

DRINKING WATER TREATMENT

Water is in its purest form the moment it condenses from vapor into a liquid, but it quickly picks up impurities. Rain or snow can pick up dust, smoke, and other particles in the air. Runoff water dissolves minerals and carries small particles of soil. Streams can carry sediment, human-made pollutants and other materials. Once water is used by humans, it picks up even more pollutants and impurities before it is returned to nature. The need for a supply of clean water required water treatment methods to be developed, so that it can be safely used.

Since very early times, people have created ways to remove debris from drinking water to make it look and taste better. Ancient Egyptian inscriptions describe water purification by boiling, exposure to sunlight, charcoal filtration, and settling in an earthen jar. The Chinese were the first to discover the purifying effect of boiling water, and as early as 400 B.C., Hippocrates, the father of medicine, recommended boiling water and straining it through cloth to remove particles.

However, it wasn't until the 1850s that scientists suspected that disease could be spread through water. The rise of microbiology identified a number of diseases that were transmitted by water supplies, and the first attempts were made to disinfect drinking water by using chlorine. Around the turn of the century, Middelkerke, Belgium became the first city to install a permanent chlorine disinfection system. Chlorination was first used in the United States in 1908 to destroy bacteria in drinking water. The widespread use of chlorination wiped out waterborne diseases such as typhoid and cholera.

Obviously, water used for drinking requires more treatment than wastewater, which is returned to a lake or stream. But the two can have an impact on each other. The extent to which drinking water must be treated depends on the quality of the raw water supply, so a community downstream from other cities may find its water quality affected by the wastewater released by those cities.

Drinking water from a well may require little or no treatment before it is used. Water from a lake exposed to recreational activities or sewage contamination may need significant treatment before it can be used as drinking water. The Safe Drinking Water Act requires EPA to establish national drinking water standards and implement source water protection to help ensure water quality.

Conventional water treatment for drinking water consists of the following steps:

*Water is pumped from the water source, such as a lake, river, or reservoir and is strained to keep fish and large objects out of the system.

*Alum or other materials are added to the water to cause the dirt and other particles to coagulate, or clump together and fall to the bottom of settling basins.

*The then-clear water is filtered through layers of sand, charcoal/anthracite, and gravel to remove more impurities.

*Chlorine is added to kill bacteria remaining in the water. Most water systems add fluoride to help prevent tooth decay. Other chemicals (lime or phosphate) may be added to adjust the pH of the water.

*Finally, the treated water is pumped through pipelines to homes and businesses or it is stored for future use. At various points in the process, water is monitored to make sure it meets the

requirements of the Safe Drinking Water Act, which measures some contaminants in concentrations as low as parts per quadrillion.

Public water supply systems in the United States produce more than 34 **billion** gallons of drinking water per day. The United States' more than 60,000 community water supply systems are valued at over \$175 billion. The price in a 1990 survey of water in North America was \$1.66 per 1000 gallons; however, the average price, in 1996, increased to approximately \$2.00 per 1000 gallons.