



# Glossary of Water Purification and Water Filtration Terms

The following words are defined as related to the water treatment industry. These definitions may vary slightly from the definitions used by the general public.

## A

**Absolute Filter Rating:** Filter rating meaning that 99.9% (or essentially all) of the particles larger than a specific micron rating will be trapped on or within the filter.

**Absorption:** The process of one substance actually penetrating into the structure of another substance. This is different from adsorption in which one substance adheres to the surface of another.

**Accumulation Tank:** A vessel or tank, which receives and stores product water for use on demand.

**Acid:** A substance, which releases hydrogen ions when dissolved in water. Most acids will dissolve the common metals and will react with a base to form a neutral salt and water. An acid is the opposite of an alkali, has a pH rating lower than 7.0, will turn litmus paper red and has a sour taste.

**Activated Alumina:** A medium made by treating aluminum ore so that it becomes porous and highly adsorptive. Activated alumina will remove several contaminants including fluoride, arsenic and selenium. This medium requires periodic cleaning and appropriate reagent such as alum, acid and or/caustic.

**Activated Carbon:** A water treatment medium, found in block, granulated, or powder form, which is produced by heating carbonaceous substances (bituminous coal or cellulose-based substance such as wood or coconut shell) in the absence of air, creating a highly porous adsorbent material.

**Adsorption:** The physical process occurring when liquids, gases or suspended matter adhere to the surface of, or in the pores of, an adsorbent medium. Adsorption is a physical process which occurs without chemical reaction.

**Aeration:** The process whereby water is brought into intimate contact with air by spraying or cascading, or air is brought into intimate contact with water by an air aspirator or by bubbling compressed air through the body of water. Both pressure (closed) aerators and open (gravity) aerators are used. Closed aeration is used chiefly for oxidation; open aeration for degassing.

**Aerobic:** An action or process conducted in the presence of air, such as aerobic digestion of organic matter by bacteria.

**Aesthetic Contaminants:** Characteristics of water which affects its taste, odor, color and appearance (and may affect the objects touched by the water) but which do not in themselves have any adverse health effects in otherwise potable water.

**Algae:** Single-celled or simple multi-celled organisms, commonly found in surface water, which produce their own food through photosynthesis. Excessive algae growth may cause the water to have undesirable odors or tastes and decay of algae can deplete the oxygen in the water.

**Alkali:** A substance which creates a bitter taste and a slippery feel when dissolved in water and will turn litmus paper blue. An alkali has a pH greater than 7.0 and is the opposite of an acid. Highly alkaline waters tend to cause drying of the skin.

**Amoeba:** A single celled protozoan that is widely found in fresh and salt water. Some types of amoebas cause diseases such as amoebic dysentery.

**Anaerobic:** A condition in which there is no air or no available free oxygen.

**Anaerobic Organisms:** An organism that can thrive in the absence of oxygen (air), such as bacteria in a septic tank.

**Anion:** An ion with a negative charge.

**Aqueous:** Containing water; watery.

**Aquifer:** A natural water-bearing formation which is found below the surface of the earth.

## B

**Back Pressure:** Pressure which creates resistance against a flow of water.

**Backflow:** The flow of water in a pipe or line in a direction opposite to the normal flow.

**Bacteria:** Single-celled organisms (single form = bacterium) which lack well-defined nuclear membranes and other specialized functional cell parts and reproduce by cell division or spores. Bacteria may be free-living organisms or parasites. Bacteria (along with fungi) are decomposers that break down the wastes and bodies of dead organisms making their components available for reuse. Bacteria cells range from about 1 - 10 micron in length and from .2 - 1.0 micron in width. They exist almost everywhere on earth. Despite their small size, the total weight of all bacteria in the world likely exceeds that of all other organisms combined. Some bacteria are helpful others are harmful.

**Bactericide:** Any substance or agent which kills bacteria.

**Bacteriostatic:** Having the ability to inhibit the growth of bacteria without destroying the bacteria. For example: silver-impregnated activated carbon will reduce bacterial colonization but not eliminate it.

**Ballast:** The power supply to activate and regulate voltage in an ultraviolet (UV) lamp.

beaver fever: See Giardia lamblia.

**Biocide:** A chemical which can kill or inhibit the growth of living organisms such as bacteria, fungi, molds and slimes. Biocides can be harmful to humans.

**Biodegradables:** Subject to degradation (break down) into simple substances by biological action. For example: the breakdown of detergents, sewage wastes and other organic matter by bacteria.

**Bleach:** A strong oxidizing agent and disinfectant formulated to break down organic matter and destroy biological organisms.

**Blinding:** The reduction or shutting off of flow due to filter medium or membrane fouling.

**Brackish Water:** Water containing dissolved solids in the range > 1,000 to < 15,000 ppm .

**Breakthrough:** The appearance in the product water of an amount of the contaminant which exceeds the design performance criteria.

**Brine:** A strong solution of salt(s) with total dissolved solid s concentrations. The waste solution in both automatic water softeners and reverse osmosis systems.

## C

**CA:** cellulose acetate.

**Calcium (Ca):** One of the principal elements making up the earth's crust. Calcium compounds, when dissolved, make hard water. The presence of calcium in water is a factor contributing to the formation of scale and insoluble soap curds which are a means of clearly identifying hard water.

**Capacity:** See rated capacity.

**Capillary Action:** A phenomenon in which water or other liquids will rise above the normal liquid level in a tiny tube or capillary due to the attraction of the molecules in the liquid for each other and for the walls of the tube.

**Carbon (C):** An element which is found in almost all living or formerly living matter including plants, proteins, organics and hydrocarbons. Carbon combines readily with oxygen to form carbon dioxide (CO<sub>2</sub> ). The term "carbon" is sometimes used as a short reference for activated carbon.

**Carbonaceous:** Containing carbon and derived from organic substances such as coal, coconut shells and wood.

**Carcinogens:** A substance that can cause cancer.

**Cartridge:** Any removable pre-formed or pre-packaged component containing a filtering medium, ion exchanger, membrane or other treatment material which fits inside a housing to make up a cartridge filter.

**Cartridge Filter:** A device often used for single faucet water treatment, made up of a housing and a removable cartridge (element). In residential filtering systems, disposable elements are used.

**Catalysis:** The speeding up (usually) of a chemical reaction by adding a specific substance, the catalyst. Although the catalyst causes the speedup of the reaction, it (the catalyst) is not changed chemically in any way.

**Cation:** An ion carrying one or more positive charges.

**Caustic:** Any substance capable of burning or destroying flesh or tissue. The term usually applies to strong bases.

**Cellulose Acetate (CA) and Cellulose Triacetate (CTA):** A cellulose ester obtained by introducing the acetyl radical (CH<sub>3</sub>CO-) of acetic acid into cellulose (as cotton or wood fibers) to produce a tough plastic material which is used to make the cellulosic type of semipermeable reverse osmosis membranes.

**Centigrade:** Also known as Celsius - a temperature scale in which 100 degrees is the boiling point and zero degrees the freezing point for water at sea level.

**CFU:** colony-forming-units.

**Channeling:** The flow of water through a limited number of passages in a filter.

**Charcoal:** An adsorbent carbon product which has about one-third the surface area of activated carbon.

**Check Valve:** A valve which will allow water to pass in one direction but will close and prevent flow (backflow) in the opposite direction.

**Chloramines:** Chemical complexes formed from the reaction between ammonia and chlorine being used to disinfect many municipal water supplies. Unlike chlorine, chloramines do not combine with organics in the water to form potentially dangerous trihalomethanes (THMs). Water containing chloramines may not be used for fish or for kidney dialysis applications.

**Chlorine (Cl<sub>2</sub>):** A gas widely used in the disinfection of water and as an oxidizing agent for organic matter. Chlorine is known to react with organic matter in the water to form trihalomethanes (THMs), a suspected carcinogen.

**Clear Water Iron:** See ferrous iron.

**Coliform bacteria:** A particular group of bacteria primarily found in human and animal intestines and wastes. These bacteria are widely used as indicator organisms to show the presence of such wastes in water and the possible presence of pathogenic (disease producing) bacteria. Escherichia coli (E. coli) is one of the fecal coliform bacteria widely used for this purpose.

**Color:** A shade or tint which is imparted to water by substances which are in true solution and thus cannot be removed by mechanical filtration. Color is most commonly caused by dissolved organic matter, but it may be produced by dissolved mineral matter.

**Contact Time:** The time the water is allowed to contain the disinfectant to assure potability. Contact time may also be called retention time.

**Contaminant:** Any undesirable physical, chemical or microbiological substance or matter in a given water source or supply. Anything in water which is not H<sub>2</sub>O may be considered a contaminant.

**Cross Contamination:** The intermixing of two water streams which results in unacceptable water quality for a given purpose.

**Cryptosporidium:** A waterborne protozoan that forms cysts and causes acute gastrointestinal illness in humans, Cryptosporidium is commonly found in unfiltered surface water and is resistant to disinfectants such as chlorine and ultraviolet light, but it can be removed by filters that capture all particles of one micron and greater in size.

**Cyst:** A capsule or protective sac produced about themselves by many protozoans (as well as some bacteria and algae) as preparation for entering a resting or a specialized reproductive stage. Similar to spores, cysts tend to be more resistant to destruction by disinfectant. Fortunately, protozoan cysts are typically 2-50 microns in diameter and can be removed from water by fine filtration.

## D

**Depth Filtration:** A filtration process in which water flows through progressively smaller pore spaces in a filter. Depth filters are designed to entrap particles throughout the mass of the filter media, as opposed to a surface filter where only the surface layer does the actual filtering.

**Desalination:** The removal of dissolved inorganic solids (salts) from solution such as water to produce a liquid which is free of dissolved salts. Desalination is typically accomplished by distillation, reverse osmosis or electrodialysis.

**Dew Point:** The temperature to which air must be cooled to cause condensation of the water vapor it contains.

**Disinfection:** The treatment of water to inactivate, destroy and /or remove pathogenic (disease producing) bacteria, viruses, cysts, and other microorganisms for the purpose of making the water microbiologically safe for human consumption. Disinfection may involve the use of disinfecting chemicals such as chlorine, iodine, ozone or peroxide; or it may involve physical processes such as distillation, microfiltration, ultrafiltration, boiling or ultraviolet radiation. Disinfection may also be called sterilization.

**Dissolved Solids:** (also known as total dissolved solids) The weight of matter, including both organic and inorganic matter, in true solution in a stated volume of water. The amount of dissolved solids is usually determined by filtering water through a 0.45 pore-diameter micron filter and weighing the filtration residue left after the evaporation of the water at 180 degree C.

**Distillate:** The product water, which is mineral-free and potable, from a distiller unit.

**Distillation:** The process of separating the water from the organic and inorganic contaminants through a combination of evaporation (or vaporization), cooling and condensation.

**Distilled Water:** Water which has been cleansed by passing through one or more evaporation-condensation cycles until it contains a very low amount of dissolved solids (usually less than 5.0 ppm TDS).

**Drain:** A pipe or conduit which carries liquids by gravity to waste.

**Drain Line:** A pipe line which is used to carry water from the water treatment system to a waste system.

**Drinking Water:** A water treated or untreated which is intended for human use and consumption and considered to be free of harmful chemicals and disease-causing bacteria, cysts, viruses or other microorganisms. See also potable water.

## E

**E. coli:** See Escherichia coli

**Efficiency (Media Filtration):** The percent of contaminant reduction which occurs with a specified medium volume and specified water contact time.

**Efficiency (Membrane Filtration):** The figure obtained (expressed as a percent) by dividing the volume gallons of product water produced by the total volume (gallons) of feed water fed to the particular unit or system.

**Effluent:** The outflow from any water processing system or device. Sometimes used to mean the product water of a given device or system.

**Ejection:** The process of forcing something out, expelling it.

**Enzyme:** A chemical produced by living cells, which can bring about the digestion (breakdown) of organic molecules into smaller units that can be used by living cell tissues.

**Escherichia coli (E coli):** One of the members of the coliform bacteria group normally found in human and animal intestines and indicative of fecal contamination when found in water. Determination of whether E. coli is present is often used to measure the microbiological safety of drinking water supplies.

**Evaporation:** The process by which a substance is changed from the liquid to the vapor state.

**Evaporation Chamber:** The part of a distillation system in which water is changed into vapor.

**Evaporite:** A mineral precipitated as a result of evaporation, such as the solids left behind in the distillation process.

## F

**FAC:** Free available chlorine.

**Facultative Organisms:** Microbes capable of adapting to either aerobic or anaerobic environments.

**Fahrenheit:** A temperature scale in which water freezes at 32 degrees and boils at 212 degrees at atmospheric pressure.

**Fecal Matter:** Matter (feces) containing or derived from animal or human bodily wastes that are discharged through the anus.

**Fecal Coliform:** Coliform bacteria found in fecal matter.

**Feed Pressure:** The pressure at which water is supplied to a water treatment device.

**Feedwater:** The water to be treated that is fed into a given water treatment system.

**Fermentation:** The conversion/breakdown of organic matter by anaerobic bacteria into carbon dioxide, methane and similar compounds of low molecular weight.

**Ferric Iron:** Small solid iron particles containing trivalent iron, which are suspended in water and visible as "rusty water". Ferric iron can normally be removed by filtration. Also known as precipitated iron.

**Ferrous Iron:** A divalent iron ion, usually as ferrous bicarbonate which when dissolved in water produces a clear solution. It is usually removed by cation exchange water softening. Also called clear water iron.

**Filter:** A device installed as part of the water system through which water flows for the purpose of removing turbidity, taste, color, iron or odor.

**Filter Media:** The selected materials in a filter that form the barrier to the passage of filterable suspended solids or dissolved molecules. Filter media are used to remove undesirable materials, tastes and odors from a water supply.

**Filtrate:** The effluent liquid from a filter system; that part of the feed stream which has passed through the filter.

**Filtration:** The process of separating solids from a liquid by means of a porous substance such as permeable fabric or membrane or layers of inert media.

**Fines:** Extremely small particles which are smaller than the specified size (in millimeters) for the medium.

**Flow Controller:** An in-line device or orifice fitting which regulate and control flow of water.

**Flow Rate:** The quantity of water which passes a given point in a specified unit of time, often expressed in U.S. gpm (or L/min).

**Fluoridation:** The addition of fluoride compound to a potable water supply to produce the concentration desired (about one PPM) for the purpose of the reduction of dental caries (tooth decay).

**Fluoride:** A natural occurring constituent of some water supplies, an excess of which (over 2.0ppm) can cause discolored teeth.

**Fouling: (Filtration):** The accumulation of undesirable foreign matter in a filter causing clogging of pores coating of surfaces and inhibiting or limiting the proper operation of the treatment system.

**Fouling (Reverse Osmosis):** A phenomenon in which a reverse osmosis membrane adsorbs, interacts with or becomes coated by solutes and or precipitates in the feed stream resulting in a decrease in membrane performance by lowering the flux and /or affecting the rejection solutes.

**Free Available Chlorine (FAC):** The concentration of residual chlorine present as dissolved gas, hypochlorous acid or hypochlorite ion but not including that chlorine combined with ammonia or other less readily available forms of chlorine.

**Fresh Water:** water having less than approximately 1,000 mg/L (ppm) of total dissolved solids (TDS).

**Fungi:** (singular = fungus) Plantlike organisms with cells that have distinct nuclei surrounded by nuclear membranes as well as other specialized functional cell parts but that cannot carry photosynthesis. Most fungi are decomposers of wastes and dead bodies from other organisms; a few are parasites. Yeasts, molds, mildew and mushrooms are all fungi.

## G

**Gallinea Ferruginea:** One of several types of bacteria that use iron in their metabolism and are capable of depositing gelatinous ferric hydroxide. Also known as iron bacteria.

**Germicidal Ultraviolet:** An ultraviolet light that peaks at a 2,537 angstrom wavelength and is in a wavelength that lies between 200 and 300 nanometers. This is known as the germicidal or short-wave ultraviolet band.

**Giardia:** A common waterborne protozoan that forms cysts and is resistant to disinfectants such as chlorine and ultraviolet light. Giardia can be removed by filters that all particles of four microns and greater in size.

**Giardia Lamblia:** A type of cyst found in the intestines of mammals and in water contaminated by mammal droppings. The giardia lamblia cyst, which is common and is frequently carried by water, is capable of causing a contagious waterborne disease characterized by acute diarrhea. This disease is referred to as beaver fever, because beaver droppings can contain giardia lamblia.

**Groundwater:** Water found beneath the surface of the ground. Ground water is primarily water which has seeped down from the surface by migrating through the interstitial spaces in soils and geologic formations.

## H

**H<sub>2</sub>O:** The chemical formula for water (dihydrogen oxide).

**Half-Life:** The time required for half of the substance present at the beginning to dissipate or disintegrate.

**Halogens:** A family group of elements including bromine, chlorine, fluorine, astatine and iodine.

**Hardness:** A common quality of water which contains dissolved compounds of calcium and magnesium and sometimes other divalent and trivalent metallic elements.

**Health Contaminant:** Any substance or condition that may have any adverse effect on human health.

**Heterotrophic Plant Count (HPC):** A procedure for estimating the total number of live non photosynthetic bacteria in water. Colony forming units (CFU) are counted after spreading the sample over a membrane or spread plate and incubating in an amiable growth medium (agar) and at an amiable temperature. These are generally not considered disease-causing bacteria.

**Hexametaphosphate:** A chemical such as sodium hexametaphosphate, added to water to increase the solubility of certain ions and to deter precipitation of certain chemicals.

**Hydrostatic Test:** A pressure test procedure in which a vessel or system is filled with water, purged of air, sealed, subjected to water pressure and then observed and/or tested for leaks, distortion and/or mechanical failure.

## I

**Influent:** The stream of water to be treated as it flows into any kind of water treatment unit or device, such as hard water into a water softener or turbid water into a filter.

**Inorganic Matter:** Chemical substances which do arise from the process of living growth, are composed of matter other than plant or animal matter. And don't contain hydrocarbons or compounds basically carbon structure. Examples are minerals and metals.

**Installation:** The connecting or setting up and start up operation of any water treatment system.

**Iodine (I):** A nonmetallic element which is the heaviest and least reactive of the naturally occurring halogens. It may be used for disinfection. In both its liquid and vapor forms, iodine is readily adsorbed by activated carbon.

**Ion Exchange:** A reversible chemical process in which ions from an insoluble permanent solid medium (the "ion exchanger" usually resin) are exchanged for ions in a solution or fluid mixture surrounding the insoluble medium.

**Iron (Fe):** A very common element often present in groundwater in amounts ranging from 0.01 to 10.0 ppm (mg/L) Iron can be found in three forms

1. Soluble form as in ferrous bicarbonate.
2. Bound with a soluble organic compound
3. As suspended ferric iron particles

**Iron Bacteria:** Bacteria which thrives on iron and are able to actually use ferrous iron (as found in water or steel pipes) in their metabolic processes, to incorporate ferric iron in their cell structure, and to deposit gelatinous ferric hydroxide iron compounds in their life processes.

**Iron Fouling:** The accumulation of iron on or within an ion exchange resin bed or filter medium in such amounts that the capacity of the medium is reduced.

## J

**Jackson Turbidity Unit (JTU):** A formerly used measurement of the turbidity in a water sample. This has been replaced by the nephelometric turbidity unit (NTU).

## K

**Kinetics:** the study of the relationships between temperature and the motion and velocity of very small particles. Kinetic relationships influence the rate of change in a chemical or physical system.

## L

**Leach:** To dissolve out by the action of a percolating liquid.

**Leach Field:** The area where the effluent from a septic tank system is distributed by horizontal underground piping designed to aid in the process of natural leaching and percolation through the soil.

**Legionella:** Over 26 species of bacteria, such as *Legionella pneumophila*, which can cause pneumonia-like illness called "Legionella Disease" (after the American Legion convention at which the disease first drew attention). These bacteria are known to thrive at 100 degrees F and are believed to live in infected humidifiers, cooling tower water and shower rooms. Infection is by inhalation.

**Lime (CaO):** A calcined chemical material, calcium oxide.

**Lime Scale:** Hard water scale formed in pipes and vessels (generally more severe on the hot water side) containing a high percentage of calcium carbonate (CaCO<sub>3</sub>) or magnesium carbonate MgCO<sub>3</sub>.

**Longitudinal Flow:** A flow pattern in which water travels from the bottom to top (or vice versa) in either a cartridge or loose media tank-type filtration system. The advantages are greater contact time, higher unit capacity, more complete utilization of medium and more uniform water quality. Also called axial flow.

**Loop:** A plumbing connection used to bypass water around a location designed for installation of a water treatment system or used when the treatment system is out of service for any reason.

## M

**Magnesium (Mg):** one of the elements that make up the earth's crust as part of many rock-forming minerals such as dolomite. Magnesium and calcium dissolved in water constitutes hardness. The presence of magnesium in water contributes to the formation of scale and insoluble soap which identify hard water.

**Manganese (Mn):** An element sometimes found dissolved in groundwater usually in combination with - but in lower concentrations than iron. Manganese is noticeable because in concentrations above 0.05mg/L it causes black staining of laundry and plumbing fixtures.

**Mechanical Filter:** A pressure or gravity filter designed to physically separate and remove suspended solids from a liquid by mechanical (physical) means rather than by chemical means.

**Media:** A selected group of material used in filters and filter devices to form barriers to the passage of certain solids or molecules which are suspended or dissolved in water.

**Membrane:** A thin sheet or surface film, either natural or man-made of microporous structure that performs as an effluent filter of particles down to the size range of chemical molecules and ions. Such membranes are termed "semipermeable" because some substances will pass through but others will not.

**Mesh Size:** Mesh is the number of openings in a square inch of a screen or sieve. It is equal to the square of the number of strains of metal or plastic screening per lineal inch.

**Methane:** A colorless, odorless, flammable gas consisting of the hydrocarbons (CH<sub>4</sub>) and resulting from the decay of vegetable matter or manure due to the action of anaerobic bacteria in swampy land, closed landfills or sewage disposal plants.

**Microbicide:** A substance that destroys microorganisms.

**Microfiltration:** The separation or removal from a liquid of particles and microorganisms in the size range of 0.1 to 2.0 microns in diameter.

**Micrograms per Liter:** Considered as equal to parts per billion (ppb). The common symbol for micrograms per liter is ug/L.

**Micrometer:** see micron.

**Micron:** A metric unit of length equal to one millionth of a meter or one thousandth of a millimeter or about 0.00003937 inches. The symbol for micron is the Greek letter  $\mu$ .

**Micron Rating:** A measurement applied to filters or filter media to indicate the particle size at which suspended solids above that size will be removed. As used in the water treatment industry standards, this may be an absolute rating or a nominal rating.

**Micronutrient:** see trace element.

**Microorganism:** A living organism invisible or barely visible to the naked eye and generally observed only through a microscope. Also called a microbe. Microorganisms are generally considered to include algae, bacteria, fungi, protozoa and viruses.

**Microwatt-Seconds per Square Centimeter:** A unit of measurement of intensity and retention or contact time in the operation of ultraviolet systems.

**Mineral:** An inorganic (non-living) substance which occurs naturally in the earth and has a composition that can be expressed as a chemical formula and a set of characteristics (crystalline structure, hardness etc.) common to all minerals. Examples of minerals are sulfur, salt and stone.

**Mineral Free Water:** Water produced by either distillation or deionization. This term is sometimes found on labels of bottled water as a substitute term for distilled or deionized water.

**Mineral Water:** Water which is naturally or artificially impregnated with mineral salts or gases (carbon dioxide). The term is also used to designate bottled water that contains no less than 250 ppm total dissolved solids (TDS) and originates from a protected ground water source.

**Mixed Bed:** The intermix of two or more filter exchange products in the same vessel during a service run.

**Mixed Media:** The use of two or more media products in a single filtration loose media bed where the products are intermixed - rather than in stratified layers. For example the intermix use of calcite and magnesia in pH modification.

**Module:** The membrane element and its housing in a reverse osmosis unit.

**Molecule:** The smallest particle of an element or compound that retains all of the characteristics of the element or compound. A molecule is made up of one or more atoms.

**Monitoring Light Sensor:** An indicator light, electrically or electronically activated, which is positioned in the effluent (product water) stream of a piece of water treatment equipment to detect and signal changes in the water quality which might malfunction of the equipment.

**Municipal Water:** Water that has been processed at a central plant to make it potable or "safe to drink" and which is then distributed to homes and businesses via water mains. The term is a general one used to refer to the common source of water in most urban and suburban areas - as opposed to water obtained from separate proprietary sources such as private wells.

## N

**Nanofiltration:** A membrane treatment process which falls between reverse osmosis and ultra filtration on the filtration/separation spectrum.

**Naturally Soft Water:** Ground surface, or rain water sufficiently free of calcium and magnesium salts so that no curd will form when soap is used and no calcium or magnesium based scale will form when the water is heated.

**Natural Sparking Water:** Carbonated water whose carbon dioxide content is from the same source as the water itself.

**Neutral:** (water chemistry) The midpoint (neutral) reading of 7.0 on the pH scale, indicating that the solution (water) producing the neutral reading will produce neither an acid nor alkaline reaction. A 7.0 reading on the pH scale means that there are an equal number of free hydrogen (acidic) ions and hydroxide (basic) ions.

**Nitrate:** A natural nitrogen compound sometimes found in well or surface waters. In high concentrations, nitrates can be harmful to young infants.

**Nominal Filter Rating:** Filter rating indicating the approximate size particle, the majority of which will not pass through the filter. It is generally interpreted as meaning that 85% of the particles of the size equal to the nominal filter rating will be retained by the filter.

**Non Degradable:** Resistant to decomposition or decay by biological means such as bacteria action or by chemical means such as oxidation, heat, sunlight or solvents.

**Nonpathogenic:** Not disease producing.

**Normal Flow Filtration:** The flow of the entire feed water stream in one direction directly through the filter media.

**Not Detectable:** A term used in reporting test results to mean that the substance being tested cannot be detected by the equipment or method being used for this particular test. This term implies that it is possible that trace amounts may be present in quantities too small to be detected by the test equipment or method.

**NTU:** nephelometric turbidity unit.

**Nucleus:** The positively charged central part of an atom containing nearly all of the atomic mass and consisting of protons and neutrons (except in hydrogen which consists of one proton only).

**Nutrients:** Elements or compounds essential as raw materials for organism growth and development.

## O

**Operating Pressure:** The manufacturer's specific range of pressure expressed in pounds per square inch (psi) within which a water processing device or water system is designed to function. A range of 30 to 100 psi is often indicated. Also called working pressure.

**Operating Temperature:** The manufacturer's recommended feed water or inlet water temperature for a water treatment system.

**Organic:** Having the characteristics of or being derived from a living organism, plant and animal. Containing carbon (although a few very simple carbon compounds such as carbon oxides, the carbides, carbon disulfides and metallic carbonates are considered inorganic).

**Organic Matter:** Substances consisting of or derived from plant or animal matter, as opposed to inorganic matter which is derived from rocks, ore and minerals. Organic matter is characterized by its carbon hydrogen structure.

**Orifice:** An opening, such as a hole or vent in something.

**Osmosis:** The natural tendency for water to spontaneously pass through a semipermeable membrane separating two solutions of different concentrations (strength). The water will naturally pass from the weaker (less concentrated) solution containing fewer particles of dissolved substance to the stronger (more concentrated) solution containing more particles of a dissolved substance. Thus natural osmosis causes the stronger solution to become more diluted and tends to equalize the strength of the solution on both sides of the membrane.

**Osmotic Pressure:** The pressure and potential energy difference which exists between two solutions on either side of a semipermeable membrane because of the tendency of water to flow in osmosis.

**Oxidizing Agent:** A chemical substance that gains electron (is reduced) and brings about the oxidation of other substances in chemical oxidation and reduction (redox) reactions.

**Ozonation:** The process of feeding ozone into a water supply for the purpose of decolorization, deodorization, disinfectant or oxidation.

**Ozone ( $O_3$ ):** A very strong oxidizing agent which is unstable and must be generated on site. Ozone is a highly reactive form of oxygen and can be produced by sending a high voltage electrical discharge through air or oxygen (such as occurs in a lightning storm). Ozone can also be produced by some types of ultra violet lamps. Ozone is an excellent oxidizing agent and bactericide.

## P

**Particle:** A very tiny, separate subdivision matter.

**Particle Filtration:** Filtration of particles in the size range of 2 microns or larger in diameter. Particle filtration is typically handled by cartridge filters and media filters.

**Particle Size:** As used in water industry standards, this term refers to the size expressed in microns, of a particle suspended in water as determined by the smallest dimension.

**Parts per Billion (ppb):** A measure proportion by weight which is equivalent to one unit weight of solute (dissolved substance) per billion unit weights of the solution.

**parts per million (ppm):** A measure of proportion by weight which is equivalent to one unit of weight of solute (dissolved substance) per million weights of solution. Since one liter of water weighs one million milligrams, one ppm is equal to one milligram per liter (mg/L). PPM is the preferred unit of measure in water or wastewater analysis.

**Pathogens:** Any disease producing organism.

**Pathogenic:** Capable of causing disease.

**Percent Recovery:** The percentage of the feed water which becomes product water. Determined by the number of gallons (or liters) of product water divided by the total gallons (or liters) of feed water and multiplied by 100. The percent recovery is called recovery rate in reverse osmosis and ultra filtration.

**Percent Rejection:** (reverse osmosis/ultra filtration) The percentage of TDS in the feed water that is prevented from passing the membrane with the permeate. The formula used is: the difference obtained from the TDS in permeate divided by TDS in feed water; then multiply the answer obtained by 100 to obtain a percentage.

**Permeate:** That portion of the feed water which passes through the membrane to become product water.

**pH (Potential of Hydrogen):** A measure of the degree of the acidity or the alkalinity of a solution as measured on a scale ("pH scale") of 0 to 14. The midpoint of 7.0 on pH scale represents neutrality, that is, a neutral solution is neither acid nor alkaline. Numbers below 7.0 indicate acidity; numbers above 7.0 indicate alkalinity. It is important to understand that pH is a measure of intensity, not capacity. That is, pH indicates the intensity of alkalinity in the same way temperature tells how hot something is but not how much heat the substance carries.

**Phosphate:** A salt of phosphoric acid. In the water treatment industry, poly phosphates are used a sequestering agents to control iron and hardness, and as a coating agent to control corrosion by formation of a thin passivating film on metal surfaces.

**POE:** Point of entry.

**Point of Entry (POE) Treatment:** Full service water treatment at the inlet to an entire building or facility (outside faucets may be excepted from treatment).

**Point of Use (POU) Treatment:** Water treatment at a single outlet or limited number of water outlets in a building, but for less than the whole building or facility. POU treatment is often used to treat water for drinking and cooking only.

**Polishing Filter:** A filter installed for use after the primary water treatment stage to remove any trace of undesirable matter or to polish the water.

**Pollutant:** A contaminant existing at a concentration high enough to endanger the environment or the public health or to be otherwise objectionable.

**Polyphosphate:** A form of phosphate polymer consisting of a series of condensed phosphoric acids containing more than one atom of phosphorus. Polyphosphate is used as a sequestering agent to control iron and hardness, and as a coating agent that forms a thin passivating film on metal surfaces to control scale.

**Porous:** Full of pores through which water, light etc may pass.

**Porosity:** A measure of the volume of pores in a material. Porosity is calculated as a ratio of the interstices of material (e.g. the volume of spaces between the media particles in a filter bed) to the volume of its mass, and is expressed as a percentage.

**Potable (Drinking) Water:** A water supply which meets U.S. EPA and/or state water quality standards and is considered safe and fit for human consumption.

**Potassium Chloride (KCl):** A colorless potassium salt which can be used as a regenerant in cation exchange water softeners.

**POU:** Point of use.

**ppb:** Parts per billion.

**ppm:** Parts per million.

**ppt:** Parts per trillion.

**Pretreatment:** Any water treatment step performed prior to the primary treatment process, such as filtration prior to deionization.

**Pressure Differential:** The difference in the pressure between two points in a water system. The difference may be due to the difference in elevation and/or to pressure drop resulting from water flow.

**Pressure Drop:** A decrease in the water pressure (in psi) which occurs as the water flows. The difference between the inlet and outlet water pressure during water flow through a water treatment device.

**Process Water:** Water used in a manufacturing or treatment process or in the actual product manufacture.

**Production Rate:** The amount (gallons or liters) of product water the system produces per minute or (especially for reverse osmosis) per 24 hour period.

**Product Water:** Water that has been through the total treatment process and meets the quality standards required for the use to which the water will be used.

**Prototype:** an original water treatment equipment unit on which a specific equipment line is modeled.

**Protozoa:** Microscopic, usually single celled microorganisms which live in water and are relatively larger in comparison to other microbes. Protozoa are higher on the food chain than the bacteria that they eat. Many protozoa are parasitic.

**psi:** Pounds per square inch.

**Pure Water:** This term has no real meaning unless the word "pure" is defined by some standard such as pharmaceutical grade water.

**Purified Water:** A USP grade water produced from water meeting U.S. EPA standards for potable drinking water which has microbiological content under control and is free from foreign substances.

**Putrefaction:** The decomposition (rotting) of organic matter caused by microbes and oxidation.

**Pyrogens:** Substances (often of unknown origin) that produce fever when introduced into the human body. Being chemically and physically stable, pyrogens are not necessarily destroyed by conditions that kill bacteria.

## Q

**Qualification Test:** Test and verifications performed to validate water treatment equipment conformance to a specific standard.

**Quartz Sleeve or Quartz Jacket:** A clear, pure fused quartz tube used to protect the high intensity ultraviolet lamps in ultraviolet systems. It usually retards less than 10% of the ultraviolet radiation dose.

## R

**Radial Flow:** The flow pattern in which water flows from the outside of a filter element to the center core.

**Radical:** A group of atoms acting as a single atom which go through chemical reactions without being changed.

**Radon (Rn):** A colorless, odorless, short lived radioactive gas which is produced by decay of the uranium/radium series and is soluble in water. Radon is considered carcinogenic when inhaled by humans. Radon can be removed from water by aeration or activated carbon.

**Rated Capacity (filtration or adsorption):** The manufacturer's statement regarding the expected number of days the equipment will be in service or the expected number of gallons of product water is delivered before backwash, rinse or replacement is needed.

**Rated Pressure Drop:** The expected pressure drop in psi as stated by the equipment manufacturer or obtained under test conditions.

**Rated Flow Rate:** The specified maximum and minimum flow rate at which a particular piece of water treatment equipment will continuously produce the desired quality of water.

**Raw Water:** Water, usually from wells or surface sources, which has had no previous treatment and is entering the water processing system or device. The water at the inlet side of any water treatment device.

**Redox:** A shortened term for "oxidation-reduction". Used in terms such as redox reactions and redox conditions.

**Regeneration (ion exchange, softening):** The use of a chemical solution (regenerant) to displace the contaminant ions deposited on the ion exchange resin during the service run and replace them with the kind of ions necessary to restore the capacity of the exchange medium for reuse.

**Reject Water:** A term used in distillation, reverse osmosis and ultra filtration to describe that portion of the incoming feed water that has passed across the membrane but has not been converted to product water and is being sent to drain.

**Rejection Rate:** In a reverse osmosis or ultra filtration system, rejection rate is the quantity of feed water that does not pass through the membrane expressed as a percent of the total quantity of incoming feed water.

**Removable:** capable of being taken away from a water treatment equipment unit using only simple tools such as a screw driver, pliers, or open ended wrench. Readily removable indicates capable of being taken away from a water treatment unit without the use of tools.

**Reservoir Tank:** Same as storage tank on a reverse osmosis system.

**Residential Equipment:** The term sometimes used to denote smaller sized water processing equipment which has been designed primarily for home use.

**Residual:** The amount of a specific material which remains in the water after the water has been through water treatment step.

**Residual Chlorine:** Chlorine allowed to remain in a treated water after a specified period of contact time and allowed to provide disinfection protection through out the distribution system. The amount of residual chlorine is the difference between the total chlorine added and that consumed by the oxidizable matter.

**Resin:** As used in the water processing industry, this term refers to ion exchange resin products which are usually specifically-manufactured organic polymer beads used in softening and other ion exchange processes to remove dissolved salts from water.

**Retention:** Contact time.

**Reverse Osmosis (RO):** A water treatment process that removes undesirable materials from water by using pressure to force the water molecules through a semipermeable membrane. This process is called "reverse" osmosis because the pressure forces the water to flow in the reverse direction (from the concentrated solution to the dilute solution) to the flow direction (from the dilute to the concentrated) in the process of natural osmosis. RO removes ionized salts, colloids and organic molecules down to a molecular weight of 100.

**Rust (ferric oxide):** A reddish corrosion product occasionally found in water. Rust is formed as a result of electro-chemical interaction between iron and atmospheric oxygen in the presence of moisture.

## S

**Safe Water:** see potable water.

**Saline:** Consisting of, or containing salt.

**Salt Water:** The general term for all water over 1,000 ppm (mg/L) total dissolved solids.

**Sand Filter:** The oldest and most basic filtration process, which generally uses two grades of sand (coarse and fine) for turbidity removal or as a first stage roughing filter or pre-filter in more complex processing systems.

**Scale:** A coating or precipitate deposited on surfaces such as kettles, water pipes or steam boilers that are in contact with hard water. Waters that contain carbonates or bicarbonates of calcium or magnesium are especially likely to cause scale when heated.

**Scavenger:** (water treatment) A polymer matrix or ion exchanger that is used specifically to remove organic species from the feed water before the water is to pass through the deionization.

screen size: SEE mesh size.

**SDI:** Silt density index.

**Selectivity:** The tendency of an ion exchanger to "prefer" (have more attraction for) certain kinds of ions over others, as if the resin were ranking the types of ions in order to be removed; most preferred ion, second most preferred, etc..

**Septic:** Producing or characterized by bacterial decomposition.

**Serial Filtration:** The arrangement of two or more filtering steps, one following the other, in order to remove increasingly finer particles at each stage and provide for filtration of all sizes of suspended solids.

**Service Flow:** The rate in U.S. gallons per minute (gpm) or liters per minute (L/min) at which a given water processing system can deliver product water. The rating may be intermittent peak flow or constant flow.

**Shallow Well:** A well sunk in easily penetrated ground to a point which is below the water table but usually less than about 30 feet in depth.

**Silt Density Index (SDI):** A test used to measure the level of suspended solids in feed water for membrane filtration systems.

**Single Stage System:** A filtering system that uses only a single filtering cartridge.

**Slug:** A temporary abnormally high concentration of an undesirable substance which shows up in the product water.

**Slurry:** A thin watery mixture of a very fine insoluble substance.

**Soda Water:** water which has impregnated with carbon dioxide (CO<sub>2</sub>) so that it will be effervescent when not under pressure. Same as seltzer water.

**Sodium: (Na<sup>+</sup>):** A metallic element found abundantly in compounds in nature, but never existing alone.

**Sodium Chloride (NaCl):** The chemical name for common table salt.

**Soft Water:** Any water which normally contains less than 1.0 grain per gallon (17.1 mg/L or ppm) of total hardness expressed as calcium carbonate equivalent.

**Softened Water:** Any water which has been processed in some manner to reduce the total hardness to 17.1 mg/L or ppm (1.0 grain per gallon) or less expressed as calcium carbonate equivalent.

**Solids:** The matter dissolved or suspended in water or wastewater.

**Spiral Wound:** A very common construction configuration for one style of reverse osmosis membrane and cartridge filter element. In RO membranes, the membrane sheets are assembled in layers around a perforated mandrel product water tube with coarse mesh spacers screens between the layers, to form a complete module element. In cartridge filter elements, the filtration material such as fiber cord, is continually wound around a perforated mandrel core tube.

**Spore:** A small reproductive body, often single celled, capable of reproducing the organism under favorable conditions. The spore is sometimes considered the resting stage of the organism. Among the organisms that may produce spores are algae, bacteria and certain protozoan. In water, most spores resist adverse conditions which would readily destroy the parent organism.

**Spring:** A place where ground water flows naturally from the soil or rock formation onto the land surface or into a body of surface water. A spring is sometimes used as a source of water for a shallow dug well.

**Static:** Fixed in a position, resting, without motion.

**Storage Capacity:** The maximum volume of water available for use from the water storage tank, e.g. the amount available from a RO or distiller water storage tank.

**String Wound Element:** A cartridge style element constructed by continuous spiral winding of natural or synthetic yarn around a pre-formed product water tube core and then building it up in layers to form a depth type filter.

**Submicron Filter:** A cartridge type membrane filter used in fine particle separation applications to remove particles of less than one micron in size.

**Sulfur (S):** A yellowish solid chemical element. "Sulfur" is also often used to refer to sulfur water.

**Sulfur Bacteria:** Thio-Bacillus

**Sulfur Water:** water containing objectionable amounts of hydrogen sulfide gas which causes an offensive "rotten egg" odor.

**Surface Filtration:** Filtration that occurs at the surface layer (as opposed to within the body depth) of the filter and is accomplished by passing the material to be filtered over a grating screen, sieve or membrane fabric with micro sized holes. The size of the holes in the filter determines what materials will pass through and what will filter out (held back).

**Surface Water:** All of the water (fresh and salt) on the surface of the earth including streams, lakes oceans, rivers, glaciers and some shallow wells that can be fed by surface runoff water.

**System:** A complete integrated series consisting of various components and perhaps multiple water treatment processes which can be tested, installed and operated as a single unit of equipment. For example, a single RO treatment system generally consists of two or more stages of media filtration plus cross flow membrane filtration and water storage.

## T

**Taste Threshold:** The minimum concentration of a chemical or biological substance which can just be tasted.

**TCE:** trichloroethylene.

**TDS:** total dissolved solids.

**Teflon:** The trade name of a high temperature industrial plastic material used in cooking, finishes, bearings, lubricating, plumbing sealants, and a practically inert coating on metal and glass surfaces.

**TFC:** Thin film composite.

**TH:** Total hardness.

**Thin Film Composite Membrane (TFC):** A class of reverse osmosis membranes made with polyamide-based polymer and fabricated with different materials in the separation and support layers.

**THMs:** Trihalomethanes.

**Thiobacillus:** A small single celled sulfur bacterium which can create hydrogen sulfide gas and the resulting "rotten-egg" odor in water supplies.

**TOC:** Total organic carbon.

**Tortuous Path:** Water flow through channels which are constricted and marked by repeated twists, bends and winding turns.

**Total Chlorine:** The total concentration of the chlorine in a water, including the combined available chlorine and the free available chlorine.

**Total Dissolved Solids (TDS):** The total weight of the solids that are dissolved in the water, given in ppm per unit volume of water. TDS is determined by filtering a given volume of water (usually through a 0.45 micron filter), evaporating it at a defined temperature (usually 103 - 105 degrees Celsius) and then weighing the residue.

**Total Hardness (TH):** The total of the amounts of divalent metallic cations, principally calcium hardness and magnesium hardness, expressed in terms of calcium carbonate equivalent.

**Total Matter:** The sum of all suspended and dissolved matter in a water sample.

**Total Solids (TS):** The weight of all organic and inorganic solids, both dissolved and suspended, per unit volume of water.

**Toxic:** Poisonous (to human beings); capable of producing disease or otherwise harmful to human health when taken into the body.

**Trace element:** An element essential to plant and/or animal nutrition in trace concentration of 1% or less.

**Trace substance (or trace):** A substance which is found during water analysis in a small concentration, high enough to be detected, but too low to be quantified accurately by standard testing methods.

**Transpiration:** The process of plants giving off watery vapor from their leaves and other surfaces.

**Trichloroethylene (TCE):** A toxic volatile organic compound often found as a solvent.

**Trihalomethanes (THMs):** A group of organic chemicals, suspected of being carcinogenic, which are formed in water when chlorine being used as a disinfectant reacts with natural organic matter such as humic acids from decayed vegetation.

**Turbidity:** The amount of small particles of solid matter suspended in water as measured by the amount of scattering and absorption of light rays caused by the particles. Turbidity is measured in nephelometric turbidity units (NTU). Potable water should not exceed 0.5 NTU.

## U

**Ultrafiltration:** A method of cross-flow filtration (similar to reverse osmosis but using lower pressure) which uses a membrane to separate small colloids and large molecules from water and other liquids.

**Ultrapure Water:** Highly treated water that is deionized and mineral free with high resistivity and no organics; it is usually used in the semiconductor and pharmaceutical industries. Ultrapure water is NOT considered biologically pure (potable) or sterile.

**Ultraviolet (UV):** Pertaining to ultraviolet light.

**Ultraviolet Chamber:** The area where the water is irradiated with ultraviolet rays.

**Ultraviolet Demand:** The amount of ultraviolet rays required to inactivate certain microorganisms.

**Ultraviolet Dosage:** The amount of disinfectant ultraviolet rays delivered to the organisms in the water being disinfected. Dosage is a combination of UV intensity times the contact time and is measured in watt-seconds per square centimeter.

**Ultraviolet (UV) Light:** Radiation (light) having a wavelength shorter than 3900 angstroms, the wavelengths of visible light, and longer than 100 angstroms, the wavelength of x-rays.

**Uniform Flow:** A flow in which the feet per second velocity rates and directions are the same from point to point along the conduit.

**Up Flow:** A pattern of water flow in which a solution (water or regenerant usually) enters at the bottom of the vessel or column and flows out at the top of the vessel or column during any phase of the treatment unit's operating cycle.

**User:** The product water consumer.

## V

**Vacuum Distillation:** Distillation that occurs at a pressure somewhat below atmospheric pressure. Lowering the pressure also lowers the boiling point of water, thus conserving energy by requiring less heat to bring about distillation.

**Validation:** Determination upon testing that a representative sample of a water treatment product/model has meet the requirements of a specific standard.

**Vapor:** The gaseous form of any substance whose usual form is liquid or solid. Visible particles of moisture suspended in air, such as mist or fog.

**Velocity:** The time measurement of linear motion (flow) in a given direction. For example, water flowing 60 feet in a conduit each minute has a velocity of 60 feet per minute (fpm) or one foot per second (1 fps).

**Viable:** capable of living independently and being reproductive.

**Viable Water Treatment Process:** A water or wastewater treatment process capable of accomplishing the desired water quality.

**Virus:** A parasitic infectious microbe, composed almost entirely of protein and nucleic acids, which can cause disease(s) in humans. Viruses can reproduce only within living cells. They are 0.004 to 0.1 micron in size, about 100 times smaller than bacteria.

**VOCs:** Volatile organic chemicals.

**Volatile:** Capable of becoming vapor at relatively low temperatures.

**Volatile Organic Chemicals (VOCs):** Synthetic organic chemicals that turn into vapor at relatively low temperatures.

## W

**Wastewater:** Water that has been used. RO, ultrafiltration, electrodialysis The stream of water (not product water) created as a result of processing water -the reject water or condensate.

**Water (H<sub>2</sub>O):** The liquid that descends from the clouds as rain and forms lakes, streams and seas (ocean). Water is a major constituent of all living matter. An odorless, colorless, tasteless liquid which exists as ice in solid form (phase) and steam in vapor form (phase). It freezes at 32° F/0° C and boils at 212° F/100° C.

**Waterborne Disease:** A disease, caused by bacterium or organism able to live in water, which can be transmitted by water.

**Water Closet:** A flushable toilet.

**Water Conditioning:** The treatment or processing of water, by any means, to modify enhance or improve its quality to meet a specific water quality need desire or set of standards. Also called water treatment.

**Water Softening:** The reduction /removal of calcium and magnesium ions, which are the principal cause of hardness in water.

**Water Source:** The basic origin of a water , either a surface source (such as lake, river or reservoir) or a subsurface source ( such as well). After treatment and pumping via pipelines, the treated and pumped water becomes a water supply.

**Water Table:** The level of the top of the zone of groundwater saturation.

**Watertight:** A condition existing in water treatment equipment and materials of such precision of construction and fit as to be impermeable to water unless sufficient pressure occurs to cause rupture.

**WHO:** World Health Organization.

## X

**X-rays:** Electromagnetic radiation with a very short wavelength (0.01 to 12 nanometers), shorter than ultraviolet radiation.

## Y

**Yield:** the amount of product water produced by a water treatment process.

## Z

**Zeolites:** Hydrated sodium alumina silicates, either naturally occurring mined products or synthetic product, with ion exchange properties.

**Zero Soft Water:** Water produced by cation exchange process and measuring less than 1.0 grain per U.S. gallon (17.1 ppm or 17.1 mg/L) as calcium carbonate. **zone of saturation:** The layer in the ground in which all available interstitial voids, cracks, crevices, holes are filled with water. The level of the top of this zone is the water table.



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