市政与环境工程系列丛书

English on Municipal Engineering

市政工程专业英语

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内 容 提 要

本书介绍了水处理和水资源方面的专业英语 29 篇，每篇又分为 2 部分，内容包括：水资源、水质、水质管理、给水处理技术、地表水污染、地下水污染、污水收集、污水处理传质理论、污水处理技术及微生物学等，信息量大，可读性强，使学生在提高英语能力和熟悉专业词汇的同时，又提高了专业技能。

本书可作为高等学校给水排水专业、水文水资源专业和环境工程专业本、专科生专业英语教材或课外专业英语阅读材料，也可为从事相关专业的工程技术人员获取相关的科技信息提供参考。

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前　言

随着我国对外交往国际化进程的加快，涌现了大量国外的技术信息，通过专业外语针对性的学习，可以在较短的时间内，提高学生科技文体阅读技巧与应用英语的能力，了解国外技术发展动态。基于以上考虑，我们编写了市政工程专业英语教材，以期学生能够提高英语阅读能力和了解更多、更广的专业知识。

本书分为两部分，第一部分为水资源、水质和给水处理技术，主要包括水资源、水质、水质管理、供水及常用的给水处理技术等；第二部分为水污染与污水处理技术，主要包括地表水污染、地下水污染、污水收集、污水处理传质理论、污水处理技术及微生物学基础等。本书的特点是：(1)选材广泛，均为专业中所涉及到的最新内容和最常用的资料及数据；(2)难易适中，所选文体均经过处理，并能适应在校大学生实际英语水平；(3)专业性强，所选文体专业学术水平高，在安排文献章节时参照了专业课“水质科学与工程”的有关内容，可以使学生较早地了解专业知识；(4)信息量大，全书共 29 篇，每篇均有 2 部分阅读材料，可以使学生通过阅读获取与专业相关的科技信息。

本书由哈尔滨工业大学陈志强和温沁雪主编，赵庆良教授主审。感谢 2000、2001 级给排水专业部分同学在本书的编写中收集了大量的资料，感谢哈尔滨工业大学吕炳南教授、任南琪教授对我们的支持，感谢刘冬梅、荣宏伟、于忠臣等参与本书的编写、修改工作。在本书的编写过程中，参考了大量的 Internet 上的资源及相关参考书，在此对其作者表示衷心感谢。由于编者水平所限，疏漏及不妥之处在所难免，敬请读者批评指正，使本书在使用的过程中不断得到改进。

编　者

2003 年 12 月

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PART ONE

Unit 1　Hydrologic Cycle

Water is the source of all life on earth. The distribution of water, however, is quite varied, many locations have plenty of it while others have very little. Water exists on earth as a solid (ice), liquid or gas (water vapor). Oceans, rivers, clouds, and rain, all of which contain water, are in a frequent state of change (surface water evaporates, cloud water precipitates, rainfall infiltrates the ground, etc.). However, the total amount of the earth's water does not change. The circulation and conservation of earth's water is called the "hydrologic cycle". The hydrologic cycle module has been organized into the following sections (see Fig. 1.1).

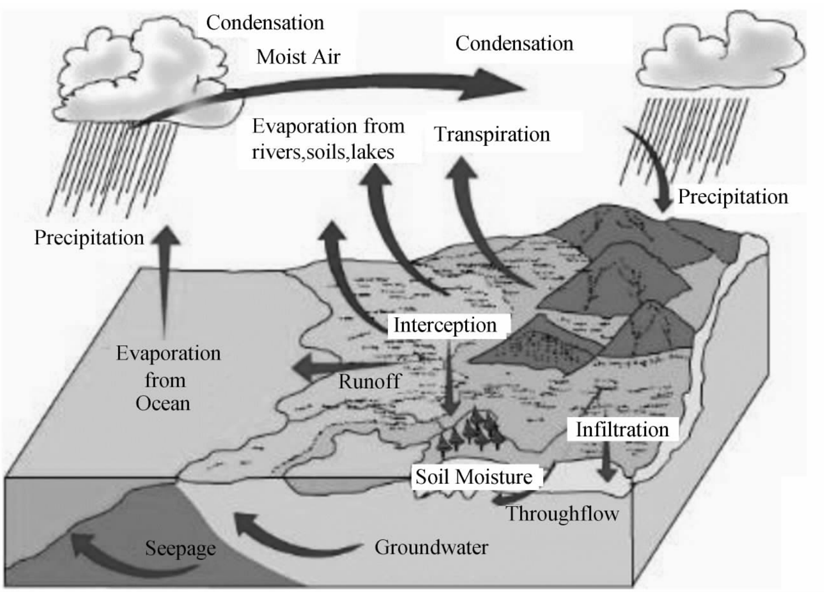

Fig. 1.1　The hydrologic cycle

The Earth's Water Budget

Water covers 70 percent of the earth's surface, but it is difficult to comprehend the total amount of water when we only see a small portion of it. The oceans contain 97.5 percent of the earth's water, land 2.4 percent, and the atmosphere holds less than 0.001 percent, which may seem surprising because water plays such an important role in weather. The annual precipitation for the earth is more than 30 times the atmosphere's total capacity to hold water. This fact indicates the rapid recycling of water that must occur between the earth's surface and the atmosphere.

Evaporation

Water is transferred from the surface to the atmosphere through evaporation, the process by which water changes from a liquid to a gas. Approximately 80 percent of all evaporation is from the oceans, with the remaining 20 percent coming from inland water and vegetation. Winds transport the evaporated water around the globe, influencing the humidity of the air throughout the world. Most evaporated water exists as a gas outside of clouds and evaporation is more intense in the presence of warmer temperatures.

Transpiration

Transpiration is the evaporation of water into the atmosphere from the leaves and stems of plants. Plants absorb soilwater through their roots and this water can originate from deep in the soil (For example, corn plants have roots that are 2.5 meters deep, while some desert plants have roots that extend 20 meters into the ground). Plants pump the water up from the soil to deliver nutrients to their leaves. This pumping is driven by the evaporation of water through small pores called "stomates", which are found on the undersides of leaves. Transpiration accounts for approximately 10 percent of all evaporating water.

Condensation

Condensation is the change of water from its gaseous form (water vapor) into liquid water. Condensation generally occurs in the atmosphere when warm air rises, cools and looses its capacity to hold water vapor. As a result, excess water vapor condenses to form cloud droplets. The upward motions that generate clouds can be produced by convection in unstable air, convergence associated with cyclones, lifting of air by fronts and lifting over elevated topography such as mountains.

Transport

In the hydrologic cycle, transport is the movement of water through the atmosphere, specifically from over the oceans to over land. Some of the earth's moisture transport is visible as clouds, which themselves consist of ice crystals and/or tiny water droplets. Clouds are propelled from one place to another by either the jet stream, surface-based circulations like land and sea breezes, or other mechanisms. However, a typical 1 kilometer thick cloud contains only enough water for a millimeter of rainfall, whereas the amount of moisture in the atmosphere is usually 10 ~ 50 times greater.

Most water is transported in the form of water vapor, which is actually the third most abundant gas in the atmosphere. Water vapor may be invisible to us, but not to satellites, which are capable of collecting data about the moisture content of the atmosphere. From this data, visualizations like this water vapor image are generated, providing a visual picture of moisture transport in the atmosphere.

Precipitation

Precipitation is the primary mechanism for transporting water from the atmosphere to the surface of the earth. There are several forms of precipitation, the most common of which for the United States is rain. Other forms of precipitation include: hail, snow, sleet, and freezing rain. A well developed extra - tropical cyclone could be responsible for the generation of any or all of these forms of precipitation. Amounts of precipitation also vary from year to year. In 1988, an intense drought gripped the Midwestern United States, disrupting agriculture because there was not enough rain to sustain crops. Five years later in 1993, the same area was subjected to severe flooding, greatly reducing the annual harvest because there was too much water for crops to grow.

Groundwater

Groundwater is all the water that has penetrated the earth's surface and is found in one of two soil layers. The one nearest the surface is the "zone of aeration", where gaps between soil are filled with both air and water. Below this layer is the "zone of saturation", where the gaps are filled with water. Under special circumstances, groundwater can even flow upward in artesian wells. The flow of groundwater is much slower than runoff, with speeds usually measured in centimeters per day, meters per year, or even centimeters per year.

Runoff

Runoff is the movement of landwater to the oceans, chiefly in the form of rivers, lakes, and streams. Runoff consists of precipitation that neither evaporates, transpires nor penetrates the surface to become groundwater. Even the smallest streams are connected to larger rivers that carry billions of gallons of water into oceans worldwide. Excess runoff can lead to flooding, which occurs when there is too much precipitation.

Summary of the Hydrologic Cycle

The hydrologic cycle begins with the evaporation of water from the surface of the ocean. As moist air is lifted, it cools and water vapor condenses to form clouds. Moisture is transported around the globe until it returns to the surface as precipitation. Once the water reaches the ground, one of two processes may occur: 1) some of the water may evaporate back into the atmosphere or 2) the water may penetrate the surface and become groundwater. Groundwater either seeps its way to into the oceans, rivers, and streams, or is released back into the atmosphere through transpiration. The balance of water that remains on the earth's surface is runoff, which empties into lakes, rivers and streams and is carried back to the oceans, where the cycle begins again.

Vocabulary

hydrologic	水文学的	stomate	气孔，气口
precipitate	沉淀，沉淀物	condensation	冷凝（作用），凝结（作用）
infiltrate	渗入，渗透	covergence	汇聚，聚合，合流
precipitation	降雨（量），降水（量）	front	锋面
evaporation	蒸发（作用）	topography	地形，地势
humidity	湿度，水分含量	breeze	微风
transpiration	蒸发(物)，散发，蒸腾作用	penetrated	渗入，透入，渗透
nutrient	营养物，有营养的	runoff	径流

Reading Material A

The Water Balance

The water balance is an accounting of the inputs and outputs of water. The water balance of a place, whether it is an agricultural field, region, or continent, can be determined by calculating the input and output of water. The geographer C. W. Thornthwaite (1899 ~ 1963) pioneered the water balance approach to water resource analysis. He and his team used the water-balance methodology to assess water needs for irrigation and other water-related issues.

Every water transfer from a physical state to another and from one reservoir to another is known to be accompanied by an energy transfer, hence every water balance is linked with a similar temperature balance. In this page, only mass transfers will be considered.

Each earth system (the whole planet, atmosphere, a continent, an ocean, a region, a watershed) has its own water balance. The water balance of a system is the net gain of water deriving from the difference between the input and the output of water in a given period of time. The water balance can therefore be expressed by the following equation:

$$G = I - O$$

Where G is the net gain of water, I is the input, O is the output. All terms can be expressed as mass per time unit (e.g. tons per day) or volume per time unit (e.g. cubic kilometer per year) or height of water per time unit (e.g. cm of water per year). If G is positive ($I > O$), water accumulates in the system; if G is negative ($I < O$), water is lost from the system.

For a long-term balance or for closed system (e.g. the whole planet) is considered to be equal to 0.

Therefore, $I = O$.

The various processes of the hydrologic cycle are the input and the output terms of the water balance. It should be observed that each of these processes could be an input term for a system and an output term for another. For example, evaporation is an input for the water balance of atmosphere and an output for the water balance of a region; runoff is an output term for continent and an input term for oceans.

Global Water Balance

Considering all the oceans, which are the greatest reservoir of free water, total evaporation from their surface (output of water) is about 455,000 cubic kilometres in a year. At the same time, total evaporation from the soil, plants and water surfaces on continents is about 62,000 cubic kilometres. Therefore, total evaporation from all earth surfaces is 517,000 cubic kilometres. In a year the same amount of water will fall on the earth surface as solid or liquid precipitation (input of water), as water quantity on the earth is considered constant ($G = 0$). Precipitation doesn't occur uniformly on continents and oceans: 108,000 cubic kilometres fall on continent, 409,000 cubic kilometres on ocean surface. From the balance between evaporation and transpiration in each of the these two system (continents and oceans) it results that continents receive by precipitation about 46,000 cubic kilometres more water than by evaporation; this excess, commonly called runoff (down flow), flows on the continent or penetrates the underground reaching the sea in different ways and balancing the negative water budget of oceans (oceans lose about 46,000 cubic kilometres more water than that received by precipitation). This runoff is to be considered also the renewable available water, that the water we can consume yearly without spoiling the continents' water reserves.

The global water balance for continents is given by:

$$G = P - (E + R)$$

Where G is the net gain or loss, P is precipitation, E is evaporation, R is runoff. R is included in the output term.

The global water balance for oceans is given by:

$$G = (P + R) - E$$

Where the runoff is considered an input for the system.

In a long term, G can be considered equal to 0 in both the equations. Therefore,

$P = E + R$, that is to say: $108,000 = 62,000 + 46,000$ for continents;

$P + R = E$, that is to say: $409,000 + 46,000 = 455,000$ for oceans.

For the whole planet, the input sum should be equal to the output sum, so the runoff term is cancelled.

$$108,000 + 409,000 = 62,000 + 455,000 = 517,000$$

Water Balance in the Atmosphere

If we consider an air column, the water balance is determined by the following processes:

1. Water input due to the evaporation (E) from the surface underneath (both solid and liquid) or to plant transpiration in the column itself.

2. Water input or output due to atmospheric motions. The water mass crossing the column may have a bigger or smaller vapour content than the column itself; therefore, it may add or take water from

the column. This is shown by the symbol C that is positive in case of addition and negative in the opposite case.

3. Water output due to precipitation (including frost and dew). The symbol is P and is negative because it diminishes the column water content.

Indicating with G the net gain of water vapour stored in the column of unitary atmosphere, with E the sum of evaporation and plant transpiration, with P precipitation and with C the net release of water due to air movements through the air column, the balance equation is given by:

$$G = E - P - C$$

Assuming a long term balance, the average annual net gain G is zero and therefore

$$E - P - C = O\text{, that is to say: } C = E - P$$

The average net release (input or output) of water vapour due to atmospheric motions is equal to the difference between evaporation and precipitation. It is positive, that is the column air will release water (in order to maintain the balance equal to 0), where evaporation is greater than precipitation. This normally occurs at low latitudes. It is negative, that is the column air will receive water from outside, where evaporation is lower than the precipitation. This normally occurs at high latitudes. These differences in gain or release of water in columns air over the latitude contribute to movement of humid air masses from equator to poles.

Vocabulary

water balance	水量平衡	accumulate	集聚
calculate	计算	region	区域
reservoir	水库,蓄水池	frost	霜,结霜
watershed	流域,水源区	dew	露,结露

Reading Material B

Protecting Water Resources

The availability and quality of water is a key factor in the nation's ability to protect public health, preserve ecological integrity, ensure sufficient agricultural production, and meet commercial needs. Issues impacting our nation's atmospheric water, surface water and groundwater (hereinafter referred to as "waters") must receive priority attention if the nation's public health and ecological and commercial objectives are to be met.

The engineering profession plays a key role in protecting and managing our nation's water resources. Engineers are leaders in developing the methods for ensuring that public health and ecological expectations for the country's water resources are satisfied.

Engineers are also the leading technical professionals in designing the infrastructure for managing water resources in areas such as flood control, water supply, water and wastewater treatment, channel and harbor construction and maintenance, and hydropower development.

Many national laws have been enacted that address water resource quality and management objectives. Among them are laws specifically oriented to water policy, such as the Federal Water Pollution Control Act, the Safe Drinking Water Act, and the Water Resources Development Act. Other federal laws, while not focused solely on water issues, also impact water policy. These include solid and hazardous waste disposal, fish and wildlife protection, and energy laws.

In 1972, Congress passed the Federal Water Pollution Control Act—commonly known as the Clean Water Act (CWA). The CWA is the primary national law for ensuring the "chemical, physical, and biological integrity of the nation's waters." The Act sets forth national goals and objectives and outlines the following activities to meet these goals: directs states to develop water quality standards for intrastate waters; develops effluent guidelines and best available technology (BAT) standards for industrial categories; establishes the National Pollutant Discharge Elimination System (NPDES) permit and enforcement program; establishes national technology-based limitations for municipal and industrial dischargers; regulates the discharge of dredge or fill material into navigable waters, including wetlands; assigns responsibilities to the states for non-point source pollution control; provides water quality-based controls for toxic pollutants; and establishes programs for funding the construction of wastewater treatment facilities.

The Safe Drinking Water Act (SDWA), first passed in 1974, strives to protect the quality of the nation's drinking water and provides limited protection of groundwater resources. The Act requires the following: issuance of BAT standards for tap water contaminants that threaten public health; monitoring and treatment of drinking water to meet federal standards; disinfection and filtration of water provided by public water systems; regulation of the disposal of wastes through underground injection; establishment of wellhead protection areas to protect wells from underground contamination; and establishment of programs for funding the construction of water treatment facilities.

The River and Harbor Act of 1899 and the Water Resources Development Act assign to the U.S. Army Corps of Engineers the responsibility for ensuring the navigability of the nation's rivers and harbors and providing flood protection. The Water Resources Development Act also provides funding for various water resource development projects that meet those objectives as well as for coastal erosion and levee construction projects.

Other national laws affecting our nation's water resources include the Resource Conservation and Recovery Act (RCRA), the Superfund Amendments and Reauthorization Act (SARA), the Coastal Zone Management Act (CZMA), and numerous fish and wildlife protection, federal land management, and energy laws. At present, procedures have been established through professional and occupational licensing laws and voluntary certification programs for ensuring the minimum competency of individuals engaged in water resource assessment, design, and management activities.

Vocabulary

water resource	水资源	discharge	排放(物)
ecological	生态的	dredge	挖掘，疏浚
infrastructure	基础	pollutant	污染物
hydropower	水力发电	disinfection	消毒,灭菌
set forth	宣布,阐明	filtration	过滤

Unit 2 Drinking Water Quality

The federal Safe Drinking Water Act, enacted in 1974 and amended in 1986, 1991, and 1996 is designed to ensure safe drinking water by establishing drinking water standards for treated potable water and by creating special protection for sources of drinking water, including groundwater sources like San Antonio's sole source aquifer.

Under changes made in the 1986 Safe Drinking Water Act amendments, the EPA required all public water systems to monitor for 16 inorganic (non-carbon compounds, such as nitrates, arsenic, fluoride, selenium) and 54 organic (any compound containing carbon) contaminants for which maximum contaminant levels have been established. The EPA currently has such levels in place for 81 contaminants, including total coliform, lead, and copper. In addition, the EPA requires monitoring of other organic chemicals for which levels have not yet established.

In Texas, the EPA has delegated authority for regulating drinking water to the state government. Currently, the state requires water systems to test for 126 chemicals, of which 73 have maximum contaminant levels. In addition, the state requires public water suppliers to test for bacteria and viruses and for secondary contaminants such as iron, manganese, and chloride that do not affect human health but lead to odor or taste problems.

Currently, the EPA has also begun a rule-making process to establish a standard for Cryptosporidium, a pathogen that can sometimes pass through disinfection and water treatment filtration to affect human health. In 1993 an outbreak of cryptosporidiosis—a disease caused by the pathogen—in Milwaukee, Wisconsin, led to 400,000 affected residents, including 4,000 hospitalizations and at least 50 deaths.

As part of the 1996 amendments, Congress, for the first time, funded the drinking water program by providing over $9.6 billion over a six-year period to states for improving drinking water infrastructure through the creation of state revolving funds, similar to the funding for wastewater treatment plants.

In Texas, the Texas Water Development Board is charged with overseeing the fund, which will provide low-interest loans to municipalities, utilities, irrigation districts, and other entities providing water for drinking. In FY 1997, Congress appropriated $740 million for direct and guaranteed loans, and Texas received a total of $71 million under the program. None of the funds can be dispersed without public participation in all aspects of the planning and implementation of the program.

Despite the passage and implementation of the Safe Drinking Water Act, drinking water in the United States and Texas is not always completely safe to drink. For example, in 1994, more than

45 million people in the United States were served by community drinking water systems that violated health-based requirements at least once. In Texas, violations are less common than nationally. According to EPA drinking water standards, Texas had 598 systems in violation, about six percent of all systems, affecting 1,658,406 people, or eight percent of the population, between 1994 and 1996. In 1997 only four percent of the population in Texas was served by public drinking water systems that did not meet health-based standards.

The Texas Natural Resource Conservation Commission implements the Safe Drinking Water Act for the state, and is charged with making sure that different types of public water systems regularly monitor their water supply, assessing the results, and enforcing the rules, including the maximum contaminant levels. In addition, under the 1996 amendments to the Safe Drinking Water Act, all states are required to develop a Source Water Assessment Program in which sources of regulated contaminants that could impact public water supply sources are identified. This assessment program will lead to a publicly accessible database of information on each water source and its actual and potential impacts of contamination sources. Currently, the TNRCC is implementing the program and the EPA is adopting rules. However, the first analysis from this assessment will not be due for several years.

Still, while most Texans get their water from municipal water systems which are afforded these basic protections, other residents of Texas receive their water supply from irrigation districts, individual water wells and increasingly from bottled water. Each of these sources have varying degrees of protection.

Vocabulary

drinking water quality	饮用水水质	lead	铅
potable	可饮用的	copper	铜
aquifer	含水层，蓄水层	manganese	锰
EPA	环保局（署）	cryptosporidium	隐孢子
arsenic	砷	pathogen	病原菌（体）
fluoride	氟化物	TNRCC (Texas Natural Resource Conservation Commission)	德克萨斯州自然资源保护委员会
selenium	硒		
coliform	大肠菌	municipal	市政的

Reading Material A

Existing Deficiencies in Water Supplies

The findings of the U.S. Public Health Service Community Water Supply Study in 1969 were a severe shock to laypersons and professionals alike. Approximately 17 percent of all public water supplies failed to meet one or more of the mandatory quality standards; 25 percent did not meet one or more of the recommended quality standards; more than 50 percent had major deficiencies in supply, storage, or distribution facilities; 90 percent failed to meet the bacteriological standards; and 90 percent had no cross-connection control programs. Conditions were particularly bad in the very small systems. Many were substandard in almost every respect.

The State of Washington, Division of Health, has accumulated some interesting statewide statistics in this regard. The Washington findings are similar to conditions prevailing in other states. It was learned that some 20 to 50 Washington communities, including some of the largest cities, are in need of additional filtration treatment. The exact needs are not known because of uncertainty that has arisen recently about the quality of supplies derived from so-called protected watersheds. The easy public access to any and all areas, including protected watersheds, that has been provided by the advent of all-terrain vehicles, trail bikes, and snowmobiles has made it very difficult or impossible to assure the safety of subsurface water supplies, which have no facilities for filtration treatment. Pending federal regulations that would require filtration of all surface water supplies appear to be a step in the right direction.

The study reported that 55 supplies, including all of the largest cities in the state, have open distribution reservoirs for storage of finished water. In the judgment of the Washington Division of Health, open distribution reservoirs are incompatible with present good public health practice, and they must now be covered under state regulations.

The Washington Division of Health is now requiring all cities to submit a comprehensive water system plan to identify present and ten-year future needs. It is anticipated that one-third of the cities already have most of the necessary data for such a plan; one-third will have a considerable amount of updating to do; and one-third have virtually none of the datas required for advanced planning, and will have to start from scratch. Two of the major unmet planning needs are coordinated planning among neighboring water utilities and minimization of the number of the new systems being constructed.

Statistics compiled by the State of Washington also reveal how little effort is being expended in the surveillance of water supplies by local, state, and federal regulatory agencies, as compared to similar efforts in air and stream pollution control. Expenditures for air pollution control were 10 times that for water supply monitoring and 200 times greater than for stream pollution control. The Washington study concluded that the incidence of disease is no longer an acceptable measure of the adequacy of public water supply systems, and there is a need to make this clear to the public, the press, and even the waterworks industry.

In addition to the deficiencies already mentioned with respect to public health, there are aesthetic considerations that deserve mention because of their importance to the consumer. Many water supplies contain sufficient iron and manganese to cause staining of laundry and plumbing fixtures, or even of building facings within the range of lawn sprinklers. Some waters are too hard to be satisfactory for many uses, or have corrosive or scaling tendencies that adversely affect plumbing in homes or factories. One of the most common complains about water quality concerns taste and odor. Bad-tasting water drives many consumers to other source of drinking water, such as private wells, cisterns, or bottled water. More often than not, such alternate sources of drinking water are of questionable bacteriological quality.

Vocabulary

deficiency	不足，缺陷	aesthetic	美学的
layperson	非专业人士	plumbing	室内管道(系统)
mandatory	强制的	hard	硬的
cross-connection	交叉连接	corrosive	腐蚀的，腐蚀物
bacteriological	细菌学的		

Reading Material B

Quality of Ground Water

For the Nation as a whole, the chemical and biological character of ground water is acceptable for most uses. The quality of ground water in some parts of the country, particularly shallow ground water, is changing as a result of human activities. Ground water is less susceptible to bacterial pollution than surface water because the soil and rocks through which ground water flows screen out most of the bacteria. Bacteria, however, occasionally find their way into ground water, sometimes in dangerously high concentrations. But freedom from bacterial pollution alone does not mean that the water is fit to drink. Many unseen dissolved mineral and organic constituents are present in ground water in various concentrations. Most are harmless or even beneficial; though occurring infrequently, others are harmful, and a few may be highly toxic.

Water is a solvent and dissolves minerals from the rocks with which it comes in contact. Ground water may contain dissolved minerals and gases that give it the tangy taste enjoyed by many people. Without these minerals and gases, the water would taste flat. The most common dissolved mineral substances are sodium, calcium, magnesium, potassium, chloride, bicarbonate, and sulfate. In water chemistry, these substances are called common constituents.

Water typically is not considered desirable for drinking if the quantity of dissolved minerals exceeds 1,000 mg/L (milligrams per liter). Water with a few thousand milligrams per liter of dissolved minerals is classed as slightly saline, but it is sometimes used in areas where less-mineralized water is not available. Water from some wells and springs contains very large concentrations of dissolved minerals and cannot be tolerated by humans and other animals or plants. Many parts of the Nation are underlain at depth by highly saline ground water that has only very limited uses.

Dissolved mineral constituents can be hazardous to animals or plants in large concentrations; for example, too much sodium in the water may be harmful to people who have heart trouble. Boron is a mineral that is good for plants in small amounts, but is toxic to some plants in only slightly larger concentrations.

Water that contains a lot of calcium and magnesium is said to be hard. The hardness of water is expressed in terms of the amount of calcium carbonate—the principal constituent of limestone—or