A Primer on Water Quality

What is in the water?

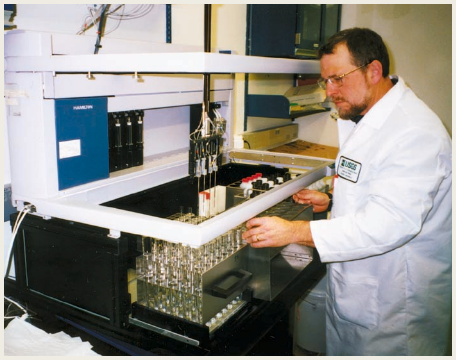
Is it safe for drinking? Can fish and other aquatic life thrive in streams and lakes that are affected by human activities? What is the water quality? To answer these questions, it is helpful to understand what "water quality" means, how it is determined, and the natural processes and human activities that affect water quality.

What do we mean by "water quality"?

Water quality can be thought of as a measure of the suitability of water for a particular use based on selected physical, chemical, and biological characteristics. To determine water quality, scientists first measure and analyze characteristics of the water such as temperature, dissolved mineral content, and number of bacteria. Selected characteristics are then compared to numeric standards and guidelines to decide if the water is suitable for a particular use.

How is water quality measured?

Some aspects of water quality can be determined right in the stream or at the well. These include temperature, acidity (pH), dissolved oxygen, and electrical conductance (an indirect indicator of dissolved minerals in the water). Analyses of individual chemicals generally are done at a laboratory.



Why do we have water-quality standards and guidelines?

Standards and guidelines are established to protect water for designated uses such as drinking, recreation, agricultural irrigation, or protection and maintenance of aquatic life. Standards for drinking-water quality ensure that public drinking-water supplies are as safe as possible. The U.S. Environmental Protection Agency (USEPA) and the States are responsible for establishing the standards for constituents in water that have been shown to pose a risk to human health. Other standards protect aquatic life, including fish, and fish-eating wildlife such as birds.

How do natural processes affect water quality?

Natural water quality varies from place to place, with the seasons, with climate, and with the types of soils and rocks through which water moves. When water from rain or snow moves over the land and through the ground, the water may dissolve minerals in rocks and soil, percolate through organic material such as roots and leaves, and react with algae, bacteria, and other microscopic organisms.

Water may also carry plant debris and sand, silt, and clay to rivers and streams making the water appear "muddy" or ***turbid***. When water evaporates from lakes and streams, dissolved minerals are more concentrated in the water that remains. Each of these natural processes changes the water quality and potentially the water use.

What is naturally in the water?

The most common dissolved substances in water are minerals or salts that, as a group, are referred to as ***dissolved solids***. Dissolved solids include ***common constituents*** such as calcium, sodium, bicarbonate, and chloride; plant ***nutrients*** such as nitrogen and phosphorus; and ***trace elements*** such as selenium, chromium, and arsenic.

In general, the common constituents are not considered harmful to human health, although some constituents can affect the taste, smell, or clarity of water. Plant nutrients and trace elements in water can be harmful to human health and aquatic life if they exceed standards or guidelines.

Dissolved gases such as oxygen and radon are common in natural waters. Adequate oxygen levels in water are a necessity for fish and other aquatic life. Radon gas can be a threat to human health when it exceeds drinking-water standards.

How do human activities affect water quality?

Urban and industrial development, farming, mining, combustion of fossil fuels, stream-channel alteration, animal-feeding operations, and other human activities can change the quality of natural waters. As an example of the effects of human activities on water quality, consider nitrogen and phosphorus fertilizers that are applied to crops and lawns. These plant nutrients can be dissolved easily in rainwater or snowmelt runoff. Excess nutrients carried to streams and lakes encourage abundant growth of algae, which leads to low oxygen in the water and the possibility of fish kills.

Chemicals such as pharmaceutical drugs, dry-cleaning solvents, and gasoline that are used in urban and industrial activities have been found in streams and ground water. After decades of use, pesticides are now widespread in streams and ground water, though they rarely exceed the existing standards and guidelines established to protect human health. Some pesticides have not been used for 20 to 30 years, but they are still detected in fish and streambed sediment at levels that pose a potential risk to human health, aquatic life, and fish-eating wildlife.

There are so many chemicals in use today that determining the risk to human health and aquatic life is a complex task. In addition, mixtures of chemicals typically are found in water, but health-based standards and guidelines have not been established for chemical mixtures.

What about bacteria, viruses, and other pathogens in water?

The quality of water for drinking cannot be assured by chemical analyses alone. The presence of ***bacteria*** in water, which are normally found in the intestinal tracts of humans and animals, signal that disease-causing pathogens may be present. Giardia and cryptosporidium are pathogens that have been found occasionally in public-water supplies and have caused illness in a large number of people in a few locations. Pathogens can enter our water from leaking septic tanks, wastewater-treatment discharge, and animal wastes.

How can I find out more about my water quality?

Contact your local water supplier and ask for information on the water quality in your area. The USEPA requires public-water suppliers to provide water-quality data to the public on an annual basis in an understandable format. State agencies that deal with health, environmental quality, or water resources also can provide information on the quality of your water. Additional resources can be found on the Internet at:
http://water.usgs.gov/nawqa
http://www.epa.gov/safewater

–Gail E. Cordy