, and regulations

- Are there land use and groundwater regulations?
- Are septic tank ordinances adequate to protect groundwater?
- Where does your community dispose of waste? How are toxic substances transported, handled, used, disposed of, or stored?
- Does your local government have a community program for the collection of toxic household products?
- What are the procedures for reporting emergency spills and illegal waste dumping? Do local agencies, such as fire departments, have contingency plans for responding to accidental spills?

## Examine the effectiveness of your state's water management

- What agencies are responsible for implementing federal and state laws, data collection and research, policy analysis and planning, monitoring, and enforcement?
- Find out which agencies are responsible for the permitting of hazardous waste facilities, municipal landfills, injection wells, and wastewater discharge from industrial facilities. Ask them who has received or requested permit waivers, variances, or exemptions. Request that they notify you of public hearing and comment periods and send you EPA permit proposal fact sheets.
- What is the budget for water quality monitoring and enforcement?
- What opportunities exist for public participation in the development of general regulations? Are there citizen advisory councils for water planning?

## Review state groundwater and drinking water protection

- Does your state have a groundwater protection policy, law, or regulation program such as a classification system?
- If it has a classification system, can the public participate in decisions regarding classification? Do all the classes protect drinking water supplies, including groundwater that supplies private wells or small systems?
- Do any programs control sources of contamination, disposal of radioactive waste, deep well injection, use of fertilizers or pesticides, on either a site-specific basis or discharger class?
- Are there controls for facility siting or protecting sensitive aquifer recharge areas?

## Mobilize public participation

- Get to know your public officials and representatives.
- Get the names, phone numbers, and addresses of state legislators.
- Exert public pressure on elected officials to act.
- Focus public attention on lax enforcement through press conferences, media, and meetings.
- When laws are not implemented, request the appropriate state legislature oversight committee to see that enforcement takes place.
- Set up informational forums.
- Testify when the opportunity arises.
- Media coverage can help increase public support and pressure. Write frequent letters to the editor to voice your concerns about these issues.
- Work with public officials to organize household hazardous waste collection days.
- Organize community emergency planning programs for toxics.

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Citizen participation is included in the following federal statutes:
Clean Water Act (CWA)
Comprehensive Emergency Response, Compensation, and Liability Act (CERCLA or Superfund)
Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)
Resource Conservation and Recovery Act (RCRA)
Safe Drinking Water Act (SDWA)
Provisions include:

- participation in state program authorizations and permitting;
- citizen petitions for the issuance, amendment, or repeal of any regulation under these acts;
- citizen suits against violators of any enforceable regulation or permit conditions. Certain laws include additional provisions. Contact your state regulatory agency or regional EPA for information about these laws and other federal and state statutes.

# Resources

The following national organizations work on many aspects of drinking water and related issues. They may be able to respond to specific questions and/or provide names of local contacts or information on technical, legal, or legislative issues.

Environmental Defense Fund
1616 P Street, NW #150
Washington, DC 20036
202 / 387-3500

Environmental Policy Institute
218 D Street, SE
Washington, DC 20003
202 / 544-2600

Environmental Task Force
1012 14th Street, NW
Washington, DC 20005
202 / 842-2222

Izaak Walton League of America
1701 N. Fort Myer Drive #1100
Arlington, VA 22209
703 / 528-1818

League of Women Voters
1730 M Street, NW
Washington, DC 20036
202 / 429-1965

National Coalition Against the Misuse of Pesticides
530 7th Street, SE
Washington, DC 20003
202 / 543-5450

National Wildlife Federation
1412 16th Street, NW
Washington, DC 20036
202 / 797-6800

Natural Resources Defense Council
122 East 42nd Street
New York, NY 10168
212 / 949-0049

Sierra Club
330 Pennsylvania Avenue, SE
Washington, DC 20003
202 / 547-1144

U.S. Public Interest Research Group
215 Pennsylvania Avenue, SE
Washington, DC 20003
202 / 546-9707

World Wildlife Fund/ Conservation Foundation
1255 23rd Street, NW
Washington, DC 20037
202 / 293-4800

The following organizations have a more regional or local focus—many are active in a number of environmental issues.

**Quality and Protection**

Citizens for a Better Environment
33 East Congress, #523
Chicago, IL 60605
312 / 939-1530
(also in San Francisco and Berkeley, CA, Wheeler, IN, Minneapolis, MN and Milwaukee, WI)

City of Durham
Environmental Coordinator
101 City Hall Plaza
Durham, NC 27701
919 / 683-4137
(local ordinances)

County of Suffolk
Department of Health Services
Environmental Pollution Control
15 Horseblock Place
Farmingville, NY 11738
516 / 451-4634
(model code - controls on toxics)

INFORM
381 Park Avenue South
New York, NY 10016
212 / 689-4040

Institute for Local Self-Reliance
2425 18th Street, NW
Washington, DC 20009
202 / 232-4108
(waste reduction)

Rural New England, Inc.
P.O. Box 786
Waldoboro, ME 04572
207 / 832-6825
(model aquifer protection zoning ordinances)

South Branch Watershed Association
R.D. 1, Route 31
Lebanon, NJ 08833
201 / 782-5513

Southwest Research and Information Center
Box 4524
Albuquerque, NM 87106
505 / 262-1862

Spokane County Engineers
(Don Miller)
Public Works Building
North 811 Jefferson Street
Spokane, WA 99260
509 / 456-3600
(innovative ordinances on toxics, sewers)

Water Pollution Control Federation
601 Wyeth Street
Alexandria, VA 22314-1994
703 / 684-2400

**Health Information**

American Academy of Environmental Medicine
P.O. Box 16106
Denver, CO 80216
(write for referral to specialist in your area)

Center for Science in the Public Interest
1501 16th Street, NW
Washington, DC 20036
202 / 332-9110
(risk assessment)

Community Health Improvement Program
Harvard School of Public Health
677 Huntington Avenue
Boston, MA 02115
617 / 732-1265

**Supply and Conservation**

Citizens Union Foundation
198 Broadway
New York, NY 10038
212 / 227-0342

City of St. Petersburg
Field Services - Reclaimed Water
290 16th Street, North
St. Petersburg, FL 33713
813 / 892-5111

Rocky Mountain Institute
P.O. Drawer 248
Old Snowmass, CO 81654
303 / 927-3851

Southern Arizona Water Resources Association, Inc.
48 North Tucson Boulevard, #106
Tucson, AZ 85716
602 / 881-3939

Western Network
1215 Paseo de Peralta
Santa Fe, NM 87501
505 / 982-9805

**Small Systems**

California Department of Water Resources
Local Projects Financing Office
P.O. Box 942836
Sacramento, CA 94236-0001
916 / 445-9248

National Demonstration Water Project
1111 North 19th Street, #400
Arlington, VA 22209
703 / 527-2282

Rural Community Assistance Program (RCAP)
-Community Resources Group, Inc.
2705 Chapman
Springdale, AR 72764
501 / 756-2900

-Great Lakes Rural Network
109 South Front Street
Freemont, OH 43420
419 / 334-8911

-Midwest Assistance Program, Inc.
P.O. Box 81
New Prague, MN 56071
612 / 758-4334

-Rural Community Assistance Corporation
2125 19th Street, Suite 203
Sacramento, CA 95818
916 / 447-2854

-Rural Housing Improvement, Inc.
218 Central Street, Box 429
Winchendon, MA 01475-0429
617 / 297-1376

-Virginia Water Project, Inc.
Southeastern Rural Community Assistance Program
702 Shenandoah Avenue, NW
P.O. Box 2868
Roanoke, VA 24001
703 / 345-6781

**Legal Assistance**

Environmental Task Force
Community Environmental Legal Services
1012 14th Street, NW
Washington, DC 20005
202 / 842-2222

Trial Lawyers for Public Justice
2000 P Street, NW
Washington, DC 20036
202 / 463-8600

Local law schools

**Public Education / Community Organizing**

Association of New Jersey Environmental Commissions
300 Mendham Road
Mendham, NJ 07945
201 / 539-7547

Citizens Clearinghouse for Hazardous Waste
P.O. Box 926
Arlington, VA 22216
703 / 276-7070

Citizens Program for the Chesapeake Bay
-6600 York Road
Baltimore, MD 21212
301 / 377-6270

-5 East Queens Way
Hampton, VA 23669
804 / 723-0774

Clean Water Action Project
317 Pennsylvania Avenue, SE
Washington, DC 20003
202 / 547-1196
(Also Boston, MA; Baltimore, MD; Duluth, Rochester, and St.Paul, MN; Charlotte, NC; New Brunswick, Point Pleasant, Seabright, and South Orange, NJ; Pittsburgh, PA; Norfolk and Richmond, VA.)

Connecticut Fund for the Environment
152 Temple Street
New Haven, CT 06510
203 / 787-0646

For a Cleaner Environment, Inc.
P.O. Box 180
Woburn, MA 01801
617 / 938-8544

Freshwater Foundation
2500 Shadywood Road, Box 90
Navarre, MN 55392-0090
612 / 471-8407

Fulton Safe Drinking Water Action Committee
808 West 3rd Street
Fulton, NY 13069
315 / 592-7580

Local Government Commission
909 12th Street, #203
Sacramento, CA 95814
916 / 448-1198
(publications)

National Water Center
Box 264
Eureka Springs, AR 72632
501 / 253-9755

Ohio Alliance for the Environment
445 King Avenue
Columbus, OH 43201
614 / 421-7819

Pascommuck Conservation Trust
1 Lovefield Street
Easthampton, MA 01027
413 / 527-5357

Pennsylvania Environmental Council
225 South 15th Street
Philadelphia, PA 19102
215 / 735-0966

South Central Connecticut Regional Water Authority
90 Sargent Drive
New Haven, CT 06511-5966
203 / 624-6671

Southwest Environmental Service
40 East 14th Street, #1
Tucson, AZ 85701
602 / 624-2353

Vermonters Organized for Cleanup
Box 190
Williamstown, VT 05679
802 / 476-7757

Washington Environmental Council
P.O. Box 508
Chimacum, WA 98325
206 / 732-4334

**Publications; Research and Technical Information**

California Water Resources Center
University of California
Davis, CA 95616
916 / 752-1544

Cornell University
Center for Environmental Research
468 Hollister Hall
Ithaca, NY 14853
607 / 255-7535

National Toxicology Program
Public Information Office - B2-04
P.O. Box 12233
Research Triangle Park, NC 27709
919 / 541-3991

New England Interstate Water Pollution Control Commission
85 Merrimac Street
Boston, MA 02114
617 / 367-8522

Science for Citizens Center of Southwestern Michigan
Western Michigan University
Kalamazoo, MI 49008
616 / 383-3983

USGS National Water Data Exchange 2nd Edition
NAWDEX Program Office
703 / 648-6848
(names of water organizations)

**Professional, Membership Organizations**

American Water Works Association
6666 West Quincy Avenue
Denver, CO 80235
303 / 794-7711

National Rural Water Association
P.O. Box 1428
Duncan, OK 73534
405 / 252-0629
(administers "circuit rider" program)

National Water Well Association
6375 Riverside Drive
Dublin, OH 43017
614 / 761-1711

Water Quality Association
4151 Naperville Road
Lisle, IL 60532
312 / 369-1600

The principal agency of the federal government dealing with water quality issues is the Environmental Protection Agency. For information contact Charlene Shaw, Communications and Outreach Coordinator, US EPA Office of Drinking Water - WH 550, 401 M Street, SW, Washington, DC 20460, tel: 202 / 382-2285.

EPA Regional Offices • Boston: 617 / 565-3424 • Dallas: 214 / 767-2630 • New York: 212 / 264-2515 • Kansas City: 913 / 236-2803 • Philadelphia: 215 / 597-9370 • Denver: 303 / 293-1692 • Atlanta: 404 / 347-3004 • San Francisco: 415 / 974-8083 • Chicago: 312 / 353-2072 • Seattle: 206 / 442-1203

# Water Testing

## Private water supply

Testing is the responsibility of the homeowner. State laws do not require that private wells be tested except in some states during property transfers. Periodic monitoring is the only way to assure that your water is safe to drink.

### Who can test your water?

The following institutions may be able to test your water for a nominal fee:

- Department of Public Health - state, county, or local;
- State university laboratories;
- State Department of Environmental Resources.

Private laboratories are listed in the yellow pages under "Water, quality" or "Laboratories, Testing." Ask the laboratory if it is "certified for testing." The fees vary depending upon the laboratory and the tests you request.

### For which contaminants should you test?

Obtain a copy of your state drinking water standards (which will be at least as strict as the federal ones and may include additional standards) from your Public Health Department. Request tests for bacteria and nitrates; if you suspect that any other contaminants might be present, you should test for those as well. For example, if you live in a mining area, test for iron, manganese, and aluminum; if near gas drilling operations, test for chlorides, sodium, barium, lead, and strontium; in an agricultural area, test for pesticides most commonly used by you and your neighbors.

### How should a sample be taken?

Accurate sampling is critically important. Follow carefully the instructions included from the laboratory. Use only the sterile containers provided and return samples promptly. Failure to do so may result in inaccurate tests.

### How often should your well be tested?

Test for bacteria and nitrates at least once a year and for other chemicals every few years or more frequently if you have had recent problems. Have the supply tested if you have drilled a new well or changed the pump or plumbing; if you live near potentially polluting activities (mining, drilling, toxic disposal sites, heavy applications of pesticides); or if you notice a change in the color, taste, or odor of the water.

## Public water supply

Because all public water systems must test their water on a prescribed basis for all state standards, there is some guarantee of protection from the regulated contaminants. However, violations do occur, lack of enforcement exists, and in older systems contaminants can form in the distribution pipes. It is advisable to test your own tap water should the following occur: ongoing or recurrent gastrointestinal problems or changes in the taste, color, or odor of your water. Some communities, suspecting specific problems in the source of their public supplies, have organized community-wide sampling.

For information on how to interpret your test report contact your local Cooperative Extension Service or Department of Health. Ask your EPA regional office for their Health Advisories on chemicals which are not regulated. To help you understand these technical materials, you can ask for assistance from a local scientist or public health official.

# Home Treatment

In some situations, such as in rural areas where wells have been contaminated or where there are insufficient funds to improve an existing facility quickly, devices (called "point-of-use" treatment) used in the kitchen to purify water for drinking and cooking may be helpful. However, they must be carefully chosen according to the specific contaminants found in the water, and they must be very carefully maintained. They are not appropriate for removal of continually high levels of contaminants and, of course, do not prevent health problems which may be caused by bathing in water containing high levels of toxic chemicals. For this reason, preliminary carbon filter treatment ("point-of-entry" treatment) may be necessary for the whole house.

EPA does not currently recommend home treatment devices either for the kitchen or the whole house as substitutes for central treatment because of the difficulty in monitoring their performance. In order to help small communities, states may find it practical to set up programs in which qualified water equipment dealers or service companies could monitor home devices on a regular basis. For example, home filters are being used in parts of New York state in response to pesticide contamination and are being monitored and maintained by a state-regulated program.

At present home treatment devices are not tested or regulated by the government. Advertising claims are often exaggerated and sometimes untrue, making it difficult for the consumer to choose between competing brands. California is the only state to have passed legislation regulating home treatment devices and making false advertising illegal. Several devices, such as activated carbon filters, distillers, and reverse osmosis systems, have been tested by independent laboratories. Rodale Press Product Testing Department has written summaries of these studies and of their own tests in the "Water Treatment Handbook" available from Rodale Press Inc., 33 East Minor St., Emmaus, PA 18049. New information on a variety of systems will be available in January 1987.

The following point-of-use devices are widely available and are capable of removing more than one contaminant.

**Activated carbon filters:** These may be attached to the faucet or installed under the counter. They are available for a range of prices, but most are more economical than reverse osmosis systems or distillers. Generally, under-the-counter models contain more carbon and are more effective. Solid carbon blocks are preferable to granulated carbon, and powdered carbon should be avoided. Some carbon filters have been found to be effective in removing up to 90% of organic contaminants such as chloroform, but do not remove dissolved inorganics or bacteria. In fact, one of the major draw-backs to carbon filters is that they provide a breeding ground for bacteria. They should be used only for water which has been previously treated to remove bacteria. Since carbon filters have a limited capacity for holding contaminants which have been removed from water, it is extremely important to change filters regularly. Rodale advises changing them even more often than recommended by the manufacturer since there is no way of accurately assessing when they are in need of cleaning.

**Reverse Osmosis Systems:** These generally consist of a pre-sediment filter, a cellophane-like membrane, and a carbon filter. The type and placement of the filters needed is determined by the contaminants in the water. The filters must be changed regularly. Rodale found these systems to be the most reliable for removal of organic chemicals. They are all relatively expensive, ranging from about $450 to $850 in 1985.

**Distillers:** These are capable of removing minerals (some of which are desirable), bacteria, inorganics, and organics. Generally, Rodale found that additional carbon filters are necessary for reliable removal of organics. Distillers range widely in size, construction, and price. All must be cleaned regularly.

Some companies are experimenting with combined systems to combat the whole array of contaminants. In assessing one of these, make sure it has been tested by an independent laboratory and that your water has been tested to determine what contaminants should be removed. All systems should be serviced regularly, so it is important to find a dealer who provides a service contract.

# Bottled Water

Although bottled water is at least 1000 times more expensive than tap water, sales topped $1.5 billion in 1985 and are growing at 15%-20% a year.

**Contaminants and Point-of-Use Treatment**

| Contaminants / Treatment | Ion Exchange (Cation) Water Softeners | Ion Exchange (Anion) | Activated Carbon Filters | Reverse Osmosis | Distillation | Activated Alumina |
|---|---|---|---|---|---|---|
| Arsenic | | ● | | ● | ● | ● |
| Barium | ● | | | ● | ● | |
| Flouride | | | | ● | ● | ● |
| Lead | | | | ● | ● | |
| Mercury | | | | | | |
| organic | | | ● | | | |
| inorganic | | | ● | ● | ● | |
| Nitrate | | ● | | ● | ● | |
| Silver | ● | | | ● | ● | |
| Total THMs | | | ● | | ● | |
| Radium | ● | | | ● | | |
| Coliform Bacteria | | | | ● | ● | |

Credit: Water Quality Association

Sources of bottled water are groundwater and tap water. Non-chlorinated water is disinfected with ozone as it is bottled. Tap water is usually dechlorinated by GAC, although this is not required by law, and is sometimes distilled. Most bottled waters are demineralized.

Bottled water is regulated by the Food and Drug Administration (FDA). The SDWA requires FDA to adopt standards for bottled water that meet EPA's national drinking water standards and to adjust them as EPA regulations change. FDA requires that bottled water come from a "protected" source, be bottled in facilities regulated as food plants, and be processed according to federally-approved manufacturing practices. If its quality is below FDA specifications, this must appear on the label. FDA does not allow unproved medical claims on the label, but the source need not be given.

Federal regulations state that bottled water companies shall submit samples regularly for testing at EPA-certified or state laboratories. Source water must be examined at least once a year for chemical contaminants and only once every four years for radiological contaminants. Source water obtained from other than a public system must be tested for microbiological contaminants at least once a week. The final product must be analyzed twice a year for chemical, physical, and radiological pollutants. Imported bottled water is randomly tested at ports of entry but is otherwise not subject to any federal controls.

Despite these regulations, little monitoring is done by FDA and many states regulate bottled water inadequately, leaving it to the bottlers to comply with federal standards. Also, bottled water is not tested for many pollutants found in source waters, including most pesticides. A 1985 study by the California State Assembly Office of Research concludes: "Under current quality standards, bottled water...is not guaranteed to be a safe and wholesome product." This agency found contaminants in excess of federal standards, including arsenic, fluorides, nitrates, and chloroform as well as bacteria, insects, and algae. Bottlers were found to have "doctored" water samples and kept false records. *The Washington Post* in 1985 tested bottled water sold in the Washington area and found chloroform in several brands, though at levels below the EPA standard for THMs.

One way to assess the quality of bottled water is to ask the bottler for a written guarantee that it meets federal regulations.

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*Now, people have found they cannot rely on the judgment of the scientific community, the altruism of polluters, or the industriousness of government regulators to protect their water quality.*

*. . . Ultimately, citizens will be guaranteed clean tap water only when they collectively demand it.*

Jonathan King
*Troubled Water*