

# COMMON TERMS USED IN WASTEWATER TREATMENT

## *State Associations and Regulatory Agencies*

AWWA	American Water Works Association
BPR	Florida Department of Business and Professional Regulation
FDEP	Florida Department of Environmental Protection
EPA	Environmental Protection Agency
FRWA	Florida Rural Water Association
FSAWWA	Florida Section of AWWA
FWPCOA	Florida Water & Pollution Control Operators Association
FWEA	Florida Water Environmental Association
NWFWMD	Northwest Florida Water Management District
SFWMD	South Florida Water Management District
SJRWMD	St. Johns River Water Management District
SRWMD	Suwannee River Water Management District
UF TREEO Center	University of Florida Center for Training, Research, and Education for Environmental Occupations

## *Monitoring Parameters*

BOD	Biochemical Oxygen Demand
CBOD	Carbonaceous Biochemical Oxygen Demand
Cl <sub>2</sub>	Chlorine
COD	Chemical Oxygen Demand
NH <sub>3</sub> -N	Ammonia Nitrogen
NO <sub>2</sub> -N	Nitrite Nitrogen
NO <sub>3</sub> -N	Nitrate Nitrogen
TDS	Total Dissolved Solids
TKN	Total Kjeldahl Nitrogen
TP	Total Phosphorous
TSS	Total Suspended Solids

## *General Abbreviations*

Cu Ft	Cubic Foot
Cu M	Cubic Meter
kg	Kilograms
L	Liter
Lbs	Pounds
mg	Milligrams
mL	Milliliter
°C	Celsius
°F	Fahrenheit

## ***Process Terminology***

DO	Dissolved Oxygen
F/M Ratio	Food to Microorganism Ratio
GSA	Gould Sludge Age
MCRT	Mean Cell Residence Time
MLSS	Mixed Liquor Suspended Solids
MLVSS	Mixed Liquor Volatile Suspended Solids
ORP	Oxidation/ Reduction Potential
OUR	Oxygen Uptake Rate
O & G	Oil and Grease
RAS	Return Activated Sludge
RBC	Rotating Biological Contactor
SA	Sludge Age
SDI	Sludge Density Index
SOUR	Specific Oxygen Uptake Rate
SRT	Solids Retention Time
SVI	Sludge Volume Index
WAS	Waste Activated Sludge

## ***Miscellaneous***

AWT, AWWT	Advanced Wastewater Treatment
BHP	Brake Horse Power
CFM	Cubic Feet Per Minute
CFR	Code of Federal Regulations
CFS	Cubic Feet Per Second
DMR	Discharge Monitoring Report
FAC	Florida Administrative Code
GPD	Gallons Per Day
GPM	Gallons Per Minute
GPS	Gallons Per Second
HP	Horse Power
MGD	Million Gallons Per Day
MG/L	Milligrams Per Liter
MOR	Monthly Operating Report
NPDES	National Pollutant Discharge Elimination System
POTW	Publicly Owned Treatment Works
PPM	Parts Per Millions
PSI	Pounds Per Square Inch
WRF	Water Reclamation Facility
WTP	Water Treatment Plant
WWTF	Wastewater Treatment Facility
WWTP	Wastewater Treatment Plant

# HELPFUL WASTEWATER TREATMENT TERMS

## **ACID:**

- (1) A substance that tends to lose a proton.
- (2) A substance that dissolves in water with the formation of hydrogen ions.
- (3) A substance containing hydrogen which may be replaced with metals to form salts
- (4) A substance that is corrosive.
- (5) A substance that may lower pH

**ACIDITY:** The capacity of water or wastewater to neutralize bases. Acidity is expressed in milligrams per liter of equivalent calcium carbonate.

**ACTIVATED SLUDGE:** Sludge particles produced in raw or settled wastewater (primarily effluent) by the growth of organisms (including zooglycal bacteria) in aeration tanks in the presence of dissolved oxygen. The term "activated" comes from the fact that the particles are teeming with bacteria, fungi, and protozoa. Activated sludge is different from primary sludge in that the sludge particles contain many living organisms which can feed on the incoming wastewater.

**ACTIVATED SLUDGE PROCESS:** A biological wastewater treatment process which speeds up the decomposition of wastes in the wastewater being treated. Activated sludge is added to wastewater and the mixture (mixed liquor) is aerated and agitated. After some time in the aeration tank, the activated sludge is allowed to settle out by sedimentation and is disposed of (wasted) or reused (returned to the aeration tank) as needed. The remaining wastewater then undergoes more treatment.

**ADVANCED WASTE TREATMENT:** Any process of water renovation that upgrades treated wastewater to meet specific reuse requirements. Typical processes include chemical treatment and pressure filtration. Also called tertiary treatment.

**AERATION:** The process of adding air to water. In wastewater treatment, air is added to refreshen wastewater and to keep solids in suspension. With mixtures of wastewater and activated sludge, adding air provides mixing and oxygen for the microorganisms treating the wastewater.

**AEROBES:** Bacteria that must have molecular (dissolved) oxygen (DO) to survive.

**AEROBIC BACTERIA:** Bacteria which will live and reproduce only in an environment containing oxygen which is available for their respiration (breathing), namely atmospheric oxygen or oxygen dissolved in water. Oxygen combined chemically, such as water molecules (H<sub>2</sub>O), cannot be used for respiration by aerobic bacteria.

**AIR LIFT:** A type of pump. This device consists of a vertical riser pipe in the wastewater or sludge to be pumped. Compressed air is injected into a tall piece at the bottom of the pipe. Fine air bubbles mix with the wastewater or sludge to form a mixture lighter than the surrounding water which causes the mixture to rise in the discharge pipe to the outlet. An air-lift pump works like the center of a stand in a percolator coffee pot.

**ALGAE:** Microscopic plants which contain chlorophyll and live floating or are suspended in water. They also may be attached to structures, rocks, or other similar substances. Algae produce oxygen during sunlight hours and use oxygen during night hours. Their biological activities appreciably affect the pH and dissolve oxygen of the water.

**ALIQOT:** Portion of a sample. Often an equally divided portion of a sample.

**ALKALINITY:** See Base.

**ANAEROBIC:** A condition in which atmospheric or dissolved molecular oxygen is *NOT* present in the aquatic (water) environment.

**ANAEROBIC BACTERIA:** Bacteria that live and reproduce in an environment containing no “free” or dissolved oxygen. Anaerobic bacteria obtain their oxygen supply by breaking down chemical compounds which contain oxygen, such as sulfate ( $\text{SO}_4^{2-}$ ).

**ANAEROBIC DIGESTION:** Wastewater solids and water (about 5% solids, 95% water) are placed in a large tank where bacteria decompose the solids in the absence of dissolved oxygen.

**ANOXIC:** Oxygen deficient or lacking sufficient oxygen.

**BOD: Biochemical Oxygen Demand.** The rate at which organisms use the oxygen in water or wastewater while stabilizing decomposable organic matter under aerobic conditions. In decomposition, organic matter serves as food for the bacteria and energy results from its oxidation. BOD measurements are used as a measure of the organic strength of wastes in water.

**BACTERIA:** Bacteria are living organisms, microscopic in size, which usually consist of a single cell. Most bacteria use organic matter for their food and produce waste products as the result of their life processes.

**BAFFLE:** A flat board or plate, deflector, guide or similar device constructed or placed in flowing water, wastewater, or slurry systems to cause more uniform flow velocities, to absorb energy, and to divert, guide, or agitate liquids (water, chemical solutions, slurry).

**BASE:**

- (1) A substance which takes up or accepts protons.
- (2) A substance which dissociates (separates) in aqueous solution to yield hydroxyl ions ( $\text{OH}^-$ ).
- (3) A substance containing hydroxyl ions which reacts with an acid to form a salt or which may react with metals to form precipitates.
- (4) A substance that may raise pH.

**BIOMASS:** A mass or clump of organic material consisting of living organisms feeding on the wastes in wastewater, dead organisms and other debris.

**BIOSOLIDS:** A primarily organic solid product, produced by wastewater treatment processes, that can be beneficially recycled. The word biosolids is replacing the word sludge.

**BLANK:** A bottle containing only dilution water or distilled water, but the sample being tested is not added. Tests are frequently run on a SAMPLE and a BLANK and the differences are compared.

**BUFFER:** A solution or liquid whose chemical makeup neutralizes acids or bases without a great change in pH.

**BULKING:** Clouds of billowing sludge that occur throughout secondary clarifiers and sludge thickeners when the sludge does not settle properly. In the activated sludge process bulking is usually caused by filamentous bacteria or bound water.

**CAVITATION:** The formation and collapse of a gas pocket or bubble on the blade of an impeller or the gate of a valve. The collapse of this gas pocket or bubble drives water into the impeller or gate with a terrific force that can cause pitting on the impeller or gate surface. Cavitation is accompanied by loud noises that sound like someone is pounding on the impeller or gate with a hammer.

**CENTRIFUGE:** A mechanical device that uses centrifugal or rotational forces to separate solids from liquids.

**CHLORINATION:** The application of chlorine to water or wastewater, generally for the purpose of disinfection, but frequently for accomplishing other biological or chemical results.

**CHLORINE DEMAND:** Chlorine demand is the difference between the amount of chlorine added to wastewater and the amount of residual chlorine remaining after a given contact time. Chlorine demand may change with dosage, time, temperature, pH, and nature and amount of the impurities in the water.

$$\text{Chlorine Demand, mg/L} = \text{Chlorine Applied, mg/L} - \text{Chlorine Residual, mg/L}$$

**CHLORINE REQUIREMENT:** The amount of chlorine which is needed for a particular purpose. Some reasons for adding chlorine are reducing the number of coliform bacteria (Most Probable Number), obtaining a particular chlorine residual, or oxidizing some substance in the water. In each case a definite dosage of chlorine will be necessary. This dosage is the chlorine requirement.

**CLARIFIER:** Settling Tank, Sedimentation Basin. A tank or basin in which wastewater is held for a period of time during which the heavier solids settle to the bottom and the lighter material will float to the water surface.

**COAGULANTS:** Chemicals that cause very fine particles to clump (floc) together into larger particles. This makes it easier to separate the solids from the water by settling, skimming, draining or filtering.

**COAGULATION:** The clumping together of very fine particles into large particles (floc) caused by the use of chemicals (coagulants).

**COLIFORM:** A type of bacteria. The presence of coliform-group bacteria is an indication of possible pathogenic bacterial contamination. The human intestinal tract is one of the main habitats of coliform bacteria. They may also be found in the intestinal tracts of warm-blooded animals, and in plants, soil, air, and the aquatic environment. Fecal coliforms are those coliforms found in the feces of various warm-blooded animals; whereas the term "coliform" also includes various other environmental sources.

**COLORIMETRIC MEASUREMENT:** A means of measuring unknown chemical concentrations in water by *MEASURING A SAMPLE'S COLOR INTENSITY*. The specific color of the sample, developed by addition of chemical reagents, is measured with a photoelectric colorimeter or is compared with "color standards" using, or corresponding with, known concentrations of the chemical.

**COMMINUTOR:** A device used to reduce the size of the solid chunks in wastewater by shredding (comminuting). The shredding action is like many scissors cutting or chopping to shreds all the large influent solids material in the wastewater.

**COMPOSITE:** A composite sample is a collection of individual samples obtained at regular intervals, usually every one or two hours during a 24-hour time span. Each individual sample is combined with the others in proportion to the rate of flow when the sample was collected. The resulting mixture (composite sample) forms a representative sample and is analyzed to determine the average conditions during the sample period.

**CONFINED SPACE:** Confined space means a space that:

- A. Is large enough and so configured that an employee can bodily enter and perform assigned work; and
- B. Has limited or restricted means for entry or exit; and
- C. Is not designed for continuous employee occupancy.

(Definition from the Code of Federal Regulations (CFR) Title 29 Part 1910.146.)

**CROSS CONNECTION:** A connection between a drinking (potable) water system and an unapproved water supply. For example, if you have a pump moving nonpotable water and hook into the drinking water system to supply water for the pump seal, a cross connection or mixing between the two water systems can occur. This mixing may lead to contamination of the drinking water.

**DECHLORINATION:** The removal of chlorine from the effluent of a treatment plant.

**DENITRIFICATION:**

- (1) The anoxic biological reduction of nitrate nitrogen to nitrogen gas.
- (2) The removal of some nitrogen from a system.
- (3) An anoxic process that occurs when nitrite or nitrate ions are reduced to nitrogen gas and nitrogen bubbles are formed as a result of this process.

**DETENTION TIME:** The time required to fill a tank at a given flow or the theoretical time required for a given flow of wastewater to pass through a tank.

**DETRITUS:** The heavy, coarse mixture of grit and organic material carried by wastewater. (also called grit).

**DIFFUSED-AIR AERATION:** A diffused air activated sludge plant takes air, compresses it, and then discharges the air below the water surface of the aerator through some type of air diffusion device.

**DIFFUSER:** A device used to break the air stream from the blower system into fine bubbles in an aeration tank or reactor.

**DIGESTER:** A tank in which sludge is placed to allow decomposition by microorganisms. Digestion may occur under anaerobic (more common) or aerobic conditions.

**DISINFECTION:** The process designed to kill or inactivate most microorganisms in wastewater, including essentially all pathogenic (disease-causing) bacteria. There are several ways to disinfect, with chlorination being the most frequently used in water and wastewater treatment plants.

**DISSOLVED OXYGEN (DO):** Molecular (atmospheric) oxygen dissolved in water or wastewater.

**EFFLUENT:** Wastewater or other liquid - raw (untreated), partially or completely treated - flowing *FROM* a reservoir, basin, treatment process or treatment plant.

**ELUTRIATION:** The washing of digested sludge with fresh water, plant effluent or other wastewater. The goal is to remove fine particles and/or the alkalinity in the sludge. This process reduces the demand for conditioning chemicals and improves settling or filtering characteristics of the sludge.

**EQUALIZING BASIN:** A holding basin in which variations in flow and composition of a liquid are averaged. Such basins are used to provide a flow of reasonably uniform volume and composition to a treatment unit. Also called a balancing reservoir.

**ESTUARY:** Bodies of water that are located at the lower end of a river and are subject to tidal fluctuations.

**EVAPOTRANSPIRATION:**

- The process by which water vapor passes into the atmosphere from living plants. Also called Transpiration.
- The total water removed from an area by transpiration (living plants) and by evaporation from soil, snow and water surfaces.

**EUTROPHICATION:** The increase of nutrient levels of a lake or other body of water; this usually causes an increase in the growth of aquatic animal and plant life.

**FILAMENTOUS ORGANISMS:** Organisms that grow in a thread or filamentous form. Common types are *Thiothrix* and *Actinomyces*. A common cause of sludge bulking in the activated sludge process.

**FLOC:** Clumps of bacteria and particles or coagulants and impurities that have come together and formed a cluster. Found in aeration tanks, secondary clarifiers and chemical precipitation processes.

**FLOCCULATION:** The gathering together of fine particles after coagulation to form larger particles by a process of gentle mixing.

**FORCE MAIN:** A pipe that carries wastewater under pressure from the discharge side of a pump to a point of gravity flow downstream.

**FREEBOARD:** The vertical distance from the normal water surface to the top of the confining wall.

**GRAB SAMPLE:** A single sample of water collected at a particular time and place which represents the composition of the water only at that time and place.

**GRIT:** The heavy material present in wastewater, such as sand, coffee grounds, eggshells, gravel and cinders.

**GRIT REMOVAL:** Grit removal is accomplished by providing an enlarged channel or chamber which causes the flow velocity to be reduced and allows the heavier grit to settle to the bottom of the channel where it can be removed.

**HEADWORKS:** The facilities where wastewater enters a wastewater treatment plant. The headworks may consist of bar screens, comminutors, a wet well and pumps.

**HYDROGEN SULFIDE GAS (H<sub>2</sub>S):** Hydrogen sulfide is a gas with a rotten egg odor. This gas is produced under anaerobic conditions. Hydrogen sulfide is particularly dangerous because it dulls your sense of smell so that you do not notice it after you have been around it for a while and because the odor is not noticeable in high concentrations. The gas is very poisonous to your respiratory system, explosive, flammable and colorless.

**INFLOW:** Water discharged into a sewer system and service connections from sources other than regular connections. This includes flow from yard drains, foundation drains and around manhole covers. Inflow differs from infiltration in that it is a direct discharge into the sewer rather than a leak in the sewer itself.

**INFLUENT:** Wastewater or other liquid - raw (untreated) or partially treated - flowing *INTO* a reservoir, basin, treatment process or treatment plant.

**MASKING AGENTS:** Substances used to cover up or disguise unpleasant odors. Liquid masking agents are dripped into the wastewater, sprayed into the air, or evaporated (using heat) with the unpleasant fumes or odors and then discharged into the air by blowers to make an undesirable odor less noticeable.

**MECHANICAL AERATION:** The use of machinery to mix air and water so that oxygen can be absorbed into the water.

**MICROORGANISMS:** Very small organisms that can be seen only through a microscope. Some microorganisms use the wastes in wastewater for food and thus remove or alter much of the undesired matter.

**MIXED LIQUOR:** When the activated sludge in an aeration tank is mixed with primary effluent or the raw wastewater and return sludge, this mixture is then referred to as mixed liquor as long as it is in the aeration tank. Mixed liquor may also refer to the contents of mixed aerobic or anaerobic digesters.

**MIXED LIQUOR SUSPENDED SOLIDS (MLSS):** Suspended solids in the mixed liquor of an aeration tank.

**MIXED LIQUOR VOLATILE SUSPENDED SOLIDS (MLVSS):** The organic or volatile suspended solids in the mixed liquor of an aeration tank. This volatile portion is used as a measure or indication of the microorganisms present.

**NPDES PERMIT:** National Pollutant Discharge Elimination System permit is the regulatory agency document issued by either a federal or state agency which is designed to control all discharges of pollutants from all point sources and storm water runoff into U.S. waterways. A treatment plant that discharges to a surface water will have a NPDES permit.

**NITRIFYING BACTERIA:** Bacteria that change the ammonia and organic nitrogen in wastewater into oxidized nitrogen (usually nitrate).

**OXIDATION:** Oxidation is the addition of oxygen, removal of hydrogen, or the removal of electrons from an element or compound. In wastewater treatment, organic matter is oxidized to more stable substances.

**PACKAGE TREATMENT PLANT:** A small wastewater treatment plant often fabricated at the manufacturer's factory, hauled to the site, and installed as one facility. The package may be either a small primary or a secondary wastewater treatment plant.

**PATHOGENIC ORGANISMS:** bacteria, viruses or cysts, which can cause disease (typhoid, cholera, dysentery) in a host such as a human. Also called Pathogens.

**PERCOLATION:** The movement or flow of waster through soil or rocks.

**POLYMER:** Polymers are used with other chemical coagulants to aid in binding small suspended particles to larger chemical flocs for their removal from water.

**PONDING:** A condition occurring on trickling filters when the hollow spaces (voids) become plugged to the extent that water passage through the filter is inadequate. Ponding may be the result of excessive slime growths, trash, or media breakdown.

**PRECIPITATE:**

- (1) An insoluble, finely divided substance which is a product of a chemical reaction within a liquid.
- (2) The separation from solution of an insoluble substance.

**PRIMARY TREATMENT:** A wastewater treatment process that takes the place in a rectangular or circular tank and allows those substances in wastewater that readily settle or float to be separated from the water being treated.

**RAW WASTEWATER:** Plant influent or wastewater *BEFORE* any treatment.

**RECEIVING WATER:** A stream, river, lake, ocean or other surface or groundwater into which treated or untreated wastewater is discharged.

**RECIRCULATION:** The return of part of the effluent from a treatment process to the incoming flow.

**RETENTION TIME:** The time water, sludge or solids are retained or held in a clarifier or sedimentation tank.

**RISING SLUDGE:** Rising sludge occurs in the secondary clarifiers of activated sludge plants when the sludge settles to the bottom of the clarifier, is compacted, and then starts to rise to the surface, usually as a result of denitrification.

**SCREEN:** A device used to retain or remove suspended or floating objects in wastewater. The screen has openings that are generally uniform in size. It retains or removes objects larger than the openings. A screen may consist of bars, rods, wires, gratings, wire mesh, or perforated plates.

**SEPTIC:** A condition produced by anaerobic bacteria. If severe, the wastewater produces hydrogen sulfide, turns black, gives off foul odors, contains little or no dissolved oxygen, and creates a high oxygen demand.

**SEWAGE:** The used waster and waster-carried solids from homes that flow in sewers to a wastewater treatment plant. The preferred term is WASTEWATER.

**SHORT-CIRCUITING:** A condition that occurs in tanks or basins when some of the water travels faster than the rest of the flowing water. This is usually undesirable since it may result in shorter contact, reaction, or settling times in comparison with the theoretical (calculated) or presumed detention times.

**SLUDGE:**

- (1) The settleable solids separated from liquids during processing.
- (2) The deposits of foreign material on the bottoms of streams or other bodies of water.

**SLUDGE DIGESTION:** The process of changing organic matter in sludge into a gas or liquid or a more stable solid form. These changes take place as microorganisms feed on sludge in anaerobic (more common) or aerobic digesters.

**SOLUBLE BOD:** Soluble BOD is the BOD of water that has been filtered in the standard suspended solids test.

**SOLUTION:** A liquid mixture of dissolved substances. In a solution it is impossible to see all the separated parts.

**STORM SEWER:** A separate pipe, conduit or open channel (sewer) that carries runoff from storms, surface drainage, and street wash, but does not include domestic and industrial wastes.

**SUPERNATANT:** Liquid removed from settling sludge. Supernatant commonly refers to the liquid between the sludge on the bottom and the scum on the surface of an anaerobic digester. The liquid is usually returned to the influent wet well or to the primary clarifier.

**SUSPENDED SOLID:** Solids that either float on the surface or are suspended in water, wastewater, or other liquids, and which are largely removable by laboratory filtering.

**TOXIC:** A substance which is poisonous to a living organism.

**TOXICITY:** The relative degree of being poisonous or toxic. A condition which may exist in wastes and will inhibit or destroy the growth or function of certain organisms.

**TRANSPIRATION:** See Evapotranspiration.

**TURBID:** Having a cloudy or muddy appearance.

**VOLATILE SOLIDS:** Those solids in water, wastewater, or other liquids that are lost on ignition of the dry solids at 550°C.

**WASTEWATER:** The used water and solids from a community that flow to a treatment plant. Storm water, surface water, and groundwater infiltration also may be included in the wastewater that enters a wastewater treatment plant. The term "sewage" usually refers to household wastes, but this word is being replaced by the term "wastewater."

**WEIR:**

(1) A wall or plate placed in an open channel and used to measure the flow of water. The depth of the flow over the weir can be used to calculate the flow rate, or a chart or conversion table may be used.

(2) A wall or obstruction used to control flow (from settling tanks and clarifiers) to assure a uniform flow rate and avoid short-circuiting.

**WET OXIDATION:** A method of treating or conditioning sludge before the water is removed. Compressed air is blown into the sludge; the air and sludge mixture is fed into a pressure vessel where the organic material is stabilized.

**WET WELL:** A compartment or tank in which wastewater is collected. The suction pipe of a pump may be connected to the wet well or a submersible pump may be located in the wet well.

**ZOOGLIAL MASS:** Jelly like masses of bacteria found in both the trickling filter and activated sludge processes. See also Biomass.