CONSUMER EDUCATION GUIDE

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THE Regulation Of Drinking Water

UNDER THE SAFE DRINKING WATER ACT

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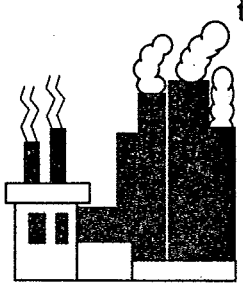
Office of Drinking Water
401 M Street, SW
Washington, DC 20460

Historical Perspective

The transmission of certain infectious diseases through drinking water has been a recognized public health problem since before the turn of the century. An influx of workers to the cities during the Industrial Revolution coupled with unsanitary practices (i.e., disposing of animal and human wastes in streets, etc.) led to contamination of drinking water supplies by microbiological organisms. The presence of these organisms in water led to the frequent transmission of diseases, including such serious illnesses as cholera and typhoid fever.



Chlorine was introduced as a disinfectant of water supplies in the United States in 1908. The subsequent widespread use of this disinfectant has resulted in dramatic decreases in the number of reported waterborne disease outbreaks and individual cases of illness. The number of deaths attributed to typhoid fever and cholera dropped to virtually zero in the U.S. by the mid-20th century.

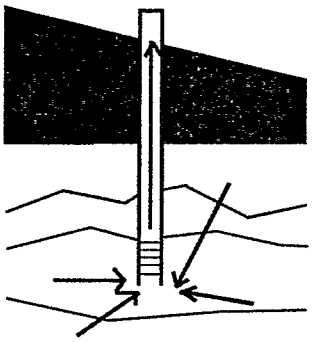
The potential adverse health effects of chemical agents in drinking water have also been recognized throughout this century. U.S. Public Health Service standards, first established in 1914, were initiated to maintain biological integrity of drinking water and were associated with certain diseases. In the ensuing decades, however, the recognition of hazards from other microbiological organisms and from natural and man-made chemical contaminants in drinking water grew and led to a number of revisions to the public health standards. Earlier standards focused on the presence of inorganic metals and minerals such as lead and arsenic. These substances were recognized at that time primarily for their short-term (acute) toxic and lethal effects.

Today, public water supplies are regulated under the Safe Drinking Water Act (SDWA) which was passed by Congress in 1974 and amended in 1986.

Sources of Drinking Water

Drinking water originates as either groundwater or surface water. Surface waters include rivers, streams, lakes, and reservoirs, while groundwater generally comes from aquifers and springs. Aquifers are underground, water bearing formations of sand, gravel, limestone or other porous material. Typically, wells are drilled to tap underground aquifers. Aquifers are generally recharged by the percolation of rainwater and snow through soils and may recharge surface water sources.

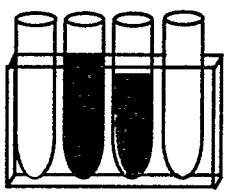
Well



Treatment of drinking water varies depending on the source of the supply. Since surface waters are open to the atmosphere and can be easily contaminated through human and animal use, they require more complicated treatment before being provided for human consumption. In contrast, groundwater provides a relatively clean source of water in relation to bacterial contamination, but may require treatment to remove inorganic or organic chemical contaminants.

Types of Contaminants, Sources, and Health Effects

Over the past two decades, several advances have been made in the ability to detect and measure contaminants present at low levels in air, soil, and water. This, together with advances in the understanding of chemical toxicology, has led to an increased awareness of the health consequences of short-term (acute) and long-term (chronic) exposure to drinking water contaminants. Cancer-causing substances in particular have received a high degree of attention because of the assumption that there is no threshold limit below which a cancer-causing substance does not pose some risk, however small.

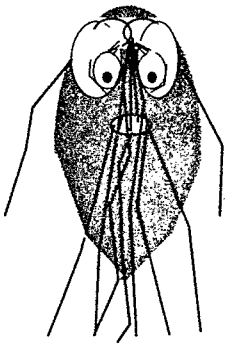


The agents responsible for the contamination of drinking water in the United States include both microbiological organisms and chemical substances. A description of these agents and their potential health effects is provided below.

Microbiological Organisms

Microbiological contamination of drinking water was an important concern in the early part of this century. Although a number of diseases no longer present a serious health hazard, concern has recently focused on two diseases, giardiasis and cryptosporidiosis, which are caused by small parasitic organisms. Due to the small size of these organisms and their resistence to disinfection, they are able to survive conventional water treatment practices. Due to these concerns, the EPA is requiring water utilities to install more stringent treatment methods which will remove these disease causing agents.

Giardia



Microbiological organisms that can cause and spread disease through water include bacteria, viruses, and parasites. These microorganisms are principally "enteric" (i.e. associated with the intestine) and are transmitted by human and animal fecal material which contaminate the source water or, in some cases, enter the distribution system through faulty piping. At present, the most common illnesses due to microbiological contamination of drinking water are acute (short-term) disorders resulting in cramps and diarrhea that range from mild to very severe. Other diseases associated with these microorganisms include dysentery, hepatitis, typhoid fever, and cholera although drinking water is rarely a carrier for these diseases today. Giardiasis and cryptosporidiosis have, however, been recently associated with several waterborne disease outbreaks.

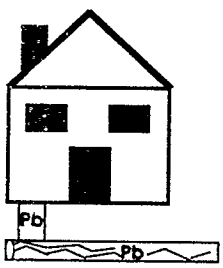
Chemical Substances

Nitrate
TCE
Iron
Radon
THMs

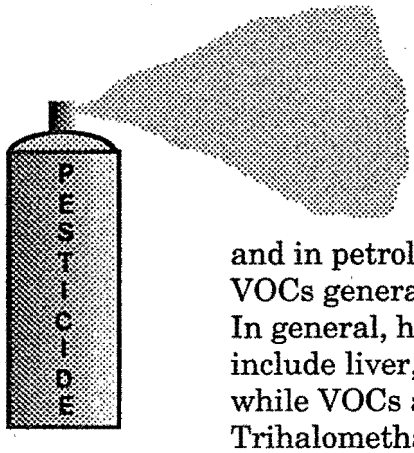
The chemicals that have been found in drinking water cover a wide spectrum of both naturally occurring and man-made substances. Naturally occurring contaminants are primarily metals and minerals which are present in water of certain geologic formations. Some of the naturally occurring contaminants, such as radon gas, are radioactive elements. Man-made chemicals that have been found in drinking water include both organic (containing carbon) and inorganic substances used as industrial, commercial, and agricultural products. Contamination of groundwater by certain solvents and degreasing agents was well-documented in the 1970s and 1980s. More recently, research has revealed the presence of a number of pesticides and herbicides in certain water supplies as well.

Some chemical contaminants in drinking water have been found to be a product of the water treatment and delivery process itself. In the early 1970s it was discovered that chlorine, used to disinfect water, combines with materials produced from decaying vegetation to form the potentially cancer-causing compounds known as trihalomethanes. Recently, increased attention has been given to the significance of the leaching of lead from pipes and solder in home plumbing and in water distribution systems.

Inorganic chemicals are metals, salts, and other chemical compounds that do not contain carbon. Many inorganic chemicals such as arsenic, fluoride, and nitrate are naturally present in water in certain geographic areas. Other chemicals such as lead may enter the water as a result of leaching from lead pipe and lead-based solder pipe joints found in the water distribution system or more commonly, home plumbing. Still other inorganic chemicals contaminate drinking water supplies through industrial waste and pesticide and fertilizer use. Among the principal health effects associated with these chemicals are liver, kidney, and nervous system disorders and the condition known as methemoglobinemia ("Blue-baby syndrome") which is specifically associated with high nitrate levels.



Organic chemicals include natural or synthetic compounds and disinfection by-products that contain carbon. These chemicals fall into four main categories: synthetic organic chemicals (SOCs), volatile organic chemicals (VOCs), polychlorinated biphenyls (PCBs), and disinfection by-products. SOCs are mainly used in the manufacture of pesticides and a wide variety of agricultural and industrial products while VOCs are used as degreasing agents, varnishes, paint thinners, pesticides, and in petroleum products. As their name implies, VOCs generally evaporate at normal temperatures. In general, health effects associated with SOCs include liver, kidney, and nervous system disorders while VOCs and SOCs may be carcinogenic. Trihalomethanes (e.g., chloroform) are a special class of organic chemicals which are produced as by-products of disinfection. These contaminants may also be carcinogenic. PCBs are generally found in electrical transformers and capacitors and have been found to be carcinogenic.

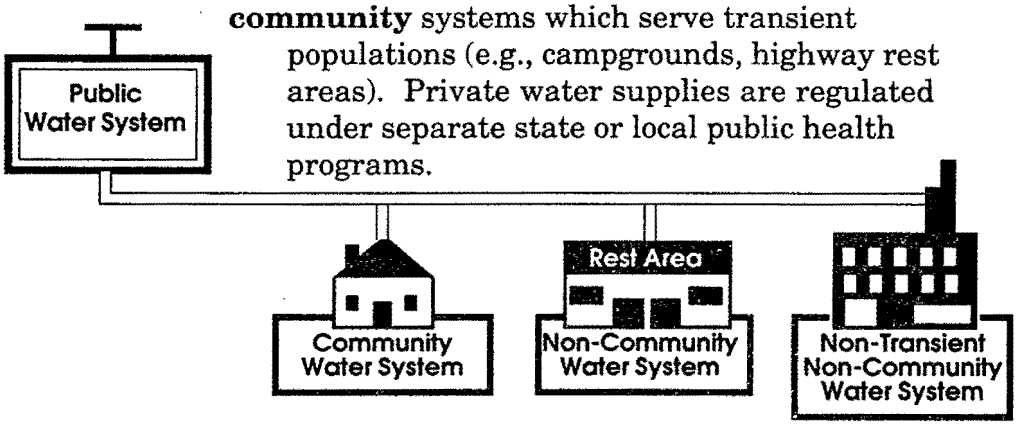


Radiological contaminants, also termed radionuclides, can enter water naturally from some soils, from the leaching of radioactive wastes, or from the mining of phosphorus or uranium. Radionuclides in drinking water may include such elements as radon, radium, and uranium. Drinking water may also become contaminated with radionuclides from man-made sources. These latter sources are typically associated with the improper disposal of nuclear waste. Radionuclides, which continuously breakdown, releasing energy, have the power to damage living cells or tissue. The major health effects associated with inhalation and ingestion of radionuclides is cancer.

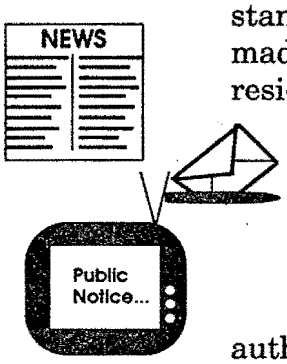
How Drinking Water Supplies are Regulated

Congress enacted the Safe Drinking Water Act (SDWA) in 1974 with the goal to provide safe drinking water to all persons served by public water supplies (water systems serving 25 or more persons on a regular basis or a system with 15 or more service connections). This Act gave the U.S. Environmental Protection Agency (EPA) authority to develop a uniform national drinking water protection program and establish national standards (acceptable or "safe" levels) for known or suspected drinking water contaminants. Between 1974 and 1986, EPA developed approximately 20 standards. Partly in response to the growing awareness of further potential threats to drinking water, Congress amended the SDWA in 1986 and called for EPA to establish standards for 83 contaminants by 1989. In addition, 25 more contaminants must be regulated at three year intervals, beginning in 1991. It is the responsibility of the states to ensure that public water supplies test for these contaminants on a regular basis and that the levels meet the required standards.

Public water supplies fall under three major categories: **community** water supplies which serve the same population on a year round basis (e.g., cities, villages, mobile home parks), **non-transient non-community** systems which supply water to the same individuals at least six months of the year (e.g., day care centers, schools, factories), and **non-community** systems which serve transient populations (e.g., campgrounds, highway rest areas). Private water supplies are regulated under separate state or local public health programs.



To establish standards, the EPA determines both a maximum contaminant level goal (MCLG) based on health data and an enforceable maximum contaminant level (MCL). In some cases, the EPA establishes a treatment technique for a particular contaminant if an MCL is not feasible. Public water supplies are required to test for these drinking water contaminants on a regular basis based on the public water supply classification (e.g., community) and the source of drinking water (i.e., surface water or groundwater) and must meet MCL or treatment technique requirements.



Public water supplies are required by law to notify the public whenever they fail to test for a required contaminant or when a drinking water standard has been exceeded. This notification may be made by: newspaper, radio or TV, hand-delivery to all residents, mailing in monthly or quarterly utility bills, or by posting in specified locations. The method of public notification is dependent on the type and severity of the violation and type of public water supply.

The federal government and the states are also authorized to initiate enforcement action against public water supplies which violate requirements of the SDWA. The primary goal of enforcement is to bring systems into compliance with the SDWA and to ensure future compliance.

Although, in general, consumers can now drink water from a public water supply tap with little fear of acute chemical poisoning or the serious infectious diseases common a century ago, there are still important health challenges that must be met with respect to our nation's drinking water.

Facts the Consumer Should Know

None of the contaminants found in drinking water supplies are pervasive. Whether they are in your water depends on geographic location, the source of water, the treatment it receives, the effectiveness of the treatment, and, in the case of lead, may depend on the type of plumbing materials in your home, the components of your water utility distribution system, and the nature of the water being delivered.

Health risks are dependent on a number of factors including the nature of the contaminant, the level of the contaminant in drinking water, the susceptibility of the person consuming the water, and the period (i.e., days, months, years) over which a person drinks water from the same supply. In general, EPA regulates drinking water contaminants which may cause cancer based on a risk of 1 in 10,000 to 1 in 1,000,000. A risk of 1 in 1,000,000 for a lifetime indicates that one person in every 1,000,000 people exposed to the causative contaminant can be expected to contract a specified disease.

All consumers of water provided by public water supplies should be aware of the source, quality, monitoring requirements, and violations associated with their water supply. Consumers should contact their state public health or environmental office, or their local water utility for this information.

In general, persons served by public water supplies do not require point-of-use (single tap) or point-of-entry (whole house) treatment devices such as carbon or reverse osmosis units in their homes since the water has already been treated at the water plant. Generally speaking, no single home treatment unit is effective against all possible

contaminants. Moreover, *the treatment unit itself* must be properly maintained to remain effective. If consumers are interested in home treatment units they should first find out about the quality of their water to determine if such units are necessary, then research the units thoroughly. Information regarding water treatment units is provided by the National Sanitation Foundation (Ann Arbor, MI) and the Water Quality Association (Lisle, IL).

Consumers should also be aware that bottled water is not necessarily better than water provided by public water supplies. Some bottled waters are disinfected spring water, while others may simply be water collected from a public water supply and treated with ozone to remove chlorine taste and odor. While bottled water may be necessary in some circumstances, it is important for the consumer to research the source and quality of the bottled water to determine if it is better than the water already being provided by the public water supply.

A number of useful pamphlets and documents have been prepared by the EPA and several consumer action groups. Please see the end of this pamphlet for pertinent telephone numbers.

Summary

Even though the vast majority of drinking water systems provide a safe supply of drinking water, EPA and states have taken great strides in passing laws and regulations designed to protect consumers from potential drinking water contaminants. Today, laws exist to regulate organic, inorganic, and radionuclide contaminants as well as microbiological and parasitic organisms. Surface water systems are required to filter and disinfect their water and soon groundwater systems will be required to disinfect. All these laws are designed to protect the consumer.

Public health officials should not, however, be complacent in their regulation of drinking water. It must be recognized by all parties, that water is a precious commodity and that its protection requires diligence, commitment, and a willingness by consumers to pay the full costs of a safe, potable water supply.

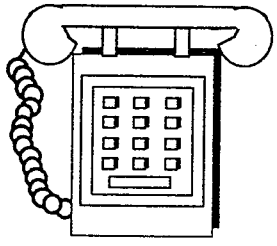
For More Information

American Water Works Association
(Water utility information) (303) 794-7711

Association of State Drinking Water Administrators (State drinking water information, consumer education guides) (703) 524-2428

EPA Safe Drinking Water Hotline
(Publications on lead, pesticides, radon, etc.) (800) 426-4791

International Bottled Water Association
(Bottled water information) (703) 683-5213



Local Water Utilities
(Water quality information) Local Directory

National Rural Water Association
(Small water utility information) (405) 252-0629

National Sanitation Foundation
(Water Treatment units, bottled water information) (313) 769-8010

State Drinking Water Programs
(Water quality information) Local Directory

State or Local Health Departments
(Water quality information) Local Directory

Water Quality Association
(Water treatment units) (708) 505-0160