United States
Environmental Protection
Agency

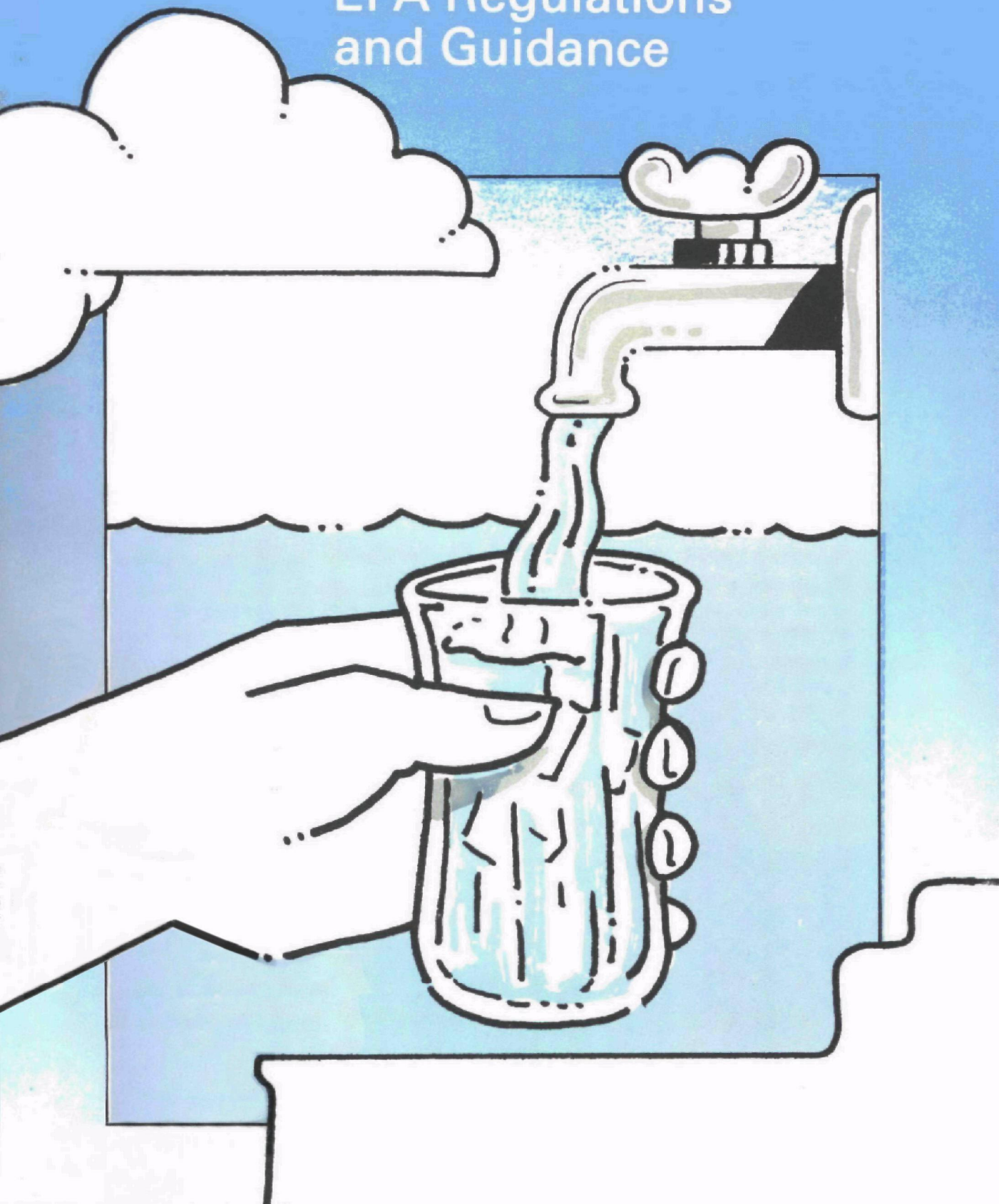
EPA 570/9-90-002
June 1990

Office of Water (WH-550)

EPA

# Your Drinking Water: From Source to Tap

## EPA Regulations and Guidance



# CONTENTS

Introduction ..... 1

What Is the Source
of My Drinking Water? ..... 2

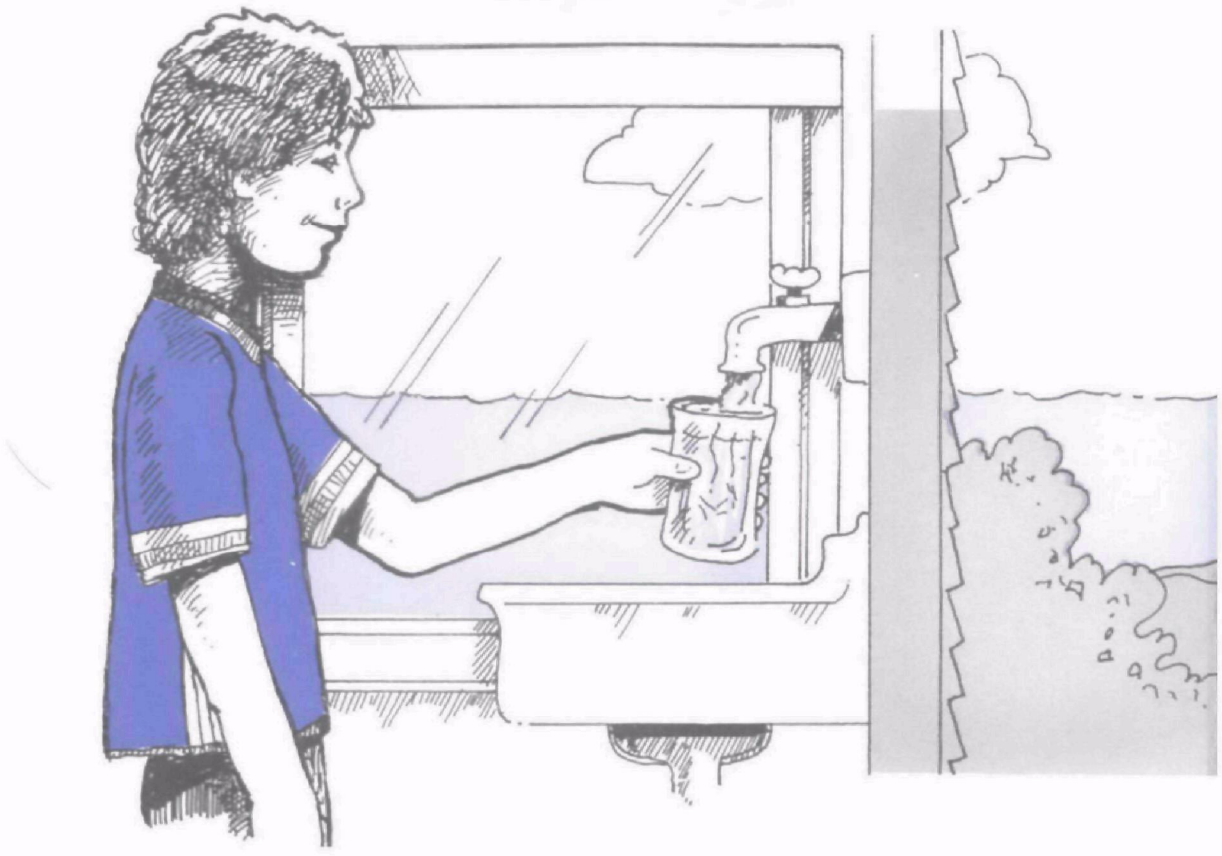
What Kinds of Chemicals
or Other Contaminants
Might Be Present in My Drinking Water? ..... 5

What Levels of These Contaminants
Are Cause for Concern? ..... 7

Who Ensures That My Drinking Water Is Safe? ..... 9

How Can I Check on
My Own Drinking Water Supply? ..... 12

How Can I Get More Information? ..... 14



# INTRODUCTION

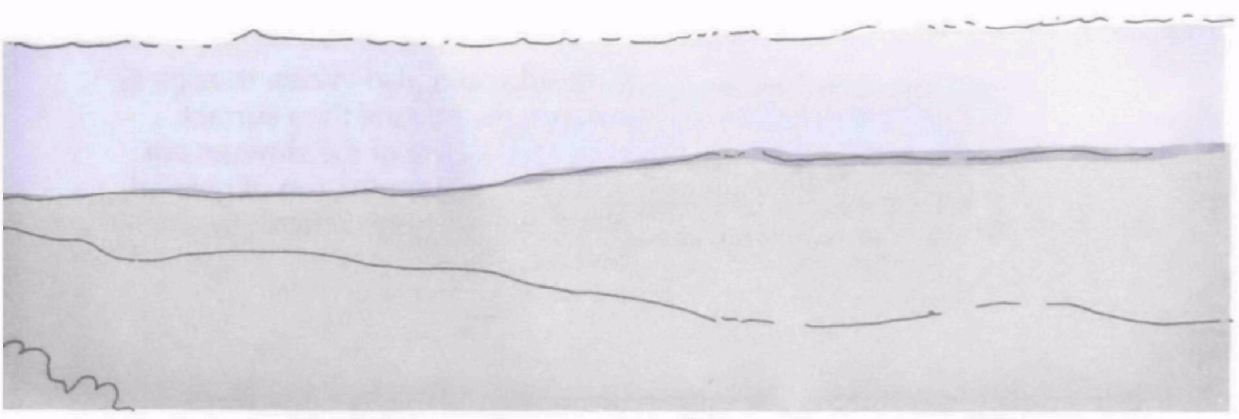
Safe drinking water is a resource that often is taken for granted. It is so abundant and inexpensive that we fill our glasses without a second thought about how the water got to our taps. Each person uses approximately 168 gallons a day, with each gallon costing less than 1/16 of a cent. We don't realize that our water runs so clear only because we enjoy one of the best water treatment systems in the world. And we don't realize that water is a resource that must be protected.

Drinking water has not always been safe in this country. Less than a century ago, serious illnesses such as cholera and typhoid fever were frequently transmitted by drinking water. Then, in 1908, chlorine was introduced as a disinfectant in U.S. water supplies to control disease-causing microorganisms. By mid-century, the number of deaths from typhoid fever and cholera had dropped significantly.

Now that we have the technology to protect our water supplies, disease epidemics are rarely spread by drinking water in this country. The challenge of keeping our drinking water safe, however, is far from over. For example, water supplies can be contaminated with naturally occurring chemicals as well as with manmade chemicals common to our industrial society, such as herbicides or pesticides. We have also increased our ability to measure low levels of chemicals in water. As a result, we have become aware that long-term exposure to some chemicals, even at low levels, can pose a health risk and thus must be controlled.

In response to these concerns, the U.S. Congress enacted the Safe Drinking Water Act in 1974. This Act required the U.S. Environmental Protection Agency (EPA) to develop a national program to protect public water supplies. EPA was also given the authority to establish national standards for known or suspected drinking water contaminants.

The Safe Drinking Water Act only regulates water systems serving 25 or more persons on a regular basis or systems with 15 or more service connections. Private water sources (for example, a private well) are not regulated by the Federal government.



## Purpose of This Pamphlet

The Safe Drinking Water Act is designed to ensure that you have clean water to drink. Most water flowing from taps in the United States *is* safe, but occasionally some problems can occur — for example, an accidental spill, problems with the maintenance of a water treatment facility, or ineffective treatment resulting in contamination. This pamphlet is designed to answer questions you might have about your water, such as, *Where does it come from? How is it protected from contamination?* Topics that are covered include:

- Sources of drinking water
- The kinds of chemicals and other contaminants that can be found in drinking water
- How scientists determine an acceptable level for a chemical in drinking water
- How the government establishes laws and guidelines to limit potentially dangerous chemicals or other contaminants in water to specific concentration levels
- What to do if you have questions or doubts about your drinking water

# WHAT IS THE SOURCE OF MY DRINKING WATER?

## Surface Water versus Ground Water

About half the people in the United States obtain their drinking water from surface waters such as lakes, rivers, and reservoirs. The rest get their water from wells or springs that are filled by ground water, which is water that lies underground in saturated layers of sand or fractured rock. The water filters down through the sand, soil, and rock until it is stopped by a solid barrier, such as a deposit of clay. Water then collects in the spaces between sand particles or in the cracks and cavities in rocks. These geologic formations are called aquifers.

## Recycling of Water Sources

Both surface and ground waters undergo a cycle of loss and replenishment (Fig. 1). Water evaporates from surface bodies of water, or it flows out — for example, from a lake into a river into the sea. At the same time, these surface bodies are replenished by stream and river inflow, rain, and melting snow. This cycling of water protects our surface water bodies by carrying away pollutants. New pollutants, however, can be carried into a body of water by the same cycle.

Ground water also cycles, though at a much slower rate than surface waters. Because of the slowness of this cycle, contamination of ground water is extremely difficult to reverse.

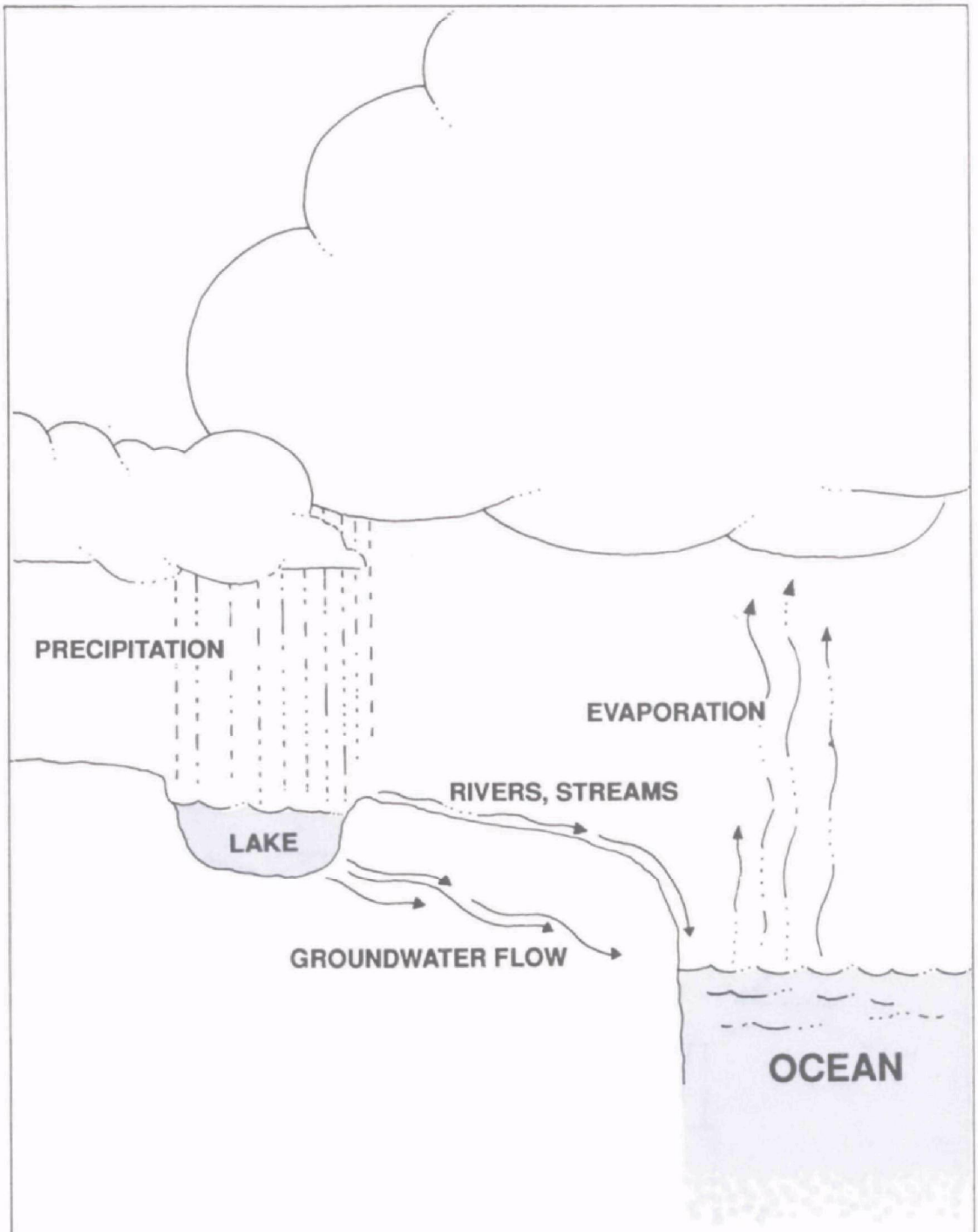



**FIGURE 1**
Surface Water Cycle

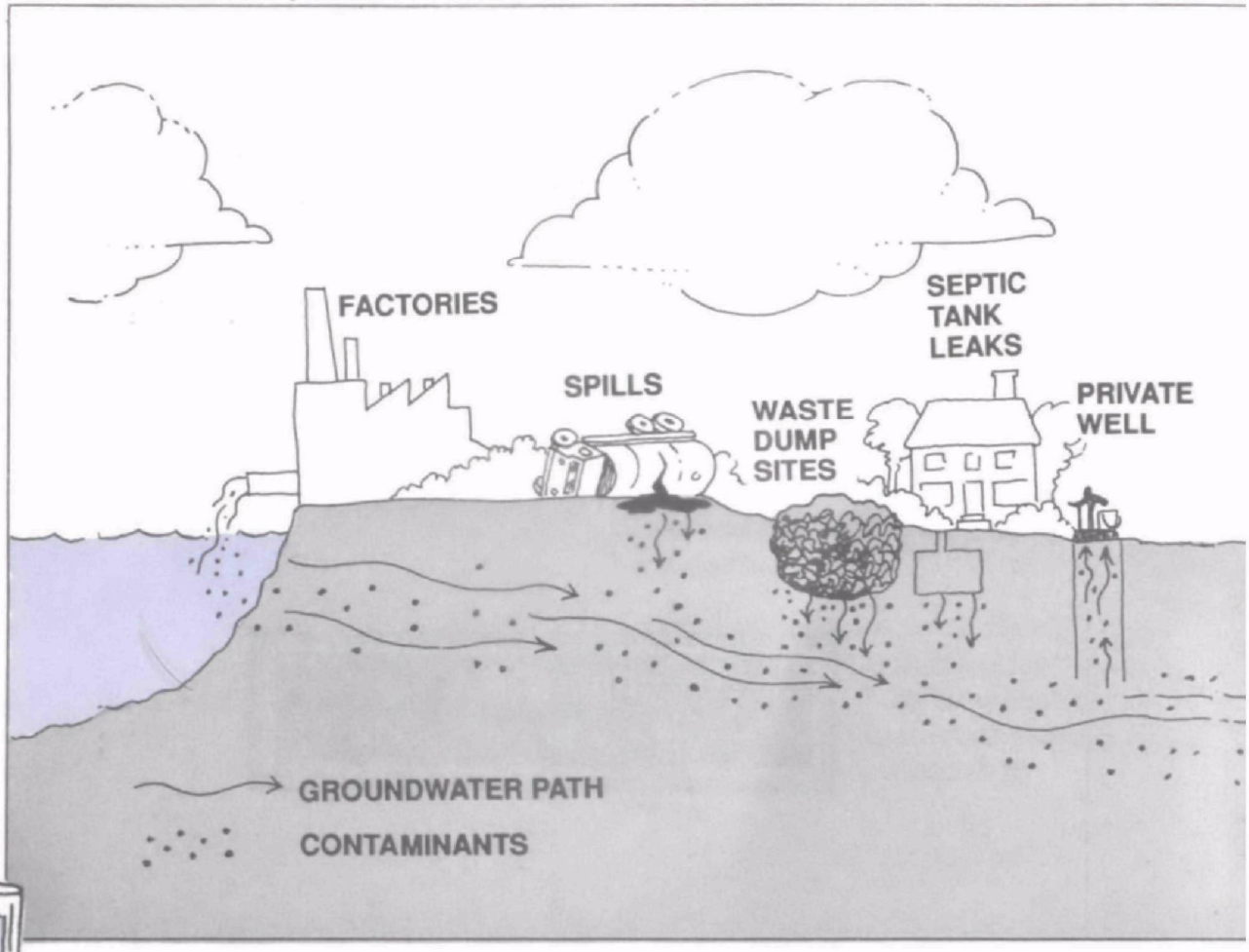
## Call Your Water Supplier for Information

To learn whether your drinking water comes from the surface or the ground, your simplest option is to call the company that supplies your water (check your water utility bill for a number). Questions you may wish to ask include:

- Does my water come from surface or ground water?
- If ground water, how deep is the well?
- Are any sources of pollutants nearby (for example, chemical waste sites, industrial discharges) that may threaten the purity of my water?
- If so, what steps are being taken, and by whom, to protect the water from contamination?

Even if your water is from a private well, a local water supplier could provide useful information regarding water quality in the area and testing options.

**FIGURE 2**
**Sources of Drinking Water Contamination**



# WHAT KINDS OF CHEMICALS OR OTHER CONTAMINANTS MIGHT BE PRESENT IN MY DRINKING WATER?

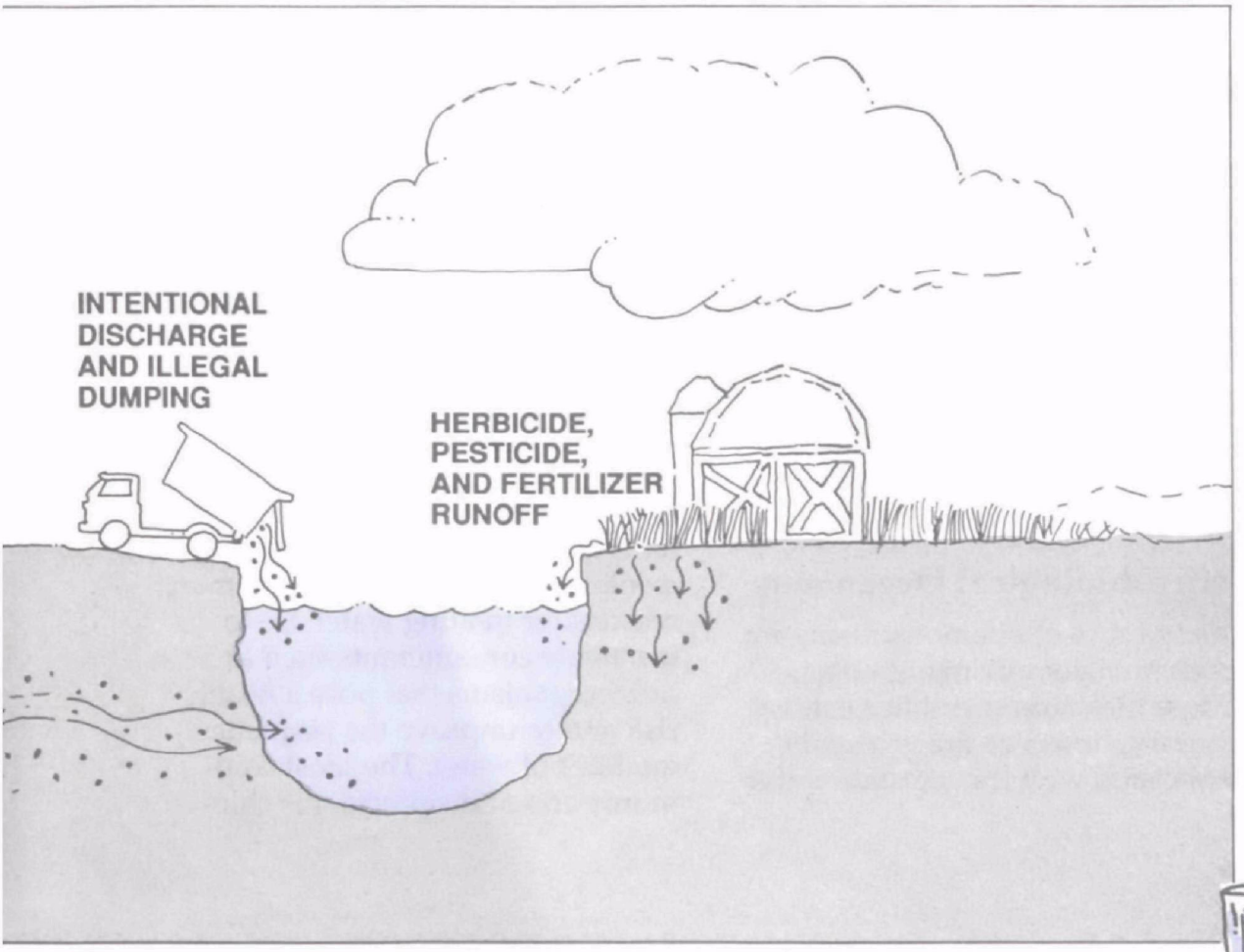
## Minerals Naturally Present in Water

All drinking water sources contain minerals dissolved from the earth. In moderate amounts, some of these minerals are desirable because they enhance the quality of the water (for example, give it a pleasing taste). A few, such as zinc, are beneficial nutrients that contribute to your good health when present in small amounts. Other chemicals, however, are undesirable above a certain level, either because they cause bad taste or odor (such as excess iron, manganese, or sulphur) or because they may be potentially harmful to your health.

## Chemical Pollutants

Water supplies can contain a variety of chemicals that may pose a health risk. These contaminants are usually the result of human activity (Fig. 2). Most effects of the chemicals on human health are associated with long-term, or chronic, exposure rather than short-term exposure. Some possible sources of surface water or groundwater contamination include:

- Leakage from waste disposal, treatment, or storage sites
- Discharges from factories, industrial sites, or sewage treatment facilities



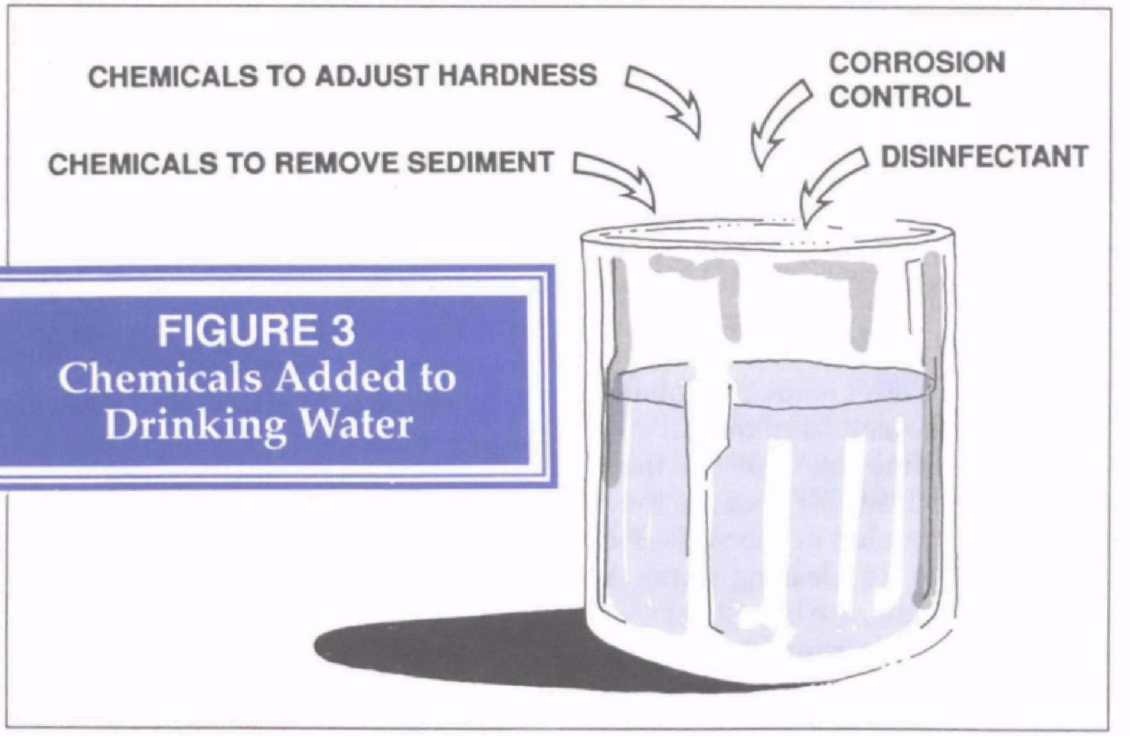



**FIGURE 3**
**Chemicals Added to Drinking Water**

- Leaching and runoff from aerial or land application of pesticides and fertilizers on yards or fields
- Accidental spills of chemicals
- Leaching in the water distribution system (e.g., lead from pipes or solder in copper service connections)
- Illegal dumping of chemical/industrial wastes
- Leakage from underground storage tanks
- Geologic formations or soils naturally high in certain minerals/chemicals

## Microbiological Organisms

Many types of microorganisms are present in your drinking water. Those that cause a public health concern, however, are primarily associated with the intestine — for example, certain kinds of bacteria, viruses, or parasitic protozoans. These organisms enter public water supplies when the source water is contaminated with human or animal wastes. It's also possible for these organisms to enter the water distribution system through faulty cross-connections with wastewater piping. The most common health effects you might experience from this type of contamination are gastrointestinal disorders (for example, cramps and diarrhea).

## Chemicals Intentionally Added to Water

Certain chemicals such as disinfectants are intentionally added to drinking water (Fig. 3). The primary reasons for treating water are to inactivate contaminants such as microorganisms that pose a health risk and to improve the aesthetic qualities of water. The most commonly added disinfectant is chlo-

rine, which is used to kill infectious organisms such as bacteria and viruses. Disinfection with chlorine or a similar chemical is essential to prevent the outbreak of diseases such as giardiasis, salmonellosis, or dysentery.

Treating surface waters usually involves the following steps: disinfection, coagulation (adding chemicals to enhance removal of dissolved and suspended solids), flocculation (gentle stirring to clump particles), sedimentation (gravitational settling of heavier particles), filtration (separating out lighter particles), and then a second disinfection step to inhibit microbial regrowth in the distribution system (Fig. 4). For groundwater supplies, some systems may include a disinfection step, but most treatment is primarily for taste and odor control.

Other chemicals besides those used for disinfection or sediment removal are sometimes added to water. These are used to adjust the hardness (which determines how easily you can wash off soap lather) or to control the corrosive action of water on household pipes and plumbing fixtures. The levels of these chemicals improve the water quality and are not considered harmful to health.

# WHAT LEVELS OF THESE CONTAMINANTS ARE CAUSE FOR CONCERN?

## Experimental Studies for Identifying Levels of Concern

Information on the toxicity of contaminants usually comes from experimental studies with laboratory animals (Fig. 5). Sometimes information is also available from observations of humans who have been exposed to the chemical, either accidentally or in the workplace. Scientists use these studies to determine the amount of a chemical that can cause an undesirable health effect, as well as the amount that does not. From these data, they calculate the highest level of that contaminant that is acceptable in your drinking water. These levels are set to protect health and include a margin of safety.

## Identifying Contaminants of Concern

The types of contaminants found in your water depend on:

- Your geographic location
- The source of your water
- The treatment your water receives
- The effectiveness of that treatment
- The plumbing materials in your home (as a source of lead)

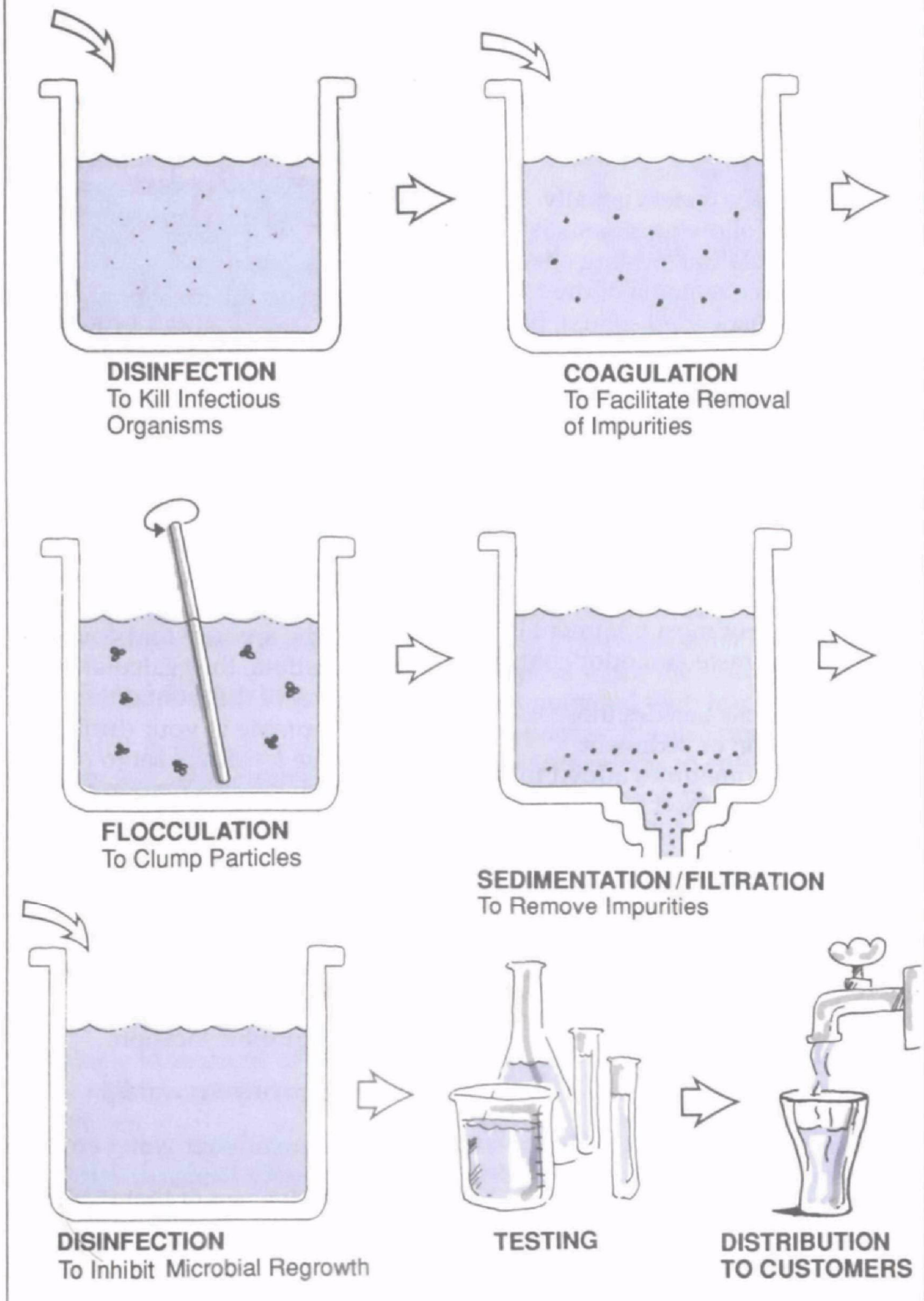



**FIGURE 4**
**Typical Steps in Drinking Water Treatment**

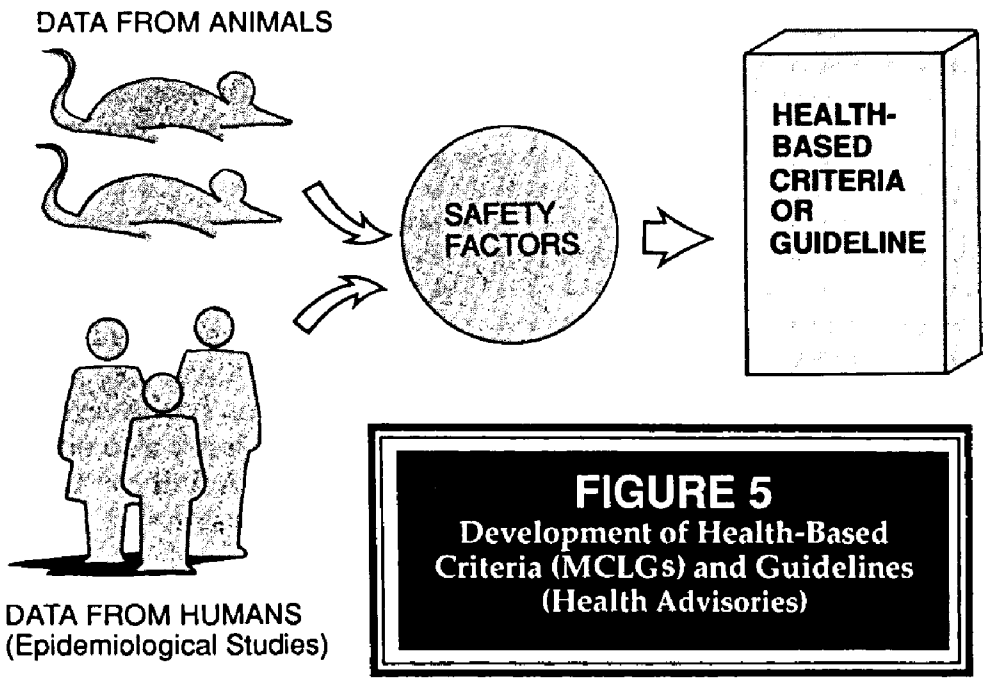



**FIGURE 5**
Development of Health-Based Criteria (MCLGs) and Guidelines (Health Advisories)

Just because a contaminant is in your water, however, does not mean you will experience adverse health effects. That depends on the following factors:

- The nature of the contaminant — some are not hazardous even at high concentrations while others cause problems at much lower levels; also interaction between chemicals can alter the risk posed by a single chemical
- The level of the contaminant — many contaminants are found in water at levels far below the concentration that would cause any harm
- Your susceptibility
- How long you may have been exposed to contaminated water (for example, days, months, or years)

## WHO ENSURES THAT MY DRINKING WATER SUPPLY IS SAFE?

### Laws and Guidelines Set by the Federal Government

The states are working with EPA to implement the Safe Drinking Water Act, which was amended in 1986 to cover an even wider range of contaminants. EPA sets the acceptable standards for contaminants in drinking water, and in most cases, the states have the primary responsibility for enforcing those standards or guidelines. States may set standards for contaminants at levels more stringent than those set by EPA. In addition, states may regulate chemicals that are not regulated by the federal government.

Contaminant levels established by EPA include (Fig. 6):

- *Maximum Contaminant Level Goals (MCLGs).* The MCLGs are non-enforceable health goals that serve as the basis for the enforceable standards. MCLGs are aspirational goals based solely on an evaluation of possible health risks and exposure and provide a margin for public safety. For chemicals that may cause cancer in humans, such as benzene, the goal is zero.

- *Maximum Contaminant Levels (MCLs).* These levels are legally enforceable standards that apply to public drinking water supplies. They are set as close to the MCLGs as feasible, taking into account available analytical methods of detection and water treatment capabilities as well as the cost of achieving various concentration levels of contaminants.

- *Health Advisories (HAs).* Health Advisories are nonenforceable and provide guidance to public health officials for unregulated contaminants that may be found in drinking water. HAs list concentrations of contaminants that would be acceptable for exposures of varying duration (one day, ten days, longer-term, or lifetime). The One-Day and Ten-Day Health Advisories are primarily intended to help public health officials evaluate the magnitude of a public health risk resulting from an accidental chemical spill or an emergency contamination situation. The Longer-term and Life time Health Advisories provide guidance for persistent water contamination situations. The Lifetime Health Advisory is derived in the same way as the MCLG.

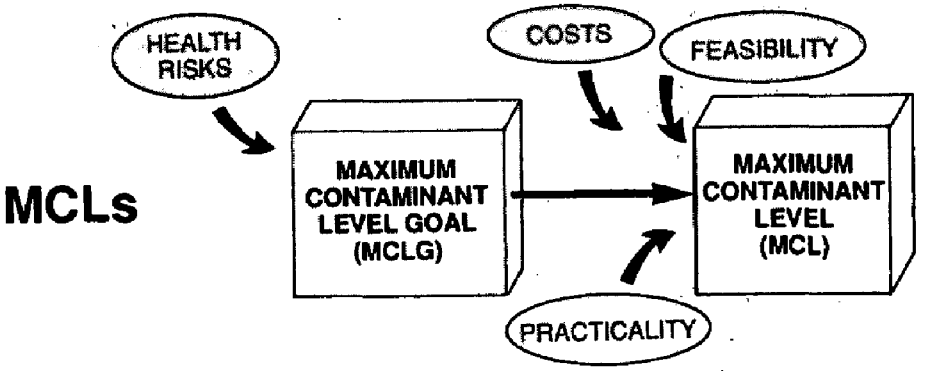
- *Secondary Maximum Contaminant Levels (SMCLs).* SMCLs identify the levels at which taste, odor, or staining from chemicals in water may become undesirable. They are not based on health risks. These standards are also not enforced by EPA, but can be enforced by the states.

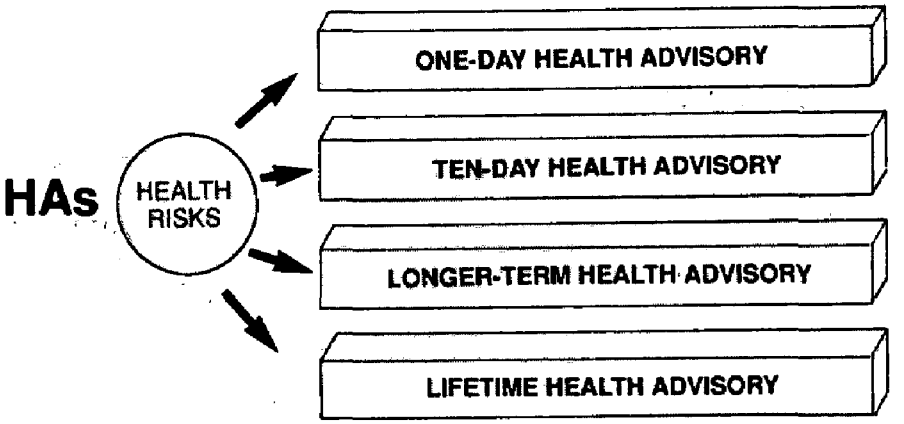
- Individual states can also establish additional guidelines (such as groundwater standards) that are enforceable.

The regulations and Health Advisories are conservative estimates that provide a margin of safety designed to protect even the most sensitive members of the population. EPA and the states are continually developing and revising the standards or guidelines for contaminants of possible concern in drinking water. The values established are based on the best scientific information available at the time. To obtain a list of standards and Health Advisories see details on page 14.

## Cooperation of EPA, States, and Water Suppliers to Meet the Regulations

Water supplied to you by public water systems must meet all the regulations established by EPA and your individual state. Typical SDWA State programs require water suppliers to take the following steps:



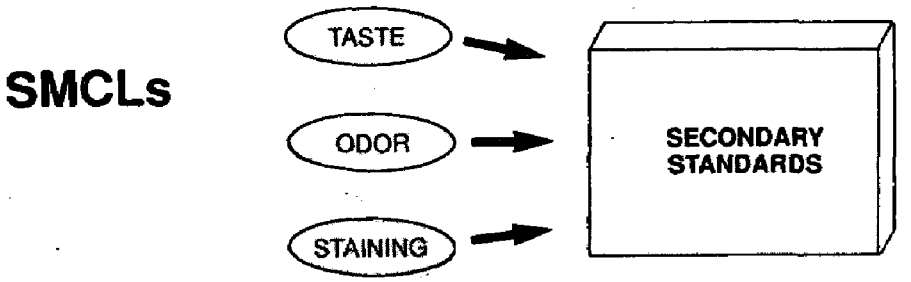




**FIGURE 6**
Drinking Water Contaminant Levels Set by EPA and Factors Influencing Their Derivation

- Regularly test water in drinking water supplies for the presence of contaminants that could cause negative health effects
- Maintain records of microbiological and chemical test results
- Compare contaminant concentrations to MCLs
- Notify the public through the news media or a statement in your water bill of any chemical concentration that exceeds the MCL and indicate the health significance of the violation

The test records maintained by the water suppliers are public information. This protocol is designed to help your state actively protect the quality of your drinking water.

# HOW CAN I CHECK ON MY OWN DRINKING WATER SUPPLY?

## Gather More Information

Your water supplier, state health official, regional EPA office, or state agency responsible for regulating water should be able to answer the following questions:

- Does my water contain measurable levels of any pollutants of possible health concern?
- Do the levels of the chemicals present in my water meet all existing federal and state regulations and guidelines? Can I receive a copy of recent test results for last year or the previous few years?
- How often have requirements not been met, and what is being done to solve any problems? Has a variance or exemption been issued?

If your water is supplied by a utility, you can gather a lot of information before you decide to test your water. On the other hand, if your water is supplied by a private well, you'll be able to gather less information, and testing may be the only way to determine your water's quality.

Before you have your water tested, ask local experts — water treatment plant officials, the planning or zoning board, and state and local health and environmental agencies — for advice concerning which contaminants should be evaluated. The potential source of contamination may help identify which contaminants to test for.

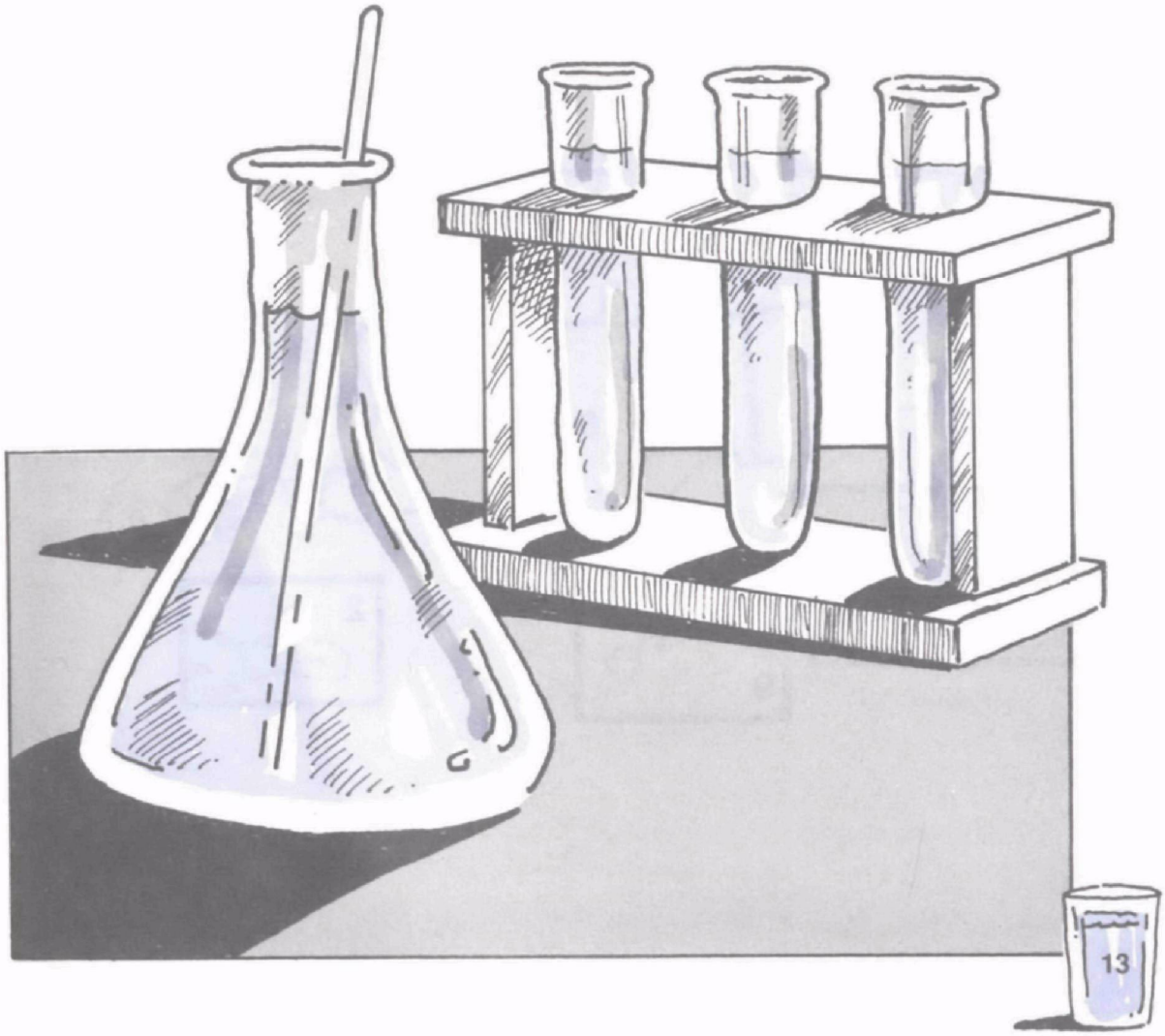
Private wells may be especially susceptible to certain types of contamination. If you use a septic tank to treat your wastewater, a malfunctioning system can contaminate your well. Also, if you dispose of hazardous household substances (such as pesticides or paints) down your drain, your septic tank can malfunction and contaminate your well. In rural areas, seepage and runoff of fertilizers and pesticides can also contaminate private wells.

## Test Your Water

Choose an EPA-certified independent lab, and be sure to follow the sampling and preservation techniques the lab recommends for taking water samples. If the samples are not collected, stored, and analyzed correctly, the results may be misleading. For lab recommendations and cost estimates, contact your local, county, or state public health department or your state agency responsible for regulating the quality of drinking water.

## Interpret the Results of Your Test

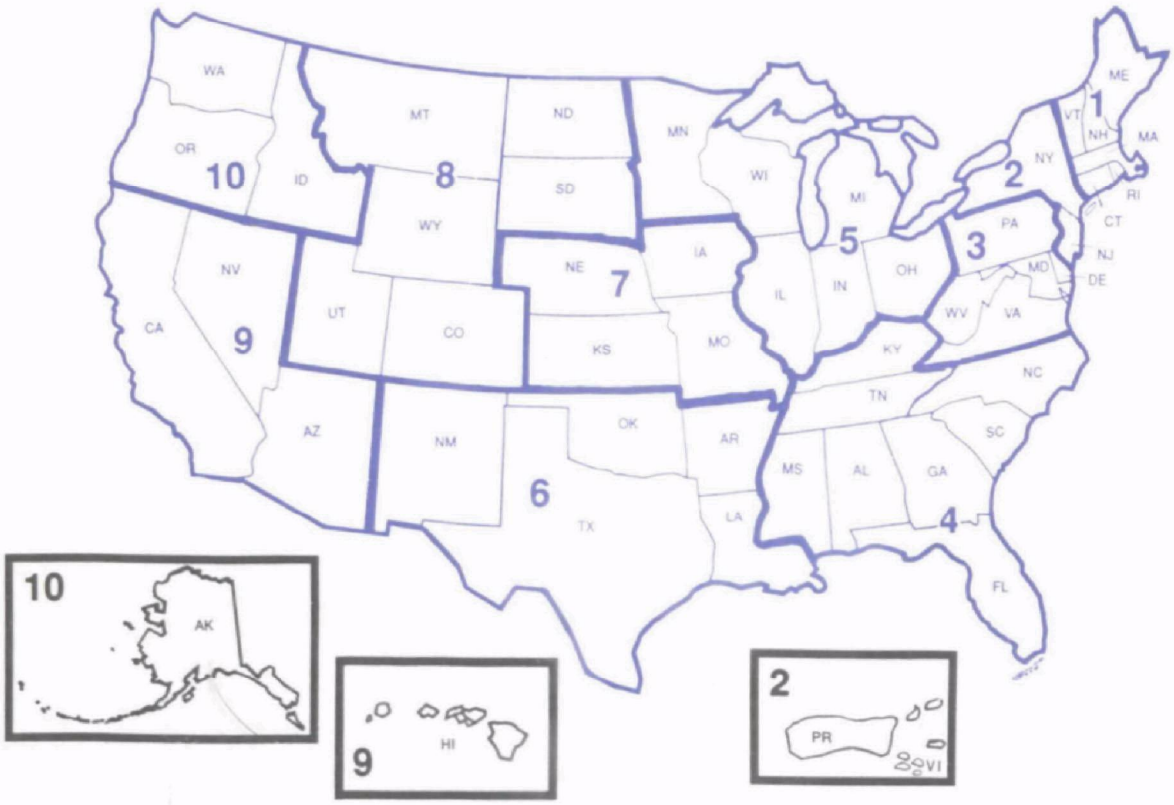
Contact your water supplier, the agency in your state that regulates drinking water, or EPA for assistance in interpreting the results of tests on your water supply. These agencies will compare the concentrations reported in your test with appropriate MCLs, HAs, or state guidance levels.



## HOW CAN I GET MORE INFORMATION?

You can get more information about the quality of your drinking water from your local water supplier, your state health department, the agency in your state responsible for drinking water, or your regional EPA office. The phone numbers of the EPA regional offices are provided on the next page. You can also call the EPA Safe Drinking Water Hotline with this toll-free number: 1-800-426-4791 Monday-Friday 8:30-4:30. For the Washington Metropolitan area and Alaska, call (202) 382-5533. To obtain the name of your state agency and the list of standards and Health Advisories, you can also call the SDWA Hotline.

### EPA REGIONS



## U.S. EPA Region 1
*Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont*
John F. Kennedy Federal Building
Room 2203
Boston, MA 02203
(617) 565-3610

## U.S EPA Region 2
*New Jersey, New York, Puerto Rico, Virgin Islands*
26 Federal Plaza Room 900
New York, NY 10278
(212) 264-1800

## U.S. EPA Region 3
*Delaware, District of Columbia, Maryland, Pennsylvania, West Virginia, Virginia*
841 Chestnut Street
Philadelphia, PA 19107
(215) 597-8227

## U.S. EPA Region 4
*Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee*
345 Courtland Street NE
Atlanta, GA 30365
(404) 347-2913

## U.S. EPA Region 5
*Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin*
230 South Dearborn Street
Chicago, IL·60604
(312) 886-0245

## U.S. EPA Region 6
*Arkansas, Louisiana, New Mexico, Oklahoma, Texas*
1201 Elm Street
Dallas, TX 75270
(214) 655-7160

## U.S. EPA Region 7
*Iowa, Kansas, Missouri, Nebraska*
726 Minnesota Avenue
Kansas City, KS 77101
(913) 551-7032

## U.S. EPA Region 8
*Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming*
One Denver Place-Suite 1300
999 18th Street
Denver, CO 80202-2413
(303) 293-1430

## U.S. EPA Region 9
*Arizona, California, Hawaii, Nevada*
1235 Mission Street
San Francisco, CA 94103
(415) 705-2111

## U.S. EPA Region 10
*Alaska, Idaho, Washington, Oregon*
1200 Sixth Avenue
Seattle, WA 98101
(206) 442-1631

| EPA Region | Phone Number | EPA Region | Phone Number |
|---|---|---|---|
| 1 | (617) 565-3610 | 6 | (214) 655-7160 |
| 2 | (212) 264-1800 | 7 | (913) 551-7032 |
| 3 | (215) 597-8227 | 8 | (303) 293-1430 |
| 4 | (404) 347-2913 | 9 | (415) 705-2111 |
| 5 | (312) 886-0245 | 10 | (206) 442-1631 |

| State | Region | State | Region |
|---|---|---|---|
| Alabama | 4 | Nevada | 9 |
| Alaska | 10 | New Hampshire | 1 |
| Arizona | 9 | New Jersey | 2 |
| Arkansas | 6 | New Mexico | 6 |
| California | 9 | New York | 2 |
| Colorado | 8 | North Carolina | 4 |
| Connecticut | 1 | North Dakota | 8 |
| Delaware | 3 | Ohio | 5 |
| District of Columbia | 3 | Oklahoma | 6 |
| Florida | 4 | Oregon | 10 |
| Georgia | 4 | Pennsylvania | 3 |
| Hawaii | 9 | Rhode Island | 1 |
| Idaho | 10 | South Carolina | 4 |
| Illinois | 5 | South Dakota | 8 |
| Indiana | 5 | Tennessee | 4 |
| Iowa | 7 | Texas | 6 |
| Kansas | 7 | Utah | 8 |
| Kentucky | 4 | Vermont | 1 |
| Louisiana | 6 | Virginia | 3 |
| Maine | 1 | Washington | 10 |
| Maryland | 3 | West Virginia | 3 |
| Massachusetts | 1 | Wisconsin | 5 |
| Michigan | 5 | Wyoming | 8 |
| Minnesota | 5 | American Samoa | 9 |
| Mississippi | 4 | Guam | 9 |
| Missouri | 7 | Puerto Rico | 2 |
| Montana | 8 | Virgin Islands | 2 |
| Nebraska | 7 | | |