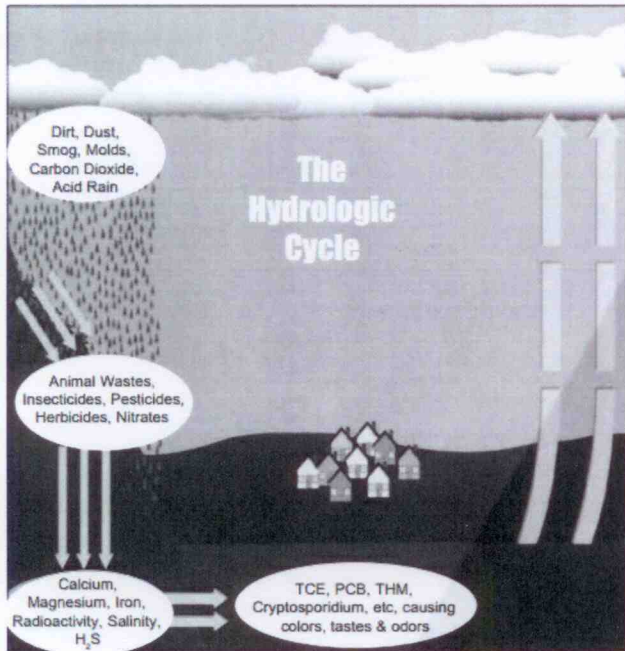


The Hydrologic Cycle



The total area of the earth is composed of 2/3 water, making it one of the most plentiful and most important materials available. Without potable water, mankind cannot survive.

Pure water consists of two parts hydrogen and one part oxygen, chemically combined to form pure water.

The only pure source of water is the earth's atmosphere (sometimes called the hydrological cycle). Impure water from the earth's oceans, lakes, rivers and surface evaporates into the atmosphere, then condenses to form rain droplets which are totally pure. The above process operates basically the same as a man-made still, which evaporates all the impurities from the water, then returns the condensates into pure water. If this process did not exist, there would likely not be enough potable water to support the earth's population.

The pure water vapor, which forms in the earth's atmosphere (clouds), begins to pick up impurities. As it begins to fall to earth in the form of rain, snow, etc., impurities are immediately absorbed. These impurities may be dust, micro-organisms, gases, etc. - at least a little of everything found in the atmosphere on the way to the surface.

The rain or snowfall finds its way to various sources of water supplies on the earth's lakes, rivers, oceans or it may soak into the ground and become a part of an underground stream or lake.

Characteristics of Various Water Sources

Rain Water

After the water picks up impurities in the atmosphere and percolates through the ground, it comes into contact with carbon dioxide and then forms carbonic acid. This dissolves some of the mineral content of the soil or rock it contacts, thus adding these minerals to the water.

Surface Water

Water from streams may be turbid due to the presence of silt, clay, etc. However, in larger surface water, a greater amount of self-purification takes place through aerobic digestion, plant life, fish, etc. and the quality of the water could change to a great degree.

Ground Water

Normally picks up the minerals it flows through. As a general rule, water from deep wells contains a higher mineral content and is less likely to contain organics or turbidity. Water from shallow wells is usually lower in mineral content and may be subjected to pollution or other bacteria which is available from various sources nearby (e.g. spring run-off through forests and hills, plants, industrial wastes, etc. which will all pass various bacteria into the water).

Impurities

Impurities in water are divided into two classifications:

1. Dissolved Solids

Those which naturally dissolve into water. NOTE: Gases may also dissolve into water unless they combine chemically with other impurities. They will be released into the atmosphere upon boiling and are not truly classified as dissolved solids. Upon evaporation, only the dissolved solids would remain in the actual mineral form and then can be analyzed by actual weight of the various elements.

2. Suspended Solids

Consist of clay, mud, silt, etc. and will not dissolve into water naturally but remain as such in their present state.

Water treatment and pollution control is one of the largest and most important industries in the modern day world. As can be seen from the preceding information, water treatment is a very broad and varied field and chemical analysis of certain water supplies is virtually impossible to completely break down. In time, modern man may discover additional information regarding the field of water treatment and the entire cycle of the earth's largest and most important single resource. The following sections will attempt to clarify some of the more common problems and solutions presently available.

Guidelines for Solving Water Problems

Problem	Symptom	Cause	Corrective Equipment
Hard Water	Spotting on dishes and glassware; scale on inside of water heater, pipes and water-using appliances; soap curd and bathtub ring; clothes look gray and dingy.	Calcium and magnesium in water, measuring 1.0 gpg or more.	Water Softener (Max. Hardness 100 gpg) (Max. Clear Water Iron 1.5 ppm)
Clear Water Iron (Ferrous)	Yellow, brown or rusty stains on plumbing fixtures, water-using appliances and fabrics; metallic taste in foods and beverages; water is clear when drawn from the faucet but oxidizes when exposed to air, then changes color ranging from yellow to brown.	Iron in the water measuring 0.3 ppm or more.	0.3-1.5 ppm Water Softener. 1.5-7.5 ppm Iron Guard Water Softener. 1.5-30 ppm Chemical Free Iron Filter (Note 1).
Red Water Iron (Ferric)	Same symptoms as Clear Water Iron but iron has already oxidized and has a yellow to rust color when drawn from the faucet.	Iron in the water measuring 0.3 ppm or more.	0.3-30 ppm Chemical Free Iron Filter (Note 1). 0.3-10 ppm Iron & Sulfur Filter.
Bacterial Iron	Same symptoms as Clear & Red Water Iron but can have clumps or balls that may foul plumbing lines and other water-using appliances; particularly noticeable as a yellow to reddish slime in toilet flush tanks.	Iron bacteria are a group of bacteria which thrive in iron-bearing water, utilizing iron as an energy source. This bacteria is not a health hazard.	Chemical Free Iron Filter (Note 1). Chemical feed pump feeding chlorine followed by a Multimedia Filter (Note 3).
Manganese	Blackish stain on fixtures and laundry; manganese content above 0.05 ppm causes stains.	Interaction of carbon dioxide or organic matter with manganese-bearing soils. Usually found in combination with iron.	0.05-1.0 ppm Chemical Free M Iron Filter (Note 1). 1.0-2.0 ppm Neutralizing Filter followed by Iron & Sulfur Filter (Note 2).
Acid Water	Blue/green or rusty stains and corrosion of plumbing fixtures and other water-using appliances; pitting of porcelain and enamel fixtures and dishes. Pin holes in copper plumbing lines.	Generally associated with water with a pH value of less than the neutral 7.0.	pH 6.0-6.9 Neutralizing Filter. pH 4.0-6.9 Chemical Feed Pump feeding soda ash. Consult our Customer Service Dept.
Aggressive/Corrosive Water	Same symptoms as Acid Water but pH is 7.0 or higher.	Alkalinity and carbon dioxide or high dissolved oxygen in water. Electrolysis - two dissimilar metals in plumbing lines.	Consult our Customer Service Dept.
Hydrogen Sulfide	Rotten egg taste and/or odor. Turns copper plumbing lines black. Very corrosive.	Hydrogen sulfide is a dissolved gas found in some water supplies.	0.1-3.0 ppm Chemical Free Iron Filter or Iron & Sulfur Filter. 3.0-15 ppm Chemical Feed Pump feeding chlorine followed by a Multimedia Filter (Note 3).
Marshy, metallic or chlorine taste and/or odors	Objectionable tastes and/or odors other than hydrogen sulfide.	Dissolved minerals or gases; organic contamination or chlorination.	Activated Carbon Filter for whole house water supply or Taste & Odor Cartridge Filter for individual faucets.
Turbidity (Sand/Sediment)	Foreign particles, dirty or cloudy water.	Tiny suspended particles that are the result of water main scale or silt. Private wells often contain sand or clay.	Multimedia Filter for whole house water supply or a Sediment Cartridge Filter for individual faucets.
Tannins	Yellow or brown tint or cast in water supply; tannins measuring 0.5 ppm or higher may cause staining and/or interference with various water treatment processes.	Result of decaying vegetative mater.	Organic Color Removal Filter. Consult our Customer Service Dept.

Note 1 - Water must have a minimum pressure of 20 psi, pumping rate of 5 gpm and a pH of 6.5 or higher for proper operation. Most water supplies contain calcium and magnesium which are not removed by an iron filter. We recommend following an iron filter with a water softener.

Note 2 - Oxidation of manganese is more pH dependent than iron. Therefore a pH of 8.2 or higher must be maintained. If the manganese level is >2.0 ppm or bacterial iron is present, consult our Customer Service Department.

Note 3 - This system also requires a retention tank to allow adequate contact time (minimum 20 minutes). An optional activated carbon filter for the whole house water supply or a taste & odor cartridge filter for individual faucets may be installed to remove any objectionable taste or odor.

