

APPENDIX A. LIST OF DEFINITIONS

A.1 List of Definitions

accuracy. How closely an instrument measures the true or actual value of the process variable being measured or sensed.

acidic. The condition of water or soil which contains a sufficient amount of acid substances to lower the pH below 7.0.

activated carbon. Adsorptive particles or granules of carbon usually obtained by heating carbon (such as wood). These particles or granules have a high capacity to selectively remove certain trace and soluble organic materials from water.

air binding. A situation where air enters the filter media. Air is harmful to both the filtration and backwash processes. Air can prevent the passage of water during the filtration process and can cause the loss of filter media during the backwash process.

alarm contact. A switch that operates when some pre-set low, high or abnormal condition exists.

algae. Microscopic plants which contain chlorophyll and live floating or suspended in water. They also may be attached to structures, rocks or other submerged surfaces. They are food for fish and small aquatic animals. Excess algal growths can impart tastes and odors to potable water. Algae produce oxygen during sunlight hours and use oxygen during the night hours. Their biological activities appreciably affect the pH and dissolved oxygen of the water.

alkaline. The condition of water or soil which contains a sufficient amount of alkali substances to raise the pH above 7.0.

alkalinity. The capacity of water to neutralize acids. This capacity is caused by the water's content of carbonate, bicarbonate, hydroxide and occasionally borate, silicate, and phosphate. Alkalinity is expressed in milligrams per liter of equivalent calcium carbonate. Alkalinity is not the same as pH because water does not have to be strongly basic (high pH) to have a high alkalinity. Alkalinity is a measure of how much acid can be added to a liquid without causing a great change in pH.

analog. The readout of an instrument by a pointer (or other indicating means) against a dial or scale.

Association of Boards of Certification. An international organization representing over 150 boards which certify the operators of waterworks and waste water facilities. For

information on ABC publications regarding the preparation of and how to study for operator certification examinations, contact ABC, 4261/2 Fifth Street, P.O. Box 786, Ames, Iowa 50010-0786.

available expansion. The vertical distance from the sand surface to the underside of a trough in a sand filter. This distance is also called FREEBOARD.

back pressure. A pressure that can cause water to backflow into the water supply when a user's water system is at a higher pressure than the public water system.

backflow. A reverse flow condition, created by a difference in water pressures, which causes water to flow back into the distribution pipes of a potable water supply from any source or sources other than an intended source. Also see backsiphonage and cross-connection.

backsiphonage. A form of backflow caused by a negative or below atmospheric pressure within a water system. Also see backflow and cross-connection.

backwashing. The process of reversing the flow of water back through the filter media to remove the entrapped solids.

bacteria. Singular: bacterium. Microscopic living organisms usually consisting of a single cell. Bacteria can aid in pollution control by consuming or breaking down organic matter in sewage, or by similarly acting on oil spills or other water pollutants. Some bacteria in soil, water or air may also cause human, animal and plant health problems.

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

best available technology (BAT). The best technology treatment techniques, or other means which the Administrator finds, after examination for efficacy under field conditions and not solely under laboratory conditions, are available (taking cost into consideration). For the purposes of setting MCLs for synthetic organic chemicals, any BAT must be at least as effective as granular activated carbon.

best management practices (BMPs). Structural, nonstructural and managerial techniques that are recognized to be the most effective and practical means to control nonpoint source pollutants yet are compatible with the productive use of the resource to which they are applied. BMPs are used in both urban and agricultural areas.

bias. An inadequacy in experimental design that leads to results or conclusions not representative of the population under study.

breakthrough. A crack or break in a filter bed allowing the passage of floc or particulate

matter through a filter. This will cause an increase in filter effluent turbidity. A breakthrough can occur: 1) when a filter is first placed in service, 2) when the effluent valve suddenly opens or closes, and 3) during periods of excessive head loss through the filter (including when the filter is exposed to negative heads).

calcium carbonate (CaCO₃) equivalent. An expression of the concentration of specified constituents in water in terms of their equivalent value to calcium carbonate. For example, the hardness in water which is caused by calcium, magnesium and other ions is usually described as calcium carbonate equivalent.

calibration. A procedure which checks or adjusts an instrument's accuracy by comparison with a standard or reference.

capital costs. Costs (usually long-term debt) of financing construction and equipment. Capital costs are usually fixed, one-time expenses which are independent of the amount of water produced.

carcinogen. Any substance which tends to produce cancer in an organism.

clarifier. A large circular or rectangular tank or basin in which water is held for a period of time, during which the heavier suspended solids settle to the bottom. Clarifiers are also called SETTLING BASINS and SEDIMENTATION BASINS.

clear well. A reservoir for the storage of filtered water of sufficient capacity to prevent the need to vary the filtration rate with variations in demand. Also used to provide chlorine contact time for disinfection.

coagulant aid. Any chemical or substance used to assist or modify coagulation.

coagulants. Chemicals that cause very fine particles to clump 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 larger particles caused by the use of chemicals (coagulants). The chemicals neutralize the electrical charges of the fine particles and cause destabilization of the particles. This clumping together makes it easier to separate the solids from the water by settling, skimming, draining, or filtering.

cohesion. Molecular attraction which holds two particles together.

colloids. Very small, finely divided solids (particles that do not dissolve) that remain dispersed in a liquid for a long time due to their small size and electrical charge. When most of the particles in water have a negative electrical charge, they tend to repel each other. This repulsion prevents the particles from clumping together, becoming heavier, and settling out.

combined sewer. A sewer that transports surface runoff and human domestic wastes (sewage), and sometimes industrial wastes. Wastewater and runoff in a combined sewer may occur in excess of the sewer capacity and cannot be treated immediately. The excess is frequently discharged directly to a receiving stream without treatment, or to a holding basin for subsequent treatment and disposal.

community water system (CWS). A public water system which serves at least 15 service connections used by year round residents or regularly serves at least 25 persons year-round

residents. Also see non-community water system, transient water system and non-transient non-community water system.

complete treatment. A method of treating water which consists of the addition of coagulant chemicals, flash mixing, coagulation - flocculation, sedimentation and filtration. Also called CONVENTIONAL FILTRATION.

continuous sample. A flow of water from a particular place in a plant to the location where samples are collected for testing. This continuous stream may be used to obtain grab or composite samples. Frequently, several taps (faucets) will flow continuously in the laboratory to provide test samples from various places in a water treatment plant.

conventional filtration. A method of treating water to remove particulates. The method consists of the addition of coagulant chemicals, flash mixing, coagulation - flocculation, sedimentation and filtration. Also called COMPLETE TREATMENT. Also see direct filtration and in-line filtration.

conventional filtration treatment. A series of processes including coagulation, flocculation, sedimentation, and filtration resulting in substantial particulate removal.

cross connection. Any actual or potential connection between a drinking (potable) water system and an unapproved water supply or other source of contamination. For example, if you have a pump moving nonpotable water and hook into the g 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. Also see backsiphonage and backflow.

CT or CTcalc. The product of “residual disinfectant concentration” (C) in mg/l determined before or at the first customer, and the corresponding “disinfectant contact time” (T) in minutes, i.e., “C” x “T”. If a public water system applies disinfectants at more than one point prior to the first customer, it must determine the CT of each disinfectant sequence before or at the first customer to determine the total percent inactivation or “total inactivation ratio”. In determining the total inactivation ratio, the public water system must determine the residual disinfectant concentration of each disinfection sequence and corresponding contact time before any subsequent disinfection application

point(s). “CT99.9” is the CT value required for 99.9 Percent (3-log) inactivation of *Giardia lamblia* cysts. CT99.9 a variety of disinfectants and conditions appear in Tables 1.1- 1.6, 2.1, and 3.1 of section 141.74(b)(3) in the code of Federal Regulations. CT99.9 is the inactivation ratio. The sum of the inactivation ratios, or total inactivation ratio shown as $E = (CT \text{ calc}) / (CT99.9)$ is calculated by adding together the inactivation ratio for each disinfection sequence. A total inactivation ratio equal to or greater than 1.0 is assumed to provide a 3-log inactivation of *Giardia lamblia* cysts.

degasification. A water treatment process which removes dissolved gases from the water. The gases may be removed by either mechanical or chemical treatment methods or a combination of both.

degradation. Chemical or biological breakdown of a complex compound into simpler compounds.

diatomaceous earth filtration (DE filtration). A filtration method resulting in substantial particulate removal, that uses a process in which: 1) a “precoat” cake of diatomaceous earth filter media is deposited on a support membrane (septum), and 2) while the water is filtered by passing through the cake on the septum, additional filter media, known as “body feed,” is continuously added to the feed water to maintain the permeability of the filter cake.

direct filtration. A filtration method of treating water which consists of the addition of coagulant chemicals, flash mixing, coagulation, minimal flocculation, and filtration. The flocculation facilities may be omitted, but the physical-chemical reactions will occur to some extent. The sedimentation process is omitted. Also see conventional filtration and in-line filtration.

effective range. That portion of the design range (usually upper 90 percent) in which an instrument has acceptable accuracy. Also see range and span

effective size (E.S.). The diameter of the particles in a granular sample (filter media) for which 10 percent of the total grains are smaller and 90 percent larger on a weight basis. Effective size is obtained by passing granular material through sieves with varying dimensions of mesh and weighing the material retained by each sieve. The effective size is also approximately the average size of the grains.

effluent. Water or some other liquid-raw, partially or completely treated-flowing from a reservoir, basin, treatment process or treatment plant.

end point. Samples are titrated to the end point. This means that a chemical is added, drop by drop, to a sample until a certain color change (blue to clear, for example) occurs. This is called the END POINT of the titration. In addition to a color change, an end point may be reached by the formation of a precipitate or the reaching of a specified pH. An end point may be detected by the use of an electronic device such as a pH meter.

enteric. Of intestinal origin, especially applied to wastes or bacteria.

entrain. To trap bubbles in water either mechanically through turbulence or chemically through a reaction.

EPA. United States Environmental Protection Agency.

epidemic. Widespread outbreak of a disease, or a large number of cases of a disease in a single community or relatively small area. Disease may spread from person to person, and/or by the exposure of many persons to a single source, such as a water supply.

filtration. A process for removing particulate matter from water by passage through porous media.

finished water. Water that has passed through a water treatment plant; all the treatment processes are completed or “finished”. This water is ready to be delivered to consumers. Also called PRODUCT WATER.

floc. Clumps of bacteria and particulate impurities that have come together and formed a cluster. Found in flocculation tanks and settling or sedimentation basins.

flocculation. The gathering together of fine particles in water by gentle mixing after the addition of coagulant chemicals to form larger particles.

garnet. A group of hard, reddish, glassy, mineral sands made up of silicates of base metals (calcium, magnesium, iron and manganese). Garnet has a higher density than sand.

gastroenteritis. An inflammation of the stomach and intestine resulting in diarrhea, with vomiting and cramps when irritation is excessive. When caused by an infectious agent, it is often associated with fever.

Giardia lamblia. Flagellate protozoan which is shed during its cyst stage into the feces of man and animals. When water containing these cysts is ingested, the protozoan causes a severe gastrointestinal disease called giardiasis.

giardiasis. Intestinal disease caused by an infestation of Giardia flagellates.

grab sample. A single sample collected at a particular time and place which represents the composition of the water only at that time and place.

ground water under the direct influence (GWUDI) of surface water. Any water beneath the surface of the ground with: 1) significant occurrence of Insects or other macroorganisms algae, or large-diameter pathogens such as Giardia lamblia or, 2) significant and relatively rapid shifts in water characteristics such as turbidity, temperature, conductivity, or pH which closely correlate to climatological or surface

water conditions. Direct influence must be determined for individual sources in accordance with criteria established by the State. The State determination of direct influence may be based on site-specific measurements of water quality and/or documentation of well construction characteristics and geology with field evaluation.

hardness, water. A characteristic of water caused mainly by the salts of calcium and magnesium, such as bicarbonate, carbonate, sulfate, chloride and nitrate. Excessive hardness in water is undesirable because it causes the formation of soap curds, increased use of soap, deposition of scale in boilers, damage in some industrial processes, and sometimes causes objectionable tastes in drinking water.

head. The vertical distance (in feet) equal to the pressure (in psi) at a specific point. The pressure head is equal to the pressure in psi times 2.31 ft/psi.

head loss. The head, pressure or energy (they are the same) lost by water flowing in a pipe or channel as a result of turbulence caused by the velocity of the flowing water and the roughness of the pipe, channel walls or restrictions caused by fittings. Water flowing in a pipe loses head, pressure or energy as a result of friction losses.

humus. Organic portion of the soil remaining after prolonged microbial decomposition, hydrogeologic cycle. The natural process recycling water from the atmosphere down to (and through) the earth and back to the atmosphere again.

influent. Water or other liquid-raw or partially flowing INTO a reservoir, basin, treatment process or treatment plant.

in-line filtration. The addition of chemical coagulants directly to the filter inlet pipe. The chemicals are mixed by the flowing water. Flocculation and sedimentation facilities are eliminated. This pretreatment method is commonly used in pressure filter installations. Also see conventional filtration and direct filtration.

jar test. A laboratory procedure that simulates a water treatment plant's coagulation/flocculation units with differing chemical doses and also energy of rapid mix, energy of slow mix, and settling time. The purpose of this procedure is to ESTIMATE the minimum or ideal coagulant dose required to achieve certain water quality goals. Samples of water to be treated are commonly placed in six jars. Various amounts of chemicals are added to each jar, and the settling of solids is observed. The dose of chemicals that provides satisfactory settling removal of turbidity and/or color is the dose used to treat the water being taken into the plant at that time. When evaluating the results of a jar test, the operator should also consider the floc quality in the flocculation area and the floc loading on the filter.

legionella. A genus of bacteria, some species of which have caused a type of pneumonia called Legionnaires Disease.

linearity. How closely an instrument measures actual values of a variable through its effective range; a measure used to determine the accuracy of an instrument.

microbial growth. The activity and growth of microorganisms such as bacteria, algae, diatoms, plankton and fungi micrograms per liter (mg/L) One microgram of a substance dissolved in each liter of water. This unit is equal to parts per billion (ppb) since one liter of water is equal in weight to one billion micrograms.

micron. A unit of length. One millionth of a meter or one thousandth of a millimeter. One micron equals 0.00004 of an inch.

microorganisms. Living organisms that can be seen individually only with the aid of a microscope.

milligrams per liter (mg/L). A measure of concentration of a dissolved substance. A concentration of one mg/L means that one milligram of a substance is dissolved in each liter of water. For practical purposes, this unit is equal to parts per million (ppm) since one liter of water is equal in weight to one million milligrams. Thus a liter of water containing 10 milligrams of calcium has 10 parts of calcium per one million parts of water, or 10 parts per million (10 ppm).

mudballs. Material that is approximately round in shape and varies from pea-sized up to two or more inches in diameter. This material forms in filters and gradually increases in size when not removed by the backwashing process.

National Environmental Training Association (NETA). A professional organization devoted to serving the environmental trainer and promoting better operation of waterworks and pollution control facilities. For information on NETA membership and publications, contact NETA, 8687 Via de Ventura, Suite 214, Scottsdale, AZ 85258

nephelometric. A means of measuring turbidity in a sample by using an instrument called a nephelometer. A nephelometer passes light through a sample and the amount of light deflected (usually at a 90-degree angle) is then measured.

nephelometric turbidity unit (NTU). The unit of measure for turbidity.

non-transient non-community water system (NTNCWS). A public water system that regularly serves at least 25 of the same nonresident persons per day for more than six months per year.

non-community water system (NCWS). A public water system that is not a community water system. There are two types of NCWSs: transient and non-transient.

operation and maintenance costs. The ongoing, repetitive costs of operating a water system; for example, employee wages and costs for treatment chemicals and periodic

equipment repairs.

organic. Substances that come from animal or plant sources. Organic substances always contain carbon. (Inorganic materials are chemical substances of mineral origin.)

organics. 1) A term used to refer to chemical compounds made from carbon molecules. These compounds may be natural materials (such as animal or plant sources) or man-made materials (such as synthetic organics). 2) Any form of animal or plant life.

overflow rate. One of the guidelines for the design of settling tanks and clarifiers in treatment plants. Used by operators to determine if tanks and clarifiers are hydraulically (flow) over- or underloaded. $\text{Overflow Rate (GPD/sq ft)} = \text{Flow (GPD)}/\text{Surface Area (sq ft)}$ particle count. The results of a microscopic examination of treated water with a special “particle counter” which classifies suspended particles by number and size.

particulate. A very small solid suspended in water which can vary widely in size, shape, density, and electrical charge. Colloidal and dispersed particulates are artificially gathered together by the processes of coagulation and flocculation.

pathogenic organisms. Organisms, including bacteria, viruses or cysts, capable of causing diseases (typhoid, cholera, dysentery) in a host (such as a person). There are many types of organisms which do NOT cause disease. These organisms are called non-pathogenic.

pathogens. Microorganisms that can cause disease in other organisms or in humans, animals and plants. They may be bacteria, viruses, or parasites and are found in sewage in runoff from animal farms or rural areas populated with domestic and/or wild animals, and in water used for swimming. Fish and shellfish contaminated by pathogens, or the contaminated water itself, can cause serious illnesses.

performance evaluation sample. A reference sample provided to a laboratory for the purpose of demonstrating that the laboratory can successfully analyze the sample within limits of performance specified by the Agency. The true value of the concentration of the reference material is unknown to the laboratory at the time of the analysis.

pH. pH is an expression of the intensity of the basic or acid condition of a liquid. Mathematically, pH is the logarithm (base 10) of the reciprocal of the hydrogen ion concentration, $[H^+]$. $pH = \text{Log} (1/H^+)$ The pH may range from 0 to 14, where 0 is most acid, 14 most basic, and 7 neutral. Natural waters usually have a pH between 6.5 and 8.5.

plug flow. A type of flow that occurs in tanks, basins or reactors when a slug of water moves through a tank without ever dispersing or mixing with the rest of the water flowing through the tank.

polymer. A chemical formed by the union of many monomers (a molecule of low

molecular weight). Polymers are used with other chemical coagulants to aid in binding small suspended particles to larger chemical flocs for their removal from water. All polyelectrolytes are polymers, but not all polymers are polyelectrolytes.

pore. A very small open space in a rock or granular material.

precision. The ability of an instrument to measure a process variable and to repeatedly obtain the same result. The ability of an instrument to reproduce the same results.

public water system. A system for the provision to the public of piped water for human consumption, If such system has at least fifteen service connections or regularly least 60 days out of the year. Such term includes: 1) any collection, treatment, storage, and distribution facilities under control of the operator of such system and used primarily in connection with such system, and 2) any collection or pretreatment storage facilities not under such control which are used primarily in connection with such system. A public water system is either a “community water system” or a “non-community water system.”

range. The spread from minimum to maximum values that an instrument is designed to measure. Also see span and effective range.

recarbonation. A process in which carbon dioxide is bubbled into the water being treated to lower the pH. The pH may also be lowered by the addition of acid. Recarbonation is the final stage in the lime-soda ash softening process. This process converts carbonate ions to bicarbonate ions and stabilizes the solution against the precipitation of carbonate compounds.

reservoir. Any natural or artificial holding area used to store; regulate, or control water.

reverse osmosis. The application of pressure to a concentrated solution which causes the passage of a liquid from the concentrated solution to a weaker solution across a semipermeable membrane. The membrane allows the passage of the solvent (water) but not the dissolved solids (solutes). The liquid produced is a demineralized water.

Safe Drinking Water Act (SDWA). Commonly referred to as SDWA. An Act passed by the U.S. Congress in 1974. The Act establishes a cooperative program among local, state and federal agencies to insure safe drinking water for consumers.

sand. Soil particles between 0.05 and 2 .0 mm in diameter.

sand filters. Devices that remove some suspended solids from sewage. Air and bacteria decompose additional wastes filtering through the sand so that cleaner water drains from the bed.

sedimentation. A water treatment process in which solid particles settle out of the water being treated in a large clarifier or sedimentation basin.

slow sand filtration. A process involving passage of raw water through a bed of sand at low velocity (generally less than 0.4 m/h) resulting in substantial particulate removal by physical and biological mechanisms.

standard. A physical or chemical quantity whose value is known exactly, and is used to calibrate or standardize instruments.

Standard Methods for the Examination of Water and Wastewater. A joint publication of the American Public Health Association, American Water Works Association, and the Water Pollution Control Federation which outlines the procedures used to analyze the impurities in water and wastewater.

standardize. To compare with a standard. 1) In wet chemistry, to find out the exact strength of a solution by comparing it with a standard of known strength. 2) To set up an instrument or device to read a standard. This allows you to adjust the instrument so that it reads accurately, or enables you to apply a correction factor to the readings.

State. The agency of the State or Tribal government which has jurisdiction over public water systems. During any period when a State or Tribal government does not have primary enforcement responsibility pursuant to Section 1413 of the Safe Drinking Water Act, the term "State" means the Regional Administrator, U.S. Environmental Protection Agency.

surface water. All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors which are directly influenced by surface water.

surfactant. Abbreviation for surface-active agent. The active agent in detergents that possesses a high cleaning ability.

suspended solids. 1) Solids that either float on the surface or are suspended in water or other liquids, and which are largely removable by laboratory filtering. 2) The quantity of material removed from water in a laboratory test, as prescribed in STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER.

transient water system. A non-community water system that does not serve 25 of the same nonresident persons per day for more than six months per year. Also called a transient non-community water system (TNCWS).

tube settler. A device that uses bundles of small bore (2 to 3 inches or 50 to 75 mm) tubes installed on an incline as an aid to sedimentation. The tubes may come in a variety of shapes including circular and rectangular. As water rises within the tubes, settling solids fall to the tube surface. As the sludge (from the settled solids) in the tube gains weight, it moves down the tubes and settles to the bottom of the basin for removal by conventional sludge collection means. Tube settlers are sometimes installed in sedimentation basins and

clarifiers to improve particle removal.

turbid. Having a cloudy or muddy appearance.

turbidimeter. A device that measures the amount of suspended solids in a liquid.

turbidity. The cloudy appearance of water caused by the presence of suspended and colloidal matter. In the waterworks field, a turbidity measurement is used to indicate the clarity of water. Technically, turbidity is an optical property of the water based on the amount of light reflected by suspended particles. Turbidity cannot be directly equated to suspended solids because white particles reflect more light than dark-colored particles and many small particles will reflect more light than an equivalent large particle.

urban runoff. Stormwater from city streets and adjacent domestic or commercial properties that may carry pollutants of various kinds into the sewer systems and/or receiving waters.

virus. The smallest form of microorganisms capable of causing disease. Especially, a virus of fecal origin that is infectious to humans by waterborne transmission.

waterborne disease outbreak. The significant occurrence of acute infectious illness, epidemiologically associated with the ingestion of water from a public water system that is deficient in treatment, as determined by the appropriate local or state agency.

water supplier. A person who owns or operates a public water system.

water supply system. The collection, treatment, storage, and distribution of potable water from source to consumer.

zeta potential. In coagulation and flocculation procedures, the difference in the electrical charge between the dense layer of ions surrounding the particle and the charge of the bulk of the suspended fluid surrounding this particle. The zeta potential is usually measured in millivolts.

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