Department Of Health

Working Copy of *Waterworks Regulations*

Chapter 590

Waterworks Regulations

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Part I - General Framework for Waterworks Regulations

12VAC5-590-10. Definitions and units of measurement.

A. Definitions. As used in this chapter, the following words, terms, and abbreviations shall have meanings respectively set forth unless the context clearly requires a different meaning:

"Action level" or "AL" means the concentration of lead or copper in water specified in 12VAC5-590-385, which determines, in some cases, the treatment requirements contained in 12VAC5-590-405 that an owner is required to complete.

"Administrative Process Act" or "APA" means Chapter 40 (§ 2.2-4000 et seq.) of Title 2.2 of the Code of Virginia. The APA is the basic law conferring authority on agencies either to make regulations or case decisions as well as to standardize court review thereof.

"Air gap separation" means the unobstructed vertical distance through the free atmosphere between the lowest point of the potable water outlet and the flood rim of the receiving vessel.

"ANSI" means the American National Standards Institute.

"Applied water" means water that is ready for filtration.

"ASME" means the American Society of Mechanical Engineers.

"ASSE" means the American Society of Sanitary Engineering.

"ASTM" means the American Society for Testing and Materials.

"Auxiliary water system" means any water supply or system on or available to the premises of the consumer other than the waterworks. These may be polluted or contaminated, objectionable, or of questionable quality and constitute an unapproved water supply or system over which the waterworks owner does not have control.

"AWWA" means the American Water Works Association.

"Backflow" means the undesirable reversal of flow of water or mixtures of water and other liquids, gases, or other substances into a waterworks.

"Backflow elimination method" means the air gap separation or physical disconnection that will eliminate the cross-connection.

"Backflow prevention assembly" means a mechanical unit, designed to control various cross-connections and stop the reversal of flow that includes an inlet and outlet shutoff valve and test cocks to facilitate testing of the assembly. Backflow prevention assemblies include the reduced pressure principle backflow prevention assembly, the double check valve assembly, and the pressure vacuum breaker assembly.

"Backflow prevention device" means a mechanical unit designed to control cross-connections and stop the reversal of flow that is not testable because it does not have inlet and outlet shutoff valves or test cocks. A backflow prevention device is not generally designed or constructed to withstand continuous pressure over 12 hours, or to control high hazards. A backflow prevention device generally includes the atmospheric type vacuum breakers and the dual check valve type devices.

"Backpressure backflow" means backflow caused by pressure in the downstream piping that is superior to the supply pressure at the point of consideration.

"Backsiphonage" means backflow caused by a reduction in pressure that causes a partial vacuum, creating a siphon effect.

"Bag filters" means pressure-driven separation devices that remove particulate matter larger than one micrometer using an engineered porous filtration media. Bag filters are typically constructed of a nonrigid, fabric filtration media housed in a pressure vessel in which the direction of flow is from the inside of the bag to outside.

"Bank filtration" means a water treatment process that uses a well to recover surface water that has naturally infiltrated into groundwater through a river bed or bank. Infiltration is typically enhanced by the hydraulic gradient imposed by a nearby pumping water supply or other well.

"Best available technology" or "BAT" means the best practicable technology, treatment techniques, or other means that the department finds, after examination for efficacy under field conditions and not solely under laboratory conditions that are available (taking cost into consideration).

"Board" means the State Board of Health.

"Boil water advisory" and "boil water notice" mean a statement that informs consumers that drinking water is or may be contaminated and that the water should be boiled before being used for human consumption.

"BSSP" means a bacteriological sample siting plan.

"CAP" means a corrective action plan.

"Cartridge filters" means pressure-driven separation devices that remove particulate matter larger than one micrometer using an engineered porous filtration media. Cartridge filters are typically constructed as rigid or semi-rigid, self-supporting filter elements housed in pressure vessels in which flow is from the outside of the cartridge to the inside.

"Case decision" means an agency determination as defined in § 2.2-4001 of the Code of Virginia.

"CCCP" means a cross-connection control program.

"CCR" means consumer confidence report.

"CDC" means the Centers for Disease Control and Prevention.

"CFE" means the combined filter effluent.

"CFR" means the Code of Federal Regulations.

"Clean compliance history" means a record of no PMCL violations for microbiological contaminants, no monitoring violations under 12VAC5-590-370, and no coliform treatment technique trigger exceedances or treatment technique violations under 12VAC5-590-392.

"Coagulation" means a process using coagulant chemicals and mixing by which colloidal and suspended materials are destabilized and agglomerated into floc.

"Combined distribution system" means the interconnected distribution system consisting of the distribution systems of wholesale waterworks and of the consecutive waterworks that receive finished water.

"Commissioner" means the State Health Commissioner, who is the executive officer of the board.

"Community waterworks" means a waterworks that serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.

"Compliance cycle" means the nine-year calendar year cycle during which a waterworks shall monitor. Each compliance cycle consists of three three-year compliance periods. The first calendar year cycle began January 1, 1993, and ended December 31, 2001, with subsequent compliance cycles continuing thereafter.

"Compliance period" means a three-year calendar year period within a compliance cycle. Each compliance cycle consists of three three-year compliance periods. The first compliance period began January 1, 1993, and ended December 31, 1995, with subsequent compliance periods continuing thereafter.

"Comprehensive business plan" means a plan detailing the technical, managerial, and financial commitments that the owner will make in order to assure that the waterworks will have the capability to provide water that complies with this chapter over the long term.

"Confirmation sample" means a sample to be collected by the owner within a specified time after the results of the initial sample are known to have exceeded a specified limit or standard in order to validate the initial result and to determine compliance.

"Confluent growth" means a continuous bacterial growth covering the entire filtration area of a membrane filter, or a portion thereof, in which bacterial colonies are not discrete.

"Consecutive waterworks" means a waterworks that receives some or all of its finished water from one or more waterworks. Consecutive waterworks may provide additional treatment to finished water. Delivery may be through a direct connection or through the distribution system of one or more consecutive waterworks.

"Consolidated" means rock made from sedimentary, igneous, or metamorphic materials that have been metamorphosed or cemented together forming strata or bodies of rock.

"Consumer" means any person receiving water for human consumption from a waterworks.

"Consumer's water system" means any water system located on the consumer's premises, supplied by or in any manner connected to a waterworks.

"Containment" means the safeguard against backflow into a waterworks from a consumer's water system by installing an appropriate backflow prevention assembly, backflow prevention device, or backflow elimination method at the service connection or downstream of the service connection but before any unprotected takeoffs.

"Contaminant" means any objectionable or hazardous physical, chemical, biological, or radiological substance or matter in water.

"Conventional filtration treatment" means a series of processes including coagulation, flocculation, sedimentation, and filtration resulting in substantial particulate removal.

"Corrosion inhibitor" means a substance capable of reducing the corrosivity of water toward metal plumbing materials, especially lead and copper, by forming a protective film on the interior surface of those materials.

"Cross-connection" means any actual or potential link, connection, or physical arrangement, direct or indirect, between used water, an auxiliary water system, or other source of contamination or pollution to the waterworks through which backflow can occur.

"DBPPs" means disinfection byproduct precursors.

"DBPs" means disinfection byproducts.

"DCLS" means the Virginia Department of General Services, Division of Consolidated Laboratory Services.

"Department" means the Virginia Department of Health.

"DEQ" means the Virginia Department of Environmental Quality.

"Diatomaceous earth filtration" means a process resulting in substantial particulate removal in which (i) a precoat cake of diatomaceous earth filter media is deposited on a support membrane (septum), and (ii) 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" means a series of processes including coagulation and filtration but excluding sedimentation resulting in substantial particulate removal.

"Disinfectant" means any chemical and physical agents, including chlorine, chlorine dioxide, chloramines, ozone, and UV light, added to water in any part of the treatment or distribution process for the purpose of killing or inactivating pathogenic organisms.

"Disinfection" means a process that inactivates or destroys pathogenic organisms in water by use of a disinfectant.

"Disinfection profile" means a summary of Giardia lamblia or virus inactivation through the water treatment plant.

"Distribution main" means a water pipeline whose primary purpose is to convey drinking water to service connections.

"Distribution system" means a network of pipelines and appurtenances by which a waterworks delivers drinking water to its consumers.

"DOC" means the dissolved organic carbon in a water sample.

"Double check valve assembly" or "double check detector backflow assembly" means a backflow prevention assembly composed of two single independently acting check valves including tightly closing shutoff valves located at each end of the assembly and test cocks to facilitate testing of the assembly, used for low hazard situations.

"DPOR" means the Virginia Department of Professional and Occupational Regulation.

"Drawdown" means the difference, measured vertically, between the static water level in the well and the water level during pumping.

"Dual sample set" means a set of two samples collected at the same time and same location, with one sample analyzed for TTHM and the other sample analyzed for HAA5.

"Enhanced coagulation" means the addition of sufficient coagulant for improved removal of disinfection byproduct precursors by conventional filtration treatment.

"Enhanced softening" means the improved removal of disinfection byproduct precursors by precipitative softening.

"Entry point" means the place where water from the source after application of any treatment is delivered to the distribution system. Where two or more sources are combined before distribution, the entry point is the location that is representative of the blended water following all treatment.

"EPA" means the U.S. Environmental Protection Agency.

"Exemption" means allowing a waterworks that satisfies the criteria in 12VAC5-590-150 to deviate from a specific PMCL or treatment technique requirement that is granted to the waterworks for a limited period of time.

"Filter profile" means a graphical representation of individual filter performance, based on continuous turbidity measurements or total particle counts versus time for an entire filter run, from start-up to backwash inclusively, that includes an assessment of filter performance while another filter is being backwashed.

"Filtration" means a process for removing particulate matter from water by passage through porous media.

"Finished water" means water that is introduced into the distribution system of a waterworks and is intended for distribution and consumption without further treatment, except as treatment is necessary to maintain water quality in the distribution system (e.g., booster disinfection).

"Flocculation" means a process to enhance agglomeration or collection of smaller floc particles into larger, more easily settleable particles through gentle stirring by hydraulic or mechanical means.

"Flowing stream" means a course of running water flowing in a definite channel.

"Free available chlorine" means that portion of the total chlorine residual remaining in water at the end of a specified contact period that will react chemically and biologically as hypochlorous acid or hypochlorite ion.

"GAC" means granular activated carbon.

"Gross alpha particle activity" means the total radioactivity due to alpha particle emission as inferred from measurements on a dry sample.

"Gross beta particle activity" means the total radioactivity due to beta particle emission as inferred from measurements on a dry sample.

"Groundwater" means all water obtained from sources not classified as surface water.

"Groundwater system" means any waterworks that uses groundwater as its source of supply; however, a waterworks that combines all its groundwater with surface water or with groundwater under the direct

influence of surface water before treatment is not a groundwater system. Groundwater systems include consecutive waterworks that receive potable water from another groundwater source.

"Groundwater under the direct influence of surface water" or "GUDI" means any water beneath the surface of the ground with (i) significant occurrence of insects or other macroorganisms, algae, or large-diameter pathogens such as Giardia lamblia or Cryptosporidium or (ii) significant and relatively rapid shifts in water characteristics such as turbidity, temperature, conductivity, or pH that closely correlate to climatological or surface water conditions. GUDI source determinations shall be made by the department in accordance with 12VAC5-590-430.

"GWMA" means the groundwater management area designation by the State Water Control Board.

"Haloacetic acids (five)" or "HAA5" means the sum of the concentrations of the haloacetic acids, expressed in milligrams per liter (mg/L) as rounded to two significant figures. For the purpose of this chapter the HAA5 shall mean monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, and dibromoacetic acid.

"Halogen" means one of the chemical elements chlorine, bromine, fluorine, astatine, or iodine.

"Health hazard" means any condition, device, or practice in a waterworks or its operation that creates, or may create, a danger to the health and well-being of the water consumer.

"HPC" means the heterotrophic plate count of a bacterial population.

"Human consumption" means drinking, food preparation, dishwashing, bathing, showering, hand washing, teeth brushing, and maintaining oral hygiene.

"Hypochlorite" means the ionic component from the disassociation of hypochlorous acid that performs the function of disinfection. It is the available active ingredient in liquid hypochlorite disinfectants such as sodium and calcium hypochlorite.

"Initial compliance period" means the compliance period in which chemical and radiological monitoring began, and it is represented by the first full three-year compliance period beginning at least 18 months after rule promulgation. It applies to inorganic, organic, and radionuclide contaminants listed in Tables 340.1, 340.2, and 340.4, respectively.

"Isolation" means the safeguard against backflow into a waterworks from a consumer's water system by installing an appropriate backflow prevention assembly or device or by installing a backflow elimination method at the sources of potential contamination in the consumer's water system. This is also called point-of-use isolation.

"Karst geology" means an area predominantly underlain by limestone, dolomite, or gypsum and characterized by rapid underground drainage. These areas often feature sinkholes, caverns, and sinking or disappearing creeks.

"Lake or reservoir" means a natural or man-made basin or hollow on the Earth's surface in which water collects or is stored that may or may not have a current or single direction of flow.

"Lead free" means the following: (i) when used with respect to solders and flux, refers to solders and flux containing not more than 0.2% lead; and (ii) when used with respect to pipes, pipe fittings, plumbing fittings, and plumbing fixtures, refers to the weighted average of wetted surfaces of pipes, pipe fittings, plumbing fittings, and plumbing fixtures containing not more than 0.25% lead.

"Lead service line" means a pipeline made of lead that connects the distribution main to the building inlet and any lead pigtail, gooseneck, or other fitting that is connected to the lead pipeline.

"Leakage" means the loss of potable water from the distribution system, up to the points of service connections, through breaks or defects in piping and piping appurtenances.

"Legionella" means a genus of bacteria, some species of which cause a type of pneumonia called Legionnaires disease.

"Level 1 assessment" means an evaluation to identify the possible presence of sanitary defects, defects in distribution system coliform monitoring practices, and, when possible, the likely reason that the waterworks triggered the assessment.

"Level 2 assessment" means an evaluation to identify the possible presence of sanitary defects, defects in distribution system coliform monitoring practices, and, when possible, the likely reason that the waterworks triggered the assessment in a more comprehensive investigation than a Level 1 assessment.

"Locational running annual average" or "LRAA" means the average of sample analytical results for samples taken at a particular monitoring location during the previous four calendar quarters.

"Log inactivation" means the inactivation of organisms expressed on a logarithmic scale. For example, a 99.9% inactivation is a 3-log inactivation; whereas a 99.99% inactivation is a 4-log inactivation.

"Log removal" means the removal of organisms expressed on a logarithmic scale. For example, a 99.9% is a 3-log removal; whereas a 99.99% removal is a 4-log removal.

"Maximum contaminant level" or "MCL" means the maximum permissible level of a contaminant in potable water that is delivered to any consumer of a waterworks. MCLs are set as close to the MCLGs as feasible using the BAT. MCLs may be either "primary" (PMCL), meaning based on health considerations, or "secondary" (SMCL), meaning based on aesthetic considerations.

"Maximum contaminant level goal" or "MCLG" means the maximum level of a contaminant in drinking water at which no known or anticipated adverse effect on the health of persons would occur and that allows an adequate margin of safety. Maximum contaminant level goals are nonenforceable health goals.

"Maximum residual disinfectant level" or "MRDL" means a level of a disinfectant added for water treatment that may not be exceeded at the consumer's tap without an unacceptable possibility of adverse health effects.

"Maximum residual disinfectant level goal" or "MRDLG" means the maximum level of a disinfectant added for water treatment at which no known or anticipated adverse effect on the health of persons would occur, and that allows an adequate margin of safety. MRDLGs are nonenforceable health goals and do not reflect the benefit of the addition of the chemical for control of waterborne microbial contaminants.

"Maximum total trihalomethane potential" or "MTP" means the maximum concentration of total trihalomethanes (TTHMs) produced in a given water containing a residual disinfectant after seven days at a temperature of 25°C or above.

"Membrane filtration" means a pressure or vacuum-driven separation process in which particulate matter larger than one micrometer is rejected by an engineered barrier, primarily through a size exclusion mechanism, and that has a measurable removal efficiency of a target organism that can be verified through the application of a direct integrity test. Included in this definition are the common membrane classifications of microfiltration (MF), ultrafiltration (UF), nanofiltration (NF), and reverse osmosis (RO).

"Membrane module" means the smallest component of a membrane unit in which a specific membrane surface area is housed in a device with a filtrate outlet.

"Membrane technology" means a process that uses a permeable membrane to remove ions, molecules, or particles from the process stream, such as MF, UF, NF, RO, and electrodialysis reversal (EDR).

"Membrane unit" means a group of membrane modules that share common valving that allows the unit to be isolated from the rest of the system for the purpose of integrity testing or other maintenance.

"Method detection limit" or "MDL" means the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.

"Microfiltration" or "MF" means a pressure-driven membrane technology that separates particles, based on the pore-size rating of the membrane, from a feed stream by using a sieving mechanism. Typically, MF can remove particles down to 0.1 micrometer in size.

"Most probable number" or "MPN" means the density or number of organisms per unit volume most likely to be present in a water sample and obtained from method-specific statistical MPN tables.

"MPA" means the microscopic particulate analysis method approved by EPA for use in the determination of whether a groundwater is under the influence of surface water.

"Nanofiltration" or "NF" means a pressure-driven membrane technology designed to remove multivalent ions ("softening") and other constituents based on the pore size, which ranges from one to 10 nanometers. Nanofiltration membranes typically operate under a pressure range of 600 to 1100 psi.

"Noncommunity waterworks" means a waterworks that is not a community waterworks, but operates at least 60 days out of the year.

"Nonpotable water" means water not classified as pure water.

"Nontransient noncommunity waterworks" or "NTNC" means a waterworks that is not a community waterworks and that regularly serves at least 25 of the same persons over six months out of the year. When used in the context of an NTNC, "regularly serves" means four or more hours per day, for four or more days per week, for 26 or more weeks per year.

"NSF" means NSF International, formerly known as the National Sanitation Foundation. NSF collaborates with ANSI and Canadian authorities on drinking water standards development (NSF/ANSI/CAN).

"One hundred year flood elevation" or "100-year flood elevation" means flood elevation that has a 1.0% probability of being equaled or exceeded in any given year.

"Operating staff" means individuals employed or appointed by an owner to work at a waterworks. Included in this definition are operators, whether or not the operator's license is appropriate for the classification and category of the waterworks, and unlicensed individuals.

"Operator" means any individual with the requisite skills, employed or appointed by any owner, who is designated by the owner to be the person having full responsibility for the waterworks operations and any subordinate operating staff. The individual may be a supervisor, a shift operator, or a substitute in charge, and have duties including testing or evaluation to control waterworks operations. Not included in this definition are superintendents or directors of public works, city engineers, or other municipal or industrial officials whose duties do not include the actual operation or direct supervision of waterworks.

"Optimal corrosion control treatment" means the corrosion control treatment that minimizes the lead and copper concentrations at consumers' taps while ensuring that the treatment does not cause the waterworks to violate any other section of this chapter.

"Optimum fluoride ion concentration" means that fluoride ion concentration recommended by the U.S. Public Health Service for protection from dental caries.

"Owner" means an individual, group of individuals, partnership, firm, association, institution, corporation, governmental entity, or the federal government that supplies or proposes to supply water to any person within the Commonwealth from or by means of any waterworks.

"PAC" means powdered activated carbon.

"PCBs" means polychlorinated biphenyls.

"PER" means a preliminary engineering report.

"Permit" means an authorization granted by the commissioner to construct or operate a waterworks.

"Permitted capacity" means the limiting hydraulic capability of the waterworks, taking into consideration the source water capacity, treatment facilities, finished water storage, delivery, and distribution system.

"Person" means any individual, corporation, partnership, association, cooperative, limited liability company, trust, joint venture, government, political subdivision, or any other legal or commercial entity and any successor, representative, agent, or instrumentality thereof.

"pH" means the negative logarithm of the hydrogen ion concentration of an aqueous solution.

"Physical disconnection" means the removal or absence of pipes, fittings, or fixtures that connect a waterworks directly or indirectly to any other water system.

"Picocurie" or "pCi" means that quantity of radioactive material producing 2.22 nuclear transformations per minute.

"PMCL" means the primary maximum contaminant level of a contaminant based on health considerations.

"Point of disinfectant application" means the point where the disinfectant is applied and water downstream of that point is not subject to recontamination by surface runoff.

"Point-of-entry device" or "POE device" means a treatment device applied to the water entering a house or building for the purpose of reducing contaminants in the water distributed throughout the house or building.

"Point-of-use device" or "POU device" means a treatment device applied to a single tap for the purpose of reducing contaminants in the water at that one tap.

"Pollution" means the presence of any foreign substance (chemical, physical, radiological, or biological) in water that tends to degrade its quality so as to constitute an unnecessary risk to human health or impair the usefulness of the water.

"Potable water" means the same as "pure water."

"Practical quantitation level" or "PQL" means the lowest level that can be reliably measured within specified limits of precision and accuracy during routine laboratory conditions.

"Prechlorination" means the application of chlorine to water before filtration.

"Presedimentation" means a preliminary treatment process used to remove gravel, sand, and other particulate material from the source water through settling before the water enters the primary clarification and filtration processes in a water treatment plant.

"Pressure vacuum breaker assembly" means a backflow prevention assembly (i) designed to prevent backsiphonage and used for high hazard or low hazard situations; (ii) composed of an independently operating spring-loaded check valve, an independently operating spring-loaded air-inlet valve, and tightly closing shutoff valves located at each end of the assembly; and (iii) fitted with properly located test cocks to facilitate testing of the assembly.

"Primary disinfection" means disinfection to achieve a desired level of inactivation of targeted pathogenic organisms in water by chemical or physical agents as an integral part of the treatment process.

"Process fluids" means any fluid or solution that may be chemically, biologically, or otherwise contaminated or polluted that would constitute a health, environmental, or system hazard if introduced into the waterworks. This includes (i) polluted or contaminated water; (ii) used waters; (iii) cooling waters; (iv) contaminated natural waters taken from wells, lakes or reservoirs, streams, or irrigation systems; (v) chemicals in solution or suspension; or (vi) oils, gases, acids, alkalis, and other liquid and gaseous fluid used in industrial or other processes.

"Process water" means water used for dissolving dry chemicals; diluting liquid chemicals; and operating chemical feeders, treatment facilities, or equipment.

"Project documents" means the engineer's report, design criteria, preliminary and final plans, specifications, and procurement documents for the construction of new waterworks or modifications to existing waterworks.

"Pure water" means water fit for human consumption that is (i) sanitary and normally free of minerals, organic substances, and toxic agents in excess of reasonable amounts and (ii) adequate in quantity and quality for the minimum health requirements of the persons served.

"QCRV" means the quality control release value used in challenge tests of microfiltration (MF) and ultrafiltration (UF) membrane filters.

"RAA" means running annual average.

"Reduced pressure principle backflow prevention assembly" or "reduced pressure zone backflow prevention assembly" or "RPZ assembly" means an assembly designed to prevent backsiphonage or backpressure backflow and used for high or low hazard situations, composed of two independently operating spring-loaded check valves together with an independent, hydraulically operating pressure differential relief valve located between the two check valves. During normal flow and at the cessation of normal flow, the pressure between these two checks shall be less than the supply pressure. The assembly shall include tightly closing shutoff valves located at each end of the RPZ assembly and shall be fitted with properly located test cocks to facilitate testing of the assembly.

"REM" means the unit of dose equivalent from ionizing radiation to the total body or any internal organ or organ system. A millirem (mrem) is 1/1000 of an REM.

"Repeat compliance period" means any subsequent compliance period after the initial compliance period.

"Residual disinfectant concentration" means the concentration of disinfectant measured in mg/L in a representative sample of water.

"Reverse osmosis" or "RO" means a membrane technology designed to remove salts, low-molecular weight solutes, and all other constituents up to 0.0001 micron in size by applying a pressure in excess of osmotic pressure to force water through a semi-permeable membrane from a region of high solution concentration to a region of lower solution concentration.

"Sanitary defect" means a defect that could provide a pathway of entry for microbial contamination into the distribution system or that is indicative of a failure or imminent failure in a protective barrier that is already in place.

"Sanitary survey" means an evaluation conducted by the department of a waterworks' water supply, facilities, equipment, operation, maintenance, monitoring records, and overall management to ensure the provision of potable water.

"SDWA" means the Safe Drinking Water Act (42 USC § 300f et seq.) and its amendments.

"Seasonal waterworks" means a noncommunity waterworks that is not operated as a waterworks on a year-round basis, and starts up and shuts down at the beginning and end of each operating season.

"Secondary disinfection" means disinfection by chemical oxidants or equivalent agents applied at the entry point or in the distribution system to provide a residual disinfectant in water to maintain water quality and safeguard against chance contamination from permeation, leaching, intrusion, regrowth, or biofilms.

"Sedimentation" means a process for removal of solids before filtration by gravity or separation.

"Service connection" means the point of delivery of finished water from a waterworks to a consumer's water system, fire protection system, irrigation system, and to all other points where finished water is delivered through the distribution system to a consumer. Generally, the service connection occurs at the water meter, or at the distribution main if no water meter is installed, or in the case of an owner of both the waterworks and the building supplied, the point of entry into the building. Service connections may be permanent, temporary, or emergency.

"Service line" means the pipeline or service pipe between the service connection and the building connection.

"Sewer" means any pipe or conduit used to convey sanitary sewage, stormwater, or industrial waste streams. Combined sewers convey both stormwater and sanitary sewage.

"Significant deficiency" means any defect in a waterworks' design, operation, maintenance, or administration, as well as the failure or malfunction of any waterworks component that may cause or has

the potential to cause, an unacceptable risk to health or could affect the reliable delivery of potable water to consumers.

"Single-family structure" means, for the purpose of 12VAC5-590-375 B only, a building constructed as a single-family residence that is currently used as either a residence or a place of business.

"Site visit" means a tour of a waterworks by the department or other authorized persons for purposes including assessing and documenting its physical condition, operations, and compliance activities.

"Slow sand filtration" means a process involving passage of source 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.

"SMCL" means the secondary maximum contaminant level of a contaminant. SMCLs are based on aesthetic qualities related to the public acceptance of drinking water.

"SOP" means standard operating procedure.

"Source water" means water as it is pumped or otherwise withdrawn from a well, spring, stream, lake or reservoir, or any body of surface water (natural or impounded), and before any treatment.

"Supervisory control and data acquisition" or "SCADA" means a computer-controlled system used by a waterworks to monitor its operations. Typical design features may be specific to individual waterworks and include alarm, response, control, and data acquisition.

"Surface water" means all water open to the atmosphere and subject to surface runoff.

"SUVA" means specific ultraviolet absorption at 254 nanometers (nm), an indicator of the humic content of the water. It is a calculated parameter obtained by dividing a sample's ultraviolet absorption at a wavelength of 254 nm (UV_{254}) (in m^{-1}) by its concentration of DOC (in mg/L).

"Synthetic organic chemical" or "SOC" means a man-made organic compound, generally utilized for agriculture or industrial purposes. Table 340.2 lists SOCs regulated as contaminants.

"System hazard" means a condition posing an actual, or threat of, damage to the physical properties of the waterworks or a consumer's water system.

"TDS" means total dissolved solids.

"TMF" means the technical, managerial, and financial capabilities to operate and maintain a waterworks.

"Too numerous to count" or "TNTC" means that the total number of bacterial colonies exceeds 200 on a 47-mm diameter membrane filter used for coliform detection.

"Total organic carbon" or "TOC" means total organic carbon in milligrams per liter (mg/l) measured using heat, oxygen, ultraviolet irradiation, chemical oxidants, or combinations of these oxidants that convert organic carbon to carbon dioxide, rounded to two significant figures.

"Total trihalomethanes" or "TTHM" means the sum of the concentrations of the trihalomethanes (THMs) expressed in milligrams per liter (mg/L) and rounded to two significant figures. For the purpose of this chapter, TTHM shall mean trichloromethane (chloroform), dibromochloromethane, bromodichloromethane, and tribromomethane (bromoform).

"Transient noncommunity waterworks" or "TNC" means a noncommunity waterworks that is not a nontransient noncommunity waterworks (NTNC). A TNC serves at least 25 persons daily for at least 60 days out of the year.

"Treatment" means any process that changes the chemical, physical, radiological, or bacteriological quality of water.

"Treatment technique" or "TT" means a technology or process demonstrated to the satisfaction of the department to lead to a reduction in the level of a specific contaminant sufficient to comply with this chapter.

"Triggered source water monitoring" means monitoring required of any groundwater system as a result of a total coliform-positive sample in the distribution system.

"Trihalomethane" or "THM" means one of the family of organic compounds, named as derivatives of methane, wherein three of the four hydrogen atoms in methane are each substituted by a halogen atom in the molecular structure.

"Ultrafiltration" or "UF" means a membrane technology designed to remove particles up to 0.01 micron in size.

"Unconsolidated" means loose sediment that has not been compacted, cemented, lithified, or metamorphosed into rock. Sediment may be derived from a sedimentary-type, igneous-type, metamorphic-type rock, which includes clay, silt, sand, gravel, and mixtures of these particle types.

"Uncovered finished water storage facility" means a tank, reservoir, or other facility used to store water that will undergo no further treatment to reduce microbial pathogens (except residual disinfection) and is directly open to the atmosphere.

"Unregulated contaminant" or "UC" means a contaminant for which a monitoring requirement has been established, but for which no MCL or treatment technique requirement has been established.

"USBC" means the Uniform Statewide Building Code (13VAC5-63).

"Used water" means any water supplied by a waterworks to a consumer's water system after it has passed through the service connection and is no longer under the control of the owner.

"UV" means ultraviolet.

"Variance" means allowing a waterworks that satisfies the criteria in 12VAC5-590-140 to provide drinking water that does not fully comply with this chapter. A PMCL variance is a variance to a primary maximum contaminant level, or a treatment technique requirement. An operational variance is a variance to an operational regulation or a SMCL.

"Virus" means a virus of fecal origin that is infectious to humans by waterborne transmission and must be preemptively inactivated through disinfection before human consumption.

"Volatile organic chemical" or "VOC" means an organic compound generally characterized by its low molecular weight and its tendency to vaporize rapidly at relatively low temperatures and pressures. Table 340.2 lists VOCs regulated as contaminants.

"VOSH" means the Virginia Occupational Safety and Health program.

"Waiver" means permission from the department to deviate from the monitoring and reporting requirements in this chapter for a specific contaminant.

"Waterborne disease outbreak" means the significant occurrence of acute infectious illness, epidemiologically associated with the ingestion of water from a waterworks that is deficient in treatment, as determined by the commissioner or the State Epidemiologist.

"Water supply" means the source of water taken into a waterworks including wells, streams, springs, lakes or reservoirs, and other bodies of surface waters (natural or impounded), and the tributaries thereto, and all impounded groundwater. The term "water supply" shall not include any waters above the point of intake of the waterworks.

"Water treatment plant" means that portion of a waterworks intended specifically for water treatment; it may include, among other operations, coagulation, sedimentation, filtration, and disinfection.

"Waterworks" means a system that serves piped water for human consumption to at least 15 service connections or 25 or more individuals for at least 60 days out of the year. "Waterworks" includes all structures, equipment, and appurtenances used in the storage, collection, purification, treatment, and distribution of potable water except the piping and fixtures inside the building where such water is delivered.

"Waterworks business operation plan" means the same as "comprehensive business plan."

"Wholesale waterworks" means a waterworks that treats source water as necessary to produce potable water and then delivers some or all of that potable water to another waterworks. Delivery may be through a direct connection or through the distribution system of one or more consecutive waterworks.

B. As used in this chapter, the following units of measurement shall use the abbreviations as shown in this subsection:

C – degrees Celsius

CU – color units

ft^2 – square feet of area

ft/min – feet per minute

ft/sec – feet per second

gpd – gallons per day

gpd/ft^2 – gallons per day per square foot

gpm – gallons per minute

gpm/ft – gallons per minute per foot

gpm/ft^2 – gallons per minute per square foot

in – inches

lb – pounds

lb/day – pounds per day

lb/ft^2 – pounds per square foot

MFL – million fibers per liter

MGD – million gallons per day

mg/L – milligrams per liter

min – minutes

mJ/cm^2 – millijoules per square centimeter

mrem – millirem

nm – nanometer (10^{-9} meter)

NTU – nephelometric turbidity units

pCi – picocuries

pCi/L – picocuries per liter

ppb – parts per billion, or micrograms per liter (µg/L)

ppm – parts per million, or milligrams per liter (mg/L)

ppq – parts per quadrillion, or pictograms per liter (pq/L)

ppt – parts per trillion, or nanograms per liter (ng/L)

psi – pounds per square inch

psig – pounds per square inch gauge

$scfm/ft^2$ – standard cubic feet per minute per square foot

µm – micrometers (10^{-6} meter or microns)

µg/L – micrograms per liter

µS/cm – microSiemens per centimeter

W/m^2 – Watts per square meter

12VAC5-590-35. Delegation of authority.

The commissioner, or the commissioner's designee, may perform any act of the board provided under this chapter, except as limited by § 32.1-20 of the Code of Virginia.

12VAC5-590-40. Administration of this chapter.

A. The board is responsible for promulgating, amending, and repealing regulations to ensure a supply of potable water.

B. The commissioner is vested with all the authority of the board when it is not in session, subject to such rules and regulations as may be prescribed by the board.

C. The department is designated as the primary agent of the board for the purpose of administering this chapter. It examines the technical aspects of all applications and plans for waterworks projects before drafting a permit for final approval by the commissioner. It also has primary responsibility for monitoring waterworks operations to ensure that water supplied to consumers is potable water.

12VAC5-590-45. Waterworks Advisory Committee.

A. A Waterworks Advisory Committee (WAC) shall be formed by the commissioner to review and make recommendations regarding the regulatory, policy, and legislative aspects of the department's authorities. WAC members shall consist of industry professionals employed outside the department with longstanding expertise or vested interest in waterworks operations and represent a diverse group of stakeholders. Members shall be experts in the fields of water treatment technologies, public health, water quality, economics, environmental science, public utilities, community development, or industry regulations. A minimum of nine persons shall be appointed to the committee by the commissioner.

B. The WAC will convene at least quarterly.

C. WAC meetings will be considered public meetings. Notice of scheduled meetings will be posted on the Virginia Regulatory Town Hall at least three working days before the date of the meeting. Meeting minutes will be posted to the Virginia Regulatory Town Hall within 10 working days after the meeting.

D. Each member of the WAC shall hold office for a term of three years, except that:

1. With approval by the commissioner, members are eligible for reappointment to consecutive terms.

2. Each member of the WAC serves at the pleasure of the commissioner.

E. The commissioner shall appoint the chair of the WAC.

F. The WAC shall have a member of the department serve as secretary.

12VAC5-590-50. Application of this chapter to waterworks in operation or planned before June 23, 2021.

A. The owner shall comply with Part II (12VAC5-590-340 et seq.) of this chapter unless a variance or exemption is issued by the commissioner.

B. Compliance with design criteria set forth in Part III of this chapter is limited to modifications to existing waterworks and for all construction of new waterworks commenced after June 23, 2021. Portions of waterworks not being modified are not required to comply with the design criteria of Part III (12VAC5-590-640 et seq.). Waterworks construction or modification is deemed to be commenced for purposes of this section upon issuance of the construction permit.

C. Compliance with the requirements set forth in Part III of this chapter including those for materials, construction methods, and disinfection is necessary for all repairs to pipes, tanks, pumps, and appurtenances that are part of a waterworks.

12VAC5-590-55. Relationship of this chapter to the Uniform Statewide Building Code.

A. This chapter governs waterworks facilities from any source water to all service connections.

B. In accordance with § 36-98 of the Code of Virginia and the USBC, the USBC governs the construction of buildings and structures, including plumbing systems and backflow prevention. The USBC also governs the water service piping from the service connection to a building or structure.

C. Notwithstanding subsections A and B of this section, this chapter shall govern:

1. Water treatment, storage, pumping facilities, and water piping that are part of a waterworks and housed in any building or structure; and

2. Backflow prevention assemblies or elimination methods, or both, installed for containment and located downstream from the service connection, including where located in any building or structure.

12VAC5-590-70. Powers and procedures.

The board reserves the right to utilize any lawful procedure for the enforcement of this chapter.

12VAC5-590-90. [Reserved].

12VAC5-590-100. Exception; emergency regulations.

If the establishment of a regulation is necessary to meet any emergency not provided for by this chapter, the board or commissioner acting on behalf of the board when it is not in session may immediately promulgate and adopt the necessary regulation by complying with the procedures set forth in either § 2.2-4011 or § 32.1-13 of the Code of Virginia.

12VAC5-590-110. Enforcement.

A. Notice. Whenever the department has reason to believe that a violation of Title 32.1 of the Code of Virginia or of any section of this chapter may have occurred or may be occurring, the department shall notify the alleged violator. The notice shall (i) be in writing; (ii) cite the statute or regulations that are allegedly being violated; (iii) state the facts that form the basis for believing that the violation may have occurred or may be occurring; and (iv) include information on the process for obtaining a final decision or fact finding from the department on whether or not a violation has occurred. This notification is not an official finding, case decision, or adjudication but may include a request to the owner to respond timely and to take specific corrective action by a stated deadline.

B. Orders. Pursuant to § 32.1-26 of the Code of Virginia, the board may issue orders to require any owner to comply with the provisions of any law administered by it, the commissioner, or the department; any regulations promulgated by the board, including any section of this chapter; or any case decision of the board or commissioner. The commissioner, acting on behalf of the board when it is not in session, will sign the order, and the order may require:

1. The immediate cessation or correction of the violation;

2. The acquisition or use of additional equipment, supplies, or personnel to ensure that the violation does not recur;

3. The submission of a plan to prevent future violations;

4. The submission of an application for a variance or exemption;

5. Any other corrective action deemed necessary for proper compliance with this chapter; or

6. An evaluation and approval of the required submissions, if appropriate.

C. Compliance with effective orders and this chapter. The commissioner may act as the agent of the board to enforce all effective orders and this chapter. Should any owner fail to comply with any effective order or this chapter, the commissioner may:

1. Institute an administrative proceeding to revoke the owner's permit in accordance with 12VAC5-590-320 and § 32.1-174 of the Code of Virginia or other appropriate administrative remedies;

2. Request the criminal prosecution by a Commonwealth's attorney with the appropriate jurisdiction in accordance with § 32.1-27 of the Code of Virginia;

3. Request civil action by the Attorney General to impose a civil penalty, seek injunctive relief, or other appropriate legal remedies pursuant to §§ 32.1-27 and 32.1-176 of the Code of Virginia; or

4. Do any combination of subdivision C 1, C 2, or C 3 of this section.

D. Special order. Pursuant to § 32.1-175.01 of the Code of Virginia, the commissioner may, after an informal fact-finding proceeding held in accordance with § 2.2-4019 of the Code of Virginia, issue a special order that may include a civil penalty against an owner who violates the Public Water Supplies Law, §§ 32.1-167 through 32.1-176 of the Code of Virginia, this chapter, or any order of the board.

E. Graduated enforcement actions. Nothing in this section shall prevent the commissioner or department from making efforts to obtain voluntary compliance through conference, warning, or other appropriate means before issuance of an order, instituting an administrative proceeding, or requesting an action by a Commonwealth's Attorney or the Attorney General.

12VAC5-590-115. Administrative proceedings.

A. Types of administrative proceedings. Administrative proceedings before the board, the commissioner, or the commissioner's designee, shall include the following forms depending upon the nature of the controversy and the interests of the named party involved.

1. An informal fact-finding proceeding is an informal conference between the department and the named party held in accordance with § 2.2-4019 of the Code of Virginia.

2. A formal hearing is an adjudicatory proceeding before the commissioner or a designated hearing officer held in accordance with § 2.2-4020 of the Code of Virginia.

B. Request for administrative proceeding. The named party may request an administrative proceeding by sending a request in writing to the department.

C. Administrative proceeding as a matter of right. The named party whose rights, duties, or privileges have been or may be affected by any action or inaction of the board, commissioner, or department in the administration of this chapter, has a right to both an informal fact-finding proceeding and a formal hearing; however, the commissioner reserves the right to require participation in an informal fact-finding proceeding before granting the request for a formal hearing.

12VAC5-590-120. Emergency orders.

A. The commissioner may, pursuant to § 32.1-175 of the Code of Virginia, issue emergency orders in any case where there is an imminent danger to the public health resulting from the operation of any waterworks or the source of a water supply.

B. An emergency order may be communicated by the best practical notice under all the circumstances and is effective immediately upon receipt. The commissioner may order the immediate cessation of the operation of any waterworks or the use of any water supply or the correction of any condition causing the production or distribution of any water constituting an imminent danger to the public health and welfare.

C. Violation of an emergency order is subject to civil enforcement and is punishable as a criminal misdemeanor.

D. Emergency orders shall be effective for a period determined by the commissioner.

E. Emergency orders may be appealed in accordance with the provisions of the APA.

12VAC5-590-125. Chronically noncompliant waterworks.

A. If the commissioner or department determines that a waterworks is a chronically noncompliant waterworks, as defined in § 32.1-167 of the Code of Virginia, then the commissioner shall issue an order to the owner containing a schedule to bring the waterworks into compliance with this chapter and require the submission of a waterworks business operation plan. If capital improvements are necessary to bring the waterworks into compliance, and the owner does not possess sufficient assets to make the necessary improvements, the order shall require the owner to make annual, good faith applications for loans, grants, or both, to appropriate financial institutions to secure funding for such improvements, until the

improvements are complete and operational. The owner shall provide a copy of the order to each consumer within 10 calendar days of issuance of the order.

B. Within 15 calendar days of issuance of the commissioner's order, the owner shall certify in writing that a copy of the order was distributed to each consumer within the 10-day period specified in subsection A of this section.

C. The commissioner shall send a copy of the order to the chief administrative officer of the locality in which the waterworks is located for appropriate action under § 15.2-2146 of the Code of Virginia.

D. In addition to the provisions of § 32.1-27 of the Code of Virginia, any owner who violates this chapter, an order of the board, or a statute governing public water supplies shall be subject to those civil penalties provided in Article 2 (§ 32.1-167 et seq.) of Chapter 6 of Title 32.1 of the Code of Virginia.

12VAC5-590-130. Suspension of this chapter.

If, in the case of a man-made or natural disaster, the commissioner determines that certain regulations cannot be complied with, then the enforcement of those regulations may be suspended for designated waterworks and a provisional regulatory scheme instituted until the conditions that brought about the suspension have abated.

12VAC5-590-140. Variances.

A. The commissioner may grant a variance to a PMCL, SMCL, treatment technique requirement, or an operational regulation by following the appropriate procedures set forth in this section.

1. Requirements for a variance. A variance may be granted to a waterworks from any requirement with respect to a PMCL or SMCL upon a finding that:

a. Alternative water supplies are not reasonably available to the waterworks;

b. The characteristics of the source water that is reasonably available to the waterworks prevents the waterworks from meeting the PMCL or SMCL requirements, and on condition that the waterworks installs the BAT, treatment techniques, or other means, that the department finds are generally available (taking costs into consideration); and

c. The granting of a variance will not result in an unreasonable risk to the health of persons served by the waterworks.

2. The commissioner may grant one or more treatment technique variances to a waterworks from any requirement of a specified treatment technique upon a finding that the waterworks applying for the variance has demonstrated that the treatment technique is not necessary to protect the health of persons because of the nature of the source water at the waterworks.

3. The commissioner may grant a variance to a waterworks from an operational regulation if a thorough investigation reveals that the hardship imposed outweighs the benefits that may be received by the public and that the granting of the variance does not subject the public to unreasonable health risks.

4. An operational variance may not be issued from monitoring, reporting, or public notification requirements.

B. Request for a variance. Any owner may apply in writing for a variance. The request shall be sent to the department for evaluation. All requests for a variance shall include the following:

1. A citation of the regulation from which a variance is requested;

2. The nature and duration of the variance requested;

3. Relevant analytical results of water quality sampling of the waterworks, including results of relevant tests conducted pursuant to the requirements of this chapter;

4. A statement of the hardship to the owner and the anticipated impacts to the public health and welfare if a variance were granted;

5. Suggested conditions that might be imposed on the granting of a variance that would limit its detrimental impact on public health and welfare;

6. Other information, if any, believed by the owner to be pertinent to the request; and

7. Any other information as may be required by the commissioner to make the determination.

C. For any request made for a PMCL variance, the owner shall also include:

1. An explanation in full and evidence of the BAT;

2. The economic and legal factors relevant to the owner's ability to comply;

3. The analytic results of source water quality relevant to the variance request;

4. A proposed compliance schedule including the date each step toward compliance will be achieved. The schedule shall include as a minimum the following dates:

a. The date by which arrangement for an alternative source water or improvement of an existing source water will be completed;

b. The date of initiation of the connection of the alternative source water or improvement of the existing source water; and

c. The date by which final compliance is to be achieved.

5. A plan for the provision of potable water in the case of an excessive rise in the contaminant level for which the variance is requested;

6. A plan for interim control measures during the effective period of the variance; and

7. A plan for notifying the consumers at least once every three months, or more frequently if determined by the commissioner, that the waterworks is operating under the conditions of a variance.

D. For any request made for a treatment technique variance, the owner must also include a statement that monitoring and other reasonable requirements prescribed by the commissioner as a condition to the variance will be performed.

E. Consideration of a variance request.

1. The commissioner shall act on any variance request submitted pursuant to subsection B of this section within 90 days of receipt of the submittal.

2. The commissioner will consider comments received during the comment period and testimony in the record of a public hearing held before making a determination.

3. In the commissioner's consideration of whether the waterworks is unable to comply with a contaminant level required by this chapter because of the nature of the source water, the commissioner shall consider such factors as the following:

a. The availability and effectiveness of BAT for which the variance is requested; and

b. The cost and other economic considerations such as implementing treatment, improving the quality of the source water, or using an alternate source.

4. In the commissioner's consideration of whether a waterworks should be granted a variance to a required treatment technique because the treatment is unnecessary to protect the public health, the commissioner shall consider such factors as the following:

a. Quality of the source water including water quality data and pertinent sources of pollution; and

b. Source protection measures employed by the waterworks.

5. In the commissioner's consideration of whether a waterworks should be granted a variance to a required operational procedure, the commissioner shall consider such factors as the following:

a. The effect that such a variance would have on the adequate operation of the waterworks, including operator safety in accordance with VOSH laws and regulations;

b. The cost and other economic considerations imposed by this requirement; and

c. The effect that such a variance would have on the protection of the public health.

F. Disposition of a variance request.

1. The commissioner may reject any request for a variance by sending a rejection notice to the applicant. The rejection notice shall be in writing and shall state the reasons for the rejection. A rejection notice constitutes a case decision. If the commissioner proposes to deny the variance, the owner shall be provided with an opportunity for an informal fact-finding proceeding as provided in § 2.2-4019 of the Code of Virginia.

2. If the commissioner grants the variance, the applicant shall be notified in writing of this decision. The notice shall identify the variance, the waterworks covered, and shall specify the period of time for which the variance will be effective.

a. For a PMCL variance as specified in subdivision A 1 of this section, the notice shall provide that the variance will be terminated when the waterworks comes into compliance with the applicable regulation and may be terminated upon a finding by the commissioner that the waterworks has failed to comply with any requirements of a final schedule issued pursuant to subdivision F 3 of this section.

b. For a treatment technique variance as specified in subdivision A 2 of this section, the notice shall provide that the variance may be terminated at any time upon a finding by the commissioner that the nature of the source water is such that the specified treatment technique for which the variance was granted is necessary to protect the public health or upon a finding that the waterworks has failed to comply with monitoring and other requirements prescribed by the commissioner as a condition to the granting of the variance.

c. For an operational variance as specified in subdivision A 3 of this section, the notice shall provide that the variance will be terminated when the waterworks comes into compliance with the applicable regulation and may be terminated upon a finding by the commissioner that the waterworks has failed to comply with any requirements or schedules issued in conjunction with the variance. The effective date of the operational variance shall be the date of its issuance. A public hearing is not required before the issuance of an operational variance.

3. Schedules pursuant to PMCL and treatment technique variances:

a. The proposed schedule for compliance shall specify dates by which steps toward compliance are to be taken, including where applicable:

(1) Date by which arrangement for the alternative source water or improvement of the existing source water will be completed;

(2) Date of connection to the alternative source water or improvement of the existing source water; and

(3) Date by which final compliance is to be achieved.

b. If the waterworks has no access to an alternative source water and can effect or anticipate no adequate improvement of the existing source water, then the proposed schedule may specify an indefinite time period for compliance until a new and effective treatment technology is developed, at which time a new compliance schedule shall be prescribed by the commissioner.

c. The schedule for implementation of interim control measures during the period of variance shall specify interim treatment techniques, methods, and equipment and dates by which steps toward meeting the interim control measures are to be met.

d. The schedule shall be prescribed by the commissioner at the time the variance is granted.

e. For a PMCL variance specified in subdivision A 1 of this section, the commissioner shall propose a schedule for:

(1) Compliance (including increments of progress) by the waterworks with each contaminant level requirement covered by the variance; and

(2) Implementation by the waterworks of such control measures as the commissioner may require for each contaminant level covered by the variance.

G. Public hearings on PMCL and treatment technique variances and their schedules.

1. Notice of a public hearing shall be provided before a variance and schedule proposed by the commissioner pursuant to subsection F of this section may take effect. A notice given pursuant to this subsection may cover the granting of more than one variance and a public hearing held pursuant to such notice shall include each of the variances covered by the notice.

2. Notice of a public hearing on a request for a variance and its schedule shall be advertised in at least one major newspaper of general circulation in the region in which the waterworks is located. The notice shall include a summary of the proposed variance and its schedule and shall contain the time, date, and place of the public hearing. If the schedule exceeds five years from the date of the variance, then the rationale for the extended compliance schedule shall be discussed in the notice.

H. Issuance of variance.

1. Within 30 days after the public hearing, the commissioner shall, taking into consideration information obtained during such hearing, revise the proposed variance as necessary and prescribe the final schedule for compliance and interim measures for the waterworks granted a variance. If the schedule for compliance exceeds five years from the date of issuance of the variance, then the commissioner shall document the rationale for the extended compliance schedule.

2. The compliance schedule shall establish the timetable by which the waterworks shall comply with each contaminant level and treatment technique requirement prescribed by this chapter. Such schedule shall also consider if the waterworks is to become part of a regional waterworks. The compliance schedule shall provide the shortest practicable time schedule under the circumstances.

I. Posting of variances. All variances granted to any waterworks are nontransferable. Each variance must be attached to the permit of the waterworks to which it is granted. Each variance is a condition to that permit and is revoked when the permit is revoked.

J. No variances shall be granted to 12VAC5-590-380, 12VAC5-590-388, 12VAC5-590-395, or 12VAC5-590-411.

12VAC5-590-150. Exemptions.

A. The commissioner may grant an exemption to any PMCL or treatment technique requirement by following the procedures set forth in this section. An exemption may be granted to a waterworks upon a finding that:

1. The waterworks must be unable to implement measures to develop an alternative water supply;

2. The waterworks cannot reasonably make management or restructuring changes that will result in compliance or improve the quality of the drinking water;

3. Due to compelling factors (which may include economic factors), the waterworks is unable to comply with contaminant level or treatment technique requirements;

4. The granting of the exemption will not result in an unreasonable risk to the health of persons served by the waterworks;

5. The waterworks was in operation on the effective date of such contaminant level or treatment technique requirements; and

6. The waterworks has not been granted a variance.

B. The owner may request an exemption for a waterworks by submitting a written request to the department for evaluation. All requests for an exemption shall include the following information:

1. A citation to the regulation from which the exemption is requested;

2. The nature and duration of the exemption requested;

3. The relevant analytical results of water quality sampling of the waterworks, including results of relevant tests conducted pursuant to the requirements of this chapter;

4. An explanation of the compelling factors such as time or economic factors that prevent such waterworks from achieving compliance;

5. Other information believed by the owner to be pertinent to the request;

6. A proposed compliance schedule, including the date when each step toward compliance will be achieved; and

7. Other information as may be required by the commissioner to make the determination.

C. Consideration of an exemption request.

1. The commissioner shall act on any exemption request submitted pursuant to subsection B of this section within 90 days of receipt of the request.

2. In the commissioner's consideration of whether the waterworks is unable to comply due to compelling factors, the commissioner shall consider such factors as the following:

a. The construction, installation, or modification of treatment equipment or systems;

b. The time needed to put a new water treatment plant into operation to replace an existing water treatment plant that is not in compliance;

c. The economic feasibility of compliance;

d. The availability of Drinking Water State Revolving Fund, a department program to assist waterworks in achieving the public health protection objectives of the SDWA, assistance or any other federal or state program that is reasonably likely to be available within the period of the exemption;

e. The consideration of rate increases, accounting changes, the appointment of a licensed operator under the state operator's licensure program, or contractual agreements for joint operation with one or more waterworks;

f. The activities consistent with Virginia's capacity development strategy to help the waterworks acquire and maintain technical, financial, and managerial capacity to come into compliance;

g. The ownership changes, physical consolidation with another waterworks, or other feasible and appropriate means of consolidation that would result in compliance; and

h. The availability of an alternative source of drinking water, including the feasibility of partnerships with neighboring waterworks, as identified by the waterworks or by the commissioner consistent with the capacity development strategy.

D. Disposition of an exemption request.

1. The commissioner may reject any request for an exemption by sending a rejection notice to the owner. The rejection notice shall be in writing and shall state the reasons for the rejection. A rejection notice constitutes a case decision. If the commissioner proposes to deny the exemption, then the owner shall be provided with an opportunity for an informal fact-finding proceeding as provided in § 2.2-4019 of the Code of Virginia.

2. If the commissioner grants the exemption, then the owner shall be notified in writing of this decision. The notice shall identify the exemption and the waterworks covered and shall specify the termination date of the exemption. Exemptions shall be terminated when the waterworks comes into compliance with the applicable regulation and may be terminated upon a finding by the commissioner that the waterworks has failed to comply with any requirements of a final schedule issued pursuant to subsection F of this section.

3. The commissioner shall propose a schedule for:

a. Compliance (including increments of progress) by the waterworks with each contaminant level and treatment technique requirement covered by the exemption; and

b. Implementation by the waterworks of such control measures as the commissioner may require for each contaminant level and treatment technique requirement covered by the exemption.

4. The schedule shall be prescribed by the commissioner at the time the exemption is granted.

5. For a waterworks that serves a population of not more than 3,300 persons and that needs financial assistance for the necessary improvements under the initial compliance schedule, an exemption granted by the commissioner may be for one or more additional two-year periods, but not to exceed a total of six additional years, only if the commissioner establishes that the waterworks is taking all practicable steps to meet the requirements of the exemption and the established compliance period. The commissioner will document the findings in granting an extension under this subdivision.

E. Public hearings on exemptions and their schedules.

1. Notice of a public hearing shall be provided before an exemption and schedule proposed by the commissioner pursuant to subsection D of this section may take effect. Such notice may cover the granting of more than one exemption, and a public hearing held pursuant to the notice shall include each of the exemptions covered by the notice.

2. Notice of a public hearing on a request for an exemption and its schedule shall be advertised in at least one major newspaper of general circulation in the region in which the waterworks is located.

3. The notice shall include a summary of the proposed exemption and its schedule and shall contain the time, date, and place of the public hearing.

F. Issuance of exemption.

1. Within 30 days after the public hearing, the commissioner shall, taking into consideration information obtained during the hearing, revise the proposed exemption as necessary and prescribe the final compliance schedule and interim measures before issuing the exemption to the waterworks.

2. The schedule shall establish the timetable by which the waterworks shall comply with each contaminant level and treatment technique requirement prescribed by this section. If the schedule for compliance exceeds five years from the date of issuance of the exemption, then the commissioner shall document the rationale for the extended compliance period. Such schedule shall also consider if the waterworks is to become part of a regional waterworks.

G. Posting of exemptions. All exemptions granted to any waterworks are nontransferable. Each exemption must be attached to the operation permit of the waterworks to which it is granted. Each exemption is a condition to that permit and is revoked when the permit is revoked.

H. No exemption shall be granted to 12VAC5-590-380, 12VAC5-590-388, or 12VAC5-590-395.

12VAC5-590-190. Permits.

A. No owner or other person may cause or allow any waterworks to be operated in the Commonwealth without a written operation permit issued by the commissioner.

B. No owner or other person shall cause or allow the construction or change in the manner of transmission, storage, purification, treatment, or distribution of water (including the extension of water pipes for the distribution of water) at any waterworks in the Commonwealth without a written construction permit or a general permit for distribution mains from the commissioner.

C. Construction permits may not be required for the extension of water distribution piping having a diameter of eight inches or less and serving less than 15 connections (see § 32.1-172 A of the Code of Virginia).

D. Individual construction permits for distribution mains are not required for waterworks that obtain a general permit (see 12VAC5-590-300).

E. Conditions may be imposed on the issuance of any permit, and no waterworks may be constructed, modified, or operated in violation of these conditions.

12VAC5-590-200. Procedure for obtaining a construction permit.

A. Construction permits are issued by the commissioner, but all requests for a construction permit are directed initially to the department. The procedure for obtaining a construction permit includes the following steps:

1. Owners shall notify the department of all proposed construction projects, except distribution main projects that are permitted under the provisions of a general permit for distribution mains (see 12VAC5-590-300), or when the project is for the extension of water distribution piping having a diameter of eight inches or less and serving less than 15 connections (see § 32.1-172 A of the Code of Virginia).

2. The submission of a Waterworks Permit Application to the department on a form approved by the department.

3. Based on the application received, the department shall notify the owner if a preliminary engineering conference is required. A preliminary engineering conference shall be required for projects proposed using alternative delivery methods authorized under § 2.2-4380 of the Code of Virginia. The preliminary engineering conference shall define the scope of the project, project phasing, milestones, and deliverables. An evaluation procedure shall be agreed upon and the conference shall be documented.

4. The submission of preliminary engineering or intermediate design reports if required by the department. The need for and scope of the reports shall be established during the preliminary engineering conference.

5. The submission of a waterworks business operation plan that demonstrates the waterworks TMF capabilities. The waterworks business operation plan consists of four primary components:

a. Waterworks information that includes ownership data, a waterworks facility description, operator requirements, staffing needs, and staff training.

b. Management information that identifies critical business practices necessary for effective management and operation of the waterworks. Management information includes the requirements essential for managing and operating the waterworks and defines the processes, methods, and tasks necessary for complying with this chapter.

c. Financial information that identifies projects, considering the waterworks revenues and cash flow, which will be sufficient for meeting the cost of operation and maintenance for at least five full years from the initiation of operations. Financial information also demonstrates the owner's ability to direct the waterworks' finances to support technical and managerial capacities and includes a self-assessment consisting of the following financial metrics: operating cash reserve, debt service coverage, emergency reserve, and revenue sufficiency.

d. Sustainability improvements that are identified throughout the waterworks business operation plan to address TMF aspects of the waterworks' business processes that need improvement.

6. The submission of plans, specifications, final design criteria, and other supporting design data. This submission may include manufacturers equipment data sheets, drawings, and specifications when the specific materials or equipment to be used in the project have been preselected by the owner with the engineer's concurrence.

B. Well site inspection. When, upon inspection by the department, one or more well locations are found suitable for well sites, tentative approval in writing shall be furnished to the owner authorizing the drilling of wells, the exact location where each well is to be drilled, and the well construction requirements. This tentative approval will become void after a 12-month period.

C. Plans for waterworks construction shall provide the following information, where applicable:

1. A general layout that includes:

a. Suitable title, to include name of waterworks;

b. Name of owner of waterworks;

c. Area or institution to be served;

d. Scale;

e. North Point;

f. Datum used;

g. Date, address, and name of owner's engineer;

h. Location and size of existing distribution system; and

i. Location and nature of existing waterworks structures and appurtenances affecting the proposed construction noted on one sheet.

2. Detailed plans that include, where applicable:

a. Stream crossings, providing profiles with elevations of the stream bed and the normal water level;

b. Profiles having a horizontal scale of not more than 100 feet to the inch and a vertical scale of not more than 10 feet to the inch, with both scales clearly indicated;

c. Location and size of property to be used for groundwater development with respect to known references such as street intersections or section lines;

d. Topography and arrangement of present or planned wells or structures, with contour intervals not greater than two feet;

e. Elevation of highest known flood, floor of structure, upper terminal of protective casing, and outside surrounding grade, using United States Coast and Geodetic Survey, United States Geological Survey, or equivalent elevations where applicable as a reference;

f. A completed Uniform Water Well Completion Report, Form GW-2, and schematic drawings of well construction, showing diameter and depth of drill holes, casing and liner diameters and depths, grouting depths, elevations and designation of geological formation, water levels, and other details to describe the proposed well completely;

g. If not previously submitted in the preliminary engineering report (PER): the location of all potential sources of pollution within 1,000 feet of drilled wells, 100 feet of treated water storage facilities, five miles upstream from surface water intakes, and the entire drainage area of springs;

h. Size, length, identity, and location of sewers, drains, distribution systems, and water treatment plant structures;

i. Schematic flow diagrams and hydraulic profiles showing the flow through various water treatment plant units;

j. Piping in sufficient detail to show flow through the water treatment plant, including waste lines;

k. Location of all chemical feeding equipment and points of chemical application;

l. All appurtenances, specific structures, equipment, water treatment plant waste disposal units, and point of discharge having any relationship to the plans for distribution system or waterworks structures;

m. Location of sanitary or other facilities such as lavatories, showers, toilets, and lockers;

n. Location, dimensions, and elevations of all proposed water treatment plant facilities; and

o. Adequate description of all features not otherwise covered by the specifications.

D. Specifications for waterworks construction improvements shall provide the following information, where applicable:

1. A program for keeping existing waterworks facilities in operation during construction of additional facilities so as to minimize interruption of service;

2. The laboratory facilities and equipment, as well as sampling taps and their locations;

3. The number and design of treatment process components;

4. The materials or proprietary equipment for sanitary or other facilities including any necessary backflow or backsiphonage backflow protection;

5. Workmanship; and

6. Other equipment.

E. Design criteria. A summary of complete design criteria shall be submitted for the proposed project, containing but not limited to the following information, where applicable:

1. Source water capacity;

2. Estimated water consumption, including average day, maximum day, and peak hour flows;

3. Number and type of proposed services;

4. Firefighting requirements;

5. Basin capacities;

6. Retention times;

7. Unit loadings;

8. Filter area and proposed filtration rate;

9. Backwash rate; and

10. Feeder capacities and ranges.

F. For community waterworks, a copy of the duly recorded (i) plat plan of the well lot or subdivision plan showing the well lot and (ii) dedication document stating that the well lot shall be used only for waterworks appurtenances as long as the lot is utilized as part of a waterworks.

G. For noncommunity waterworks, the department may on a case-by-case basis require a copy of a duly recorded plat plan of a well lot and a dedication document stating that the well lot shall be used only for waterworks appurtenances as long as the lot is utilized as part of a waterworks. In imposing such a requirement, the department shall take into consideration public health protection and the waterworks operations, treatment processes, and appurtenances.

12VAC5-590-210. Requirements for the submission of engineering data.

A. In accordance with Chapter 4 (§ 54.1-400 et seq.) of Title 54.1 of the Code of Virginia, all drawings, specifications, and engineer's reports submitted for approval shall be prepared by or under the supervision of a licensed professional engineer qualified to practice in Virginia, unless submitted under § 54.1-408 of the Code of Virginia for practice of land surveying in subdivisions.

B. The quantity, format, and method of submission shall meet the evaluation needs of the department and shall be consistent with the requirements in Chapter 42.1 (§ 59.1-479 et seq.) of Title 59.1 of the Code of Virginia.

C. All reports, plans, and specifications shall be submitted to the department at least 60 days before the date upon which action by the department or commissioner is desired.

D. If the procedures for obtaining a construction permit in 12VAC5-590-200 are not complied with or if plans and specifications are found to be incomplete or inadequate for evaluation, then the plans and specifications will be returned to the submitting party. If revisions to the plans or specifications or both are necessitated, the owner and engineer who prepared them will be notified in writing of the necessary

revisions. Revised plans, specifications, or both constitute a resubmission. Every effort will be made to complete the evaluation of these revisions promptly.

12VAC5-590-220. Compliance with the Manual of Practice.

A. The design guidelines set forth in Part III Manual of Practice for Waterworks Design (12VAC5-590-640 et seq.) of this chapter (Manual of Practice) specify general criteria for the design and construction of waterworks. The commissioner may impose standards or requirements that are more stringent than those contained in the Manual of Practice when required to meet drinking water quality standards. Any special standards or requirements with a federal mandate shall take precedence over the criteria in the Manual of Practice and will be items that warrant careful consideration at the preliminary engineering conference, referenced in 12VAC5-590-200.

B. Designs submitted for waterworks must demonstrate that the waterworks will adequately safeguard public health. Submissions that are in substantial compliance with the Manual of Practice and any additional requirements of the commissioner, as noted in subsection A of this section, will be approved. Justification for a design may be required for those portions of the submitted design that differ from the criteria set forth in the Manual of Practice and any established by the commissioner. Deviations from mandatory criteria contained in the Manual of Practice shall be identified and justified. For each deviation, the commissioner may issue a design exception or require compliance with the criteria.

C. Final, complete, and detailed plans and specifications submitted in accordance with the provisions of 12VAC5-590-200 and 12VAC5-590-210 will be evaluated by the department as soon as practicable upon receipt. Plans and specifications will be approved if they demonstrate substantial compliance with the design criteria set forth in the Manual of Practice and any established by the commissioner and if the waterworks, as constructed or modified, will be able to function in compliance with Part II (12VAC5-590-340 et seq.) of this chapter.

D. Compliance with the Manual of Practice for transient noncommunity waterworks is allowed the following exceptions as long as the conditions in subsection E of this section are satisfied:

1. The design of a transient noncommunity waterworks is not required to satisfy the professional engineer licensure requirement of 12VAC5-590-210 under the following conditions:

a. The waterworks shall serve no more than 100 persons per day.

b. The waterworks shall consist only of one supply of source water, a pressure tank no greater than 250 gallon capacity, and a single service connection.

c. The single service connection shall be a building or structure of less than 5,000 square feet total floor space. The determination of square footage shall be calculated using the outside perimeter of the building or structure.

2. Although the owner of a transient noncommunity waterworks is required to use a water well systems provider certified by DPOR for drilling wells, the remainder of the waterworks facility construction at a transient noncommunity waterworks may be performed by a master plumber or a certified water well systems provider, as defined in § 54.1-1129.1 of the Code of Virginia.

E. The conditions for exceptions to the Manual of Practice for transient noncommunity waterworks specified in subsection D of this section are as follows:

1. The owner shall submit a signed and dated statement attached to the permit application, certifying that subsection D of this section will be satisfied.

2. The owner shall submit information related to the design, construction, and materials used as required by the department.

12VAC5-590-230. Issuance of the construction permit.

A. Upon approval of the plans and specifications, the commissioner will issue a permit to the owner to construct or modify the waterworks in accordance with the approved plans and specifications.

B. The construction permit shall be valid for a period of five years. If construction has not begun within five years but were to proceed in the future, then the owner shall reapply for a new construction permit.

C. The construction permit may include conditions for securing equipment certifications and performance validations.

12VAC5-590-240. Revisions of approved plans.

A. Any deviations from the approved plans and specifications affecting capacity, hydraulic conditions, operating units, the functioning of water treatment processes, or the quality of water to be delivered must be approved by the department before any of these deviations are implemented.

B. Revised plans and specifications shall be submitted in time to allow the evaluation and approval of these plans or specifications before any construction work that will be affected by these changes may begin.

12VAC5-590-250. Statement required upon completion of construction.

A. Upon completion of the construction or modification of the waterworks, the owner shall submit to the department a statement signed by a licensed professional engineer stating that the construction work was completed in accordance with the approved plans and specifications, revised only in accordance with the provisions of 12VAC5-590-240. This statement is called a statement of completion of construction and shall be based upon inspections of the waterworks during and after construction or modifications. These inspections are to be adequate to ensure the truth of the statement of completion of construction.

B. The project documents may require a performance validation report to confirm the design, performance criteria, and appropriate emergency procedures for specific processes and equipment. The project documents may also require operator training. If these requirements are included in the project documents, then the statement of completion of construction shall also include the performance validation report and a certification of successful operator training, as applicable.

12VAC5-590-260. Issuance of the operation permit.

A. Upon receipt of the statement of completion of construction, receipt of all required certifications and test results, inspection by the department to ensure that the project has been satisfactorily completed in accordance with the approved design documents, and verification that bacteriological test results comply with the requirements set forth in Part II of this chapter, as appropriate, the commissioner will issue an operation permit.

B. The owner shall not operate a waterworks without first having obtained an operation permit except as provided in 12VAC5-590-290.

C. The commissioner shall establish the type (community waterworks, NTNC, or TNC), classification, and permitted capacity of the waterworks and specify these on the operation permit. Conditions may be included with the permit for operator, monitoring, and reporting requirements.

12VAC5-590-270. Start-up testing and inspections.

A. Before placing a new or modified waterworks into operation following construction, the owner shall test the water at the entry point to the distribution system in a manner acceptable to the department. The owner shall notify the department of the time and place of the tests. The owner shall send the results of the tests to the department.

B. The commissioner and department have a right to inspect any waterworks and to be present for any testing in accordance with Title 32.1 of the Code of Virginia.

12VAC5-590-290. Issuance of a temporary operation permit.

A. Water treatment methods, processes, and equipment that are not covered by the design criteria of Part III (12VAC5-590-640 et seq.) of this chapter, and that in principle or application are new or nonconventional, are subject to a temporary permit application procedure instead of that set forth in 12VAC5-590-200. A temporary permit may be issued only after detailed evaluation of all engineering data and after a period of extensive monitoring of the water treatment plant performance.

B. The department encourages the development of any new or nonconventional methods, processes, and equipment that by virtue of treatability studies appear to have application for water treatment. However, these new or nonconventional developments shall have been thoroughly tested in a full-scale or representative pilot plant installation before these methods, processes, and equipment are approved and an operation permit issued. The results shall be submitted to the department. The testing required on new or nonconventional developments shall generally follow these guidelines:

1. All procedures used in validating the process shall be conducted under the supervision of (i) a licensed professional engineer experienced in the field of environmental engineering, (ii) the owner's engineering staff, or (iii) a testing firm acceptable to the department;

2. Samples shall be collected and analyzed in a manner that shall demonstrate water treatment plant effectiveness and efficiency under adverse conditions and over extended periods of time in the area of the proposed installation;

3. The data shall be from the continuous operation of a full-scale or pilot plant treating the type of water to be handled;

4. Automatic indicating, recording, and totalizing equipment shall be provided, and the total flow shall be measured and recorded daily;

5. If the source water receives upstream discharges of treated industrial wastes or treated wastewater, then automatic indicating and recording equipment shall be provided for continuously monitoring the pH of the source and finished water in addition to the chlorine residual of the finished water;

6. The minimum sampling and analysis program will be established by the department in accordance with the process under investigation; and

7. All analyses shall utilize methods that are consistent with 12VAC5-590-440.

C. Detailed plans shall be submitted where possible showing how, in case of nonacceptance, the water treatment plant or water treatment methods, processes, and equipment will be converted to, or replaced with, a proven process. Also, financial resources must be assured to make the conversion (for example, funds placed in escrow or a bond posted.

D. After evaluation of the plans and testing data, the commissioner will issue a construction permit if the performance data verifies that the method, process, or equipment may efficiently produce water in accordance with the design specifications and the operation standards of Part II (12VAC5-590-340 et seq.) of this chapter.

E. Upon completion of construction or modification, a temporary permit for a definite period of time will be issued for the operation of the new or nonconventional methods, processes, and equipment. Not more than one temporary permit will be granted for a similar installation during the evaluation period. The temporary operation permit shall require that:

1. The evaluation period shall be a minimum of 12 months and no longer than 18 months; and

2. The holder of a temporary operation permit shall submit reports on operation during the evaluation period as required by the department. The reports shall be prepared by (i) a licensed professional engineer experienced in the field of environmental engineering, (ii) the owner's operating or engineering staff, or (iii) a testing organization.

F. The commissioner may issue a temporary operation permit if the waterworks is not in compliance with this chapter and public health will not be jeopardized. The temporary permit may be issued for a period of time and subject to conditions as the commissioner may deem appropriate for the owner to achieve compliance with this chapter.

1. The commissioner may require, as a condition to a temporary operation permit, the submission of a waterworks business operation plan by new waterworks and existing waterworks that have demonstrated limited TMF capabilities or significant noncompliance with this chapter.

2. The waterworks business operation plan shall satisfy the requirements of 12VAC5-590-200 A5.

12VAC5-590-300. Issuance of a general permit for construction of distribution mains.

A. Instead of obtaining a permit for each distribution main project, an owner may elect to obtain a general permit for the construction of distribution mains. These general permits are issued by the commissioner, but all requests for a general permit are directed initially to the department.

B. The following requirements shall be satisfied for the issuance of a general permit:

1. The owner shall develop, adopt, and have the department's approval of general specifications and plan details covering distribution main design and construction. The general specifications shall be at least as stringent as the requirements contained in this chapter.

2. The owner shall enter into a memorandum of understanding (MOU) with the department. The department will outline the waterworks-specific requirements, and the owner's method of compliance with the requirements. The waterworks-specific requirements include the following:

a. The maximum size of pipe to be covered by the general permit;

b. The means for modifying the department's approved general specifications and plan details;

c. The maintenance of engineering capabilities satisfactory to the department, either on-staff or through contractual arrangements;

d. The preparation of engineering plans and specifications for individual projects;

e. The maintenance of up-to-date distribution system maps and other appropriate records; and

f. The submission by the owner to the department of appropriate reports, including an annual report and summary, concerning all projects constructed under the terms of the MOU and information concerning changes to the distribution system.

C. Once the general specifications are approved and the MOU is agreed to by the department, the commissioner will issue a general permit for distribution mains with the MOU attached.

D. The general permit allows for the construction of distribution mains. The duration for the general permit is five years.

12VAC5-590-310. Amendment or reissuance of operation permits.

A. The commissioner may amend or reissue an operation permit (i) when there is a change in the manner of storage, treatment, or supply of source water at the permitted location; (ii) when the existing permit is no longer valid; (iii) for any other cause incident to the protection of the public health; or (iv) for the supplying of potable water. A notice may be required to be given to the owner, and if one is required, a hearing held in accordance with the provisions of 12VAC5-590-115.

B. The commissioner may require submission of a waterworks business operation plan as a condition to amend or reissue an operation permit. The waterworks business operation plan shall satisfy the requirements of 12VAC5-590-200 A 5.

12VAC5-590-320. Revocation of an operation permit.

A. The commissioner may revoke an operation permit in accordance with the APA. Reasons for revocation include:

1. The waterworks can no longer be depended upon to furnish potable water;

2. The capacity of the waterworks is inadequate for the purpose of furnishing potable water;

3. The owner has failed to abide by an order issued by the commissioner;

4. The owner has abandoned the waterworks and discontinued supplying potable water; or

5. The owner has failed to pay the waterworks operation fee required by § 32.1-171.1 of the Code of Virginia.

B. Procedure for revocation of operation permit. When revoking an operation permit in accordance with subsection A of this section, the commissioner shall:

1. Send a written notice of intent to revoke by certified mail to the last known address of the owner. The notice shall state the reasons for the proposed revocation of the operation permit, the authority under which the commissioner proposes to act, and offer the opportunity for an administrative proceeding in accordance with 12VAC5-590-115.

2. Provide at least 30 days advance notice of the administrative proceeding.

12VAC5-590-330. Monitoring, records, and reporting.

A. The commissioner or department may require the owner to install, use, and maintain monitoring equipment for the control and testing of water flowing through the water treatment plant to:

1. Identify and determine the cause of operational problems;

2. Determine the necessary corrective actions for these problems;

3. Ensure compliance with Part II of this chapter; and

4. Prepare the finished water for entry into the distribution system.

B. Sampling and testing shall be by methods approved by the department. Test results shall be recorded, compiled, and reported to the department in an acceptable manner and format.

12VAC5-590-340. Compliance standards.

A. All physical, chemical, bacteriological, or radiological analyses for the purpose of demonstrating compliance with the requirements of this chapter shall be performed by laboratories that have received certification by EPA or DCLS as specified in 12VAC5-590-440. The owner is responsible for the collection and submission of all samples. The department may require sampling and testing that exceeds the minimal requirements specified in this chapter. A sample is deemed to have been collected only when its results are made known to the department.

B. Specific limits. No attempt has been made to prescribe specific limits for every contaminant that might occur in a water supply or a waterworks. Although the need exists for continued attention to the entry of chemical, physical, bacteriological, and radiological substances into drinking water, the limits are confined to substances recognized as being detrimental to the health or well-being of the consumer or that cause significant degradation of the usefulness of the water. Limits for innumerable substances would require an impossible burden of analytical examination. The specific limits included in this chapter are listed in Tables 340.1 through 340.7.

C. Compliance is determined:

1. Based on sample results or calculated averages, where appropriate, rounded to the same number of significant figures as the PMCL, SMCL, AL, or MRDL of the contaminant in question, or

2. By the application of the specific treatment technique for particular contaminants (see 12VAC5-590-391).

TABLE 340.1 Inorganic Chemicals	
SUBSTANCE	PMCL (mg/L)
Antimony	0.006
Arsenic	0.010[a]
Asbestos	7 million fibers/liter (longer than 10 μm)
Barium	2
Beryllium	0.004
Cadmium	0.005
Chromium	0.1
Cyanide (as free Cyanide)	0.2
Fluoride	4.0[b]
Mercury	0.002
Nickel	No limits designated
Nitrate (as N)	10[c]
Nitrite (as N)	1.0[c]
Total Nitrate and Nitrite (as N)	10[c]
Selenium	0.05
Thallium	0.002
SUBSTANCE	SECONDARY MAXIMUM CONTAMINANT LEVEL (mg/L)
Aluminum	0.05-0.2[d]
Chloride	250[c]
Copper	1.0
Corrosivity	Noncorrosive
Fluoride	2.0
Foaming agents	0.5[e]
Iron	0.3
Manganese	0.05
Silver	0.1
Sodium	No limits designated[f]
Sulfate	250[c]
Zinc	5

TABLE 340.1 Inorganic Chemicals (*continued*)	
SUBSTANCE	ACTION LEVEL (mg/L)
Lead	0.015
Copper	1.3

[a]Arsenic sampling results shall be reported to the nearest 0.001 mg/L.

[b]The fluoride PMCL applies only to community waterworks.

[c]Significant figures are noted as shown. For values with trailing zeros, significant figures are noted as shown. The limits for nitrate and nitrate-nitrite have two significant figures. The limits for chloride and sulfate have three significant figures.

[d]Varying water quality and treatment situations necessitates a flexible range for the aluminum SMCL. The owner is encouraged to maintain an aluminum concentration as low as possible. If the aluminum concentration in the finished water causes discoloration, then the owner is urged to contact the department.

[e]Concentrations reported in terms of Methylene Blue Active Substances.

[f]Monitoring and reporting in accordance with 40 CFR 141. 41 and 12VAC5-590-372 D 6.

TABLE 340.2 Organic Chemicals	
SUBSTANCE	PMCL (mg/L)
VOC	
Benzene	0.005
Carbon tetrachloride	0.005
Chlorobenzene (also called Monochlorobenzene)	0.1
o-Dichlorobenzene	0.6
p-Dichlorobenzene	0.075
1,2-Dichloroethane (also called Ethylene dichloride)	0.005
1,1-Dichloroethylene (also called Dichloroethene)	0.007
cis-1,2-Dichloroethylene	0.07
Trans-1,2-Dichloroethylene	0.1
Dichloromethane (also called Methylene chloride)	0.005
1,2-Dichloropropane	0.005
Ethylbenzene	0.7
Styrene	0.1
Tetrachloroethylene (PCE) (also called Perchloroethylene)	0.005
Toluene	1
1,2,4-Trichlorobenzene	0.07
1,1,1-Trichloroethane	0.2
1,1,2-Trichloroethane	0.005
Trichloroethylene (TCE)	0.005
Vinyl Chloride	0.002
Xylene (total)	10[a]
SOC	
Acrylamide	TT[b]
Alachlor (also called Lasso)	0.002
Atrazine	0.003
Benzo(a)pyrene	0.0002
Carbofuran	0.04
Chlordane	0.002
Dalapon	0.2

TABLE 340.2 Organic Chemicals (*continued*)	
SUBSTANCE	PMCL (mg/L)
Di(2-ethylhexyl)adipate (also called Bis(2-ethylhexyl)adipate)	0.4
Di(2-ethylhexyl)phthalate (also called Bis(2-ethylhexyl)phthalate)	0.006
1,2-Dibromo-3-chloropropane (DBCP)	0.0002
2,4-Dichlorophenoxyacetic Acid (2,4-D)	0.07
Dinoseb	0.007
Diquat	0.02
Endothall	0.1
Endrin	0.002
Epichlorohydrin	TT[b]
Ethylene dibromide (EDB) (also called 1,2-Dibromoethane)	0.00005
Glyphosate	0.7
Heptachlor	0.0004
Heptachlor epoxide	0.0002
Hexachlorobenzene	0.001
Hexachlorocyclopentadiene	0.05
Lindane (also called gamma-HCH and gamma BHC)	0.0002
Methoxychlor	0.04
Oxamyl (Vydate)	0.2
Pentachlorophenol (PCP)	0.001
Picloram	0.5
Polychlorinated biphenyls (PCBs)	0.0005
Simazine	0.004
2,3,7,8-TCDD (Dioxin)	3×10^{-8}
Toxaphene	0.003
2,4,5-Trichlorophenoxypropionic Acid (2,4,5-TP or Silvex)	0.05

[a]The limit for xylene has two significant figures.

[b]Each waterworks must certify annually to the department that when acrylamide and epichlorohydrin are used to treat water, the combination (or product) of dose and monomer level does not exceed the levels specified as follows: (i) acrylamide = 0.05% dosed at 1 mg/L (or equivalent) and (ii) epichlorohydrin = 0.01% dosed at 20 mg/L (or equivalent). The certification shall be in writing, using third-party certification approved by the department or the manufacturer's certification.

TABLE 340.3 Physical Quality		
PARAMETER	STANDARD	CONCENTRATION
Color	SMCL	15 Color Units (CU)
Odor	SMCL	3 Threshold odor numbers
pH	SMCL	6.5-8.5
Total dissolved solids (TDS)	SMCL	500 mg/L[a]
Turbidity	Treatment Technique	See 12VAC5-590-395 A 2 b[b]

[a]TDS has three significant figures.

[b]Operational goal: Surface water treatment plants with gravity flow granular media filters are capable of producing filtered water with a turbidity consistently less than 0.10 NTU. Therefore, for water treatment plants, the operational goal for filter effluent turbidity for each filter, before any post-filtration chemical addition, is 0.10 NTU.

TABLE 340.4 Radiological Quality	
PARAMETER	PMCL
Combined radium-226 and radium-228.	5 pCi/L
Gross alpha particle activity (excluding Radon and Uranium)	15 pCi/L
Beta particle and photon radioactivity.	4 mrem/yr [a, b]
Uranium	30 µg/L[c]

[a]The average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water shall not produce an annual dose equivalent to the total body or any internal organ greater than 4 mrem/year.

[b]Except for the radionuclides listed in Schedule I, the concentration of man-made radionuclides causing 4 mrem total body or organ dose equivalents shall be calculated on the basis of a 2 liter per day drinking water intake using the 168-hour data listed in "Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure," NBS Handbook 69 issued June 5, 1959, and amended August 1963, U.S. Department of Commerce. If two or more radionuclides are present, the sum of their annual dose equivalent to the total body or to any organ shall not exceed 4 mrem/year.

[c]The limit for uranium has two significant figures.

Schedule 1		
Average annual concentrations assumed to produce a total body organ dose of 4 mrem/year.		
RADIONUCLIDE	CRITICAL ORGAN	pCi/L
Tritium	Total Body	20,000[d]
Strontium-90	Bone Marrow	8

[d]The limit for tritium has five significant figures.

TABLE 340.5 Microbial Contaminants	
CONTAMINANT	PMCL or TT
Cryptosporidium	TT Minimum 99% (2-log) removal plus additional log removal or inactivation based upon bin classification in 12VAC5-590-401 D.
Giardia lamblia	TT 99.9% (3-log) removal or inactivation.
Viruses	TT 99.99% (4-log) removal or inactivation
Legionella	TT No limit, but if Giardia lamblia and viruses are removed or inactivated, according to the treatment techniques in 12VAC5-590-395, Legionella will also be controlled.
Heterotrophic plate count (HPC)	TT No more than 500 bacterial colonies per milliliter. (HPC is not a contaminant, it is an analytic method used to measure a variety of bacteria found in water.)
Escherichia coli (E. coli)	PMCL (1) Any E. coli-positive repeat sample following a total coliform-positive routine sample. (2) Total coliform-positive repeat sample following an E. coli-positive routine sample. (3) Failure to collect all require repeat samples following an E. coli-positive routine sample. (4) Failure to test for E. coli when any repeat sample tests positive for total coliform.

TABLE 340.6 Disinfection Byproducts	
PARAMETER	PMCL (mg/L)
TTHM Bromodichloromethane Bromoform Chloroform Dibromochloromethane	0.080[a]
HAA5 Bromoacetic acid Dibromoacetic acid Dichloroacetic acid Monochloroacetic acid Trichloroacetic acid	0.060[a]
Bromate	0.010[a]
Chlorite	1.0[a]
[a]The limits for TTHM, HAA5, and bromate have three significant figures. The limit for chlorite has two significant figures.	

TABLE 340.7 Maximum Residual Disinfectant Level Goals (MRDLG) and Maximum Residual Disinfectant Levels (MRDL) for Disinfectants	
RESIDUAL DISINFECTANT	MRDLG and MRDL (mg/L)
Chlorine	4.0 (as Cl_2)[a]
Chloramines	4.0 (as Cl_2)[a]
Chlorine Dioxide	0.8 (as ClO_2)
[a]Chlorine and chloramines have two significant figures.	

D. Notwithstanding the MRDLs in Table 340.7, an owner may increase the residual disinfectant level of chlorine or chloramines (but not chlorine dioxide) in the distribution system to a level and for a time necessary to protect public health. This may include specific microbiological contamination problems caused by circumstances such as distribution line breaks, storm runoff events, water supply contamination events, or cross-connection events.

12VAC5-590-350. Assessments and sanitary surveys.

A. Frequent assessments shall be made by the owner of the water supply and waterworks to locate and identify health hazards to the waterworks. The manner and frequency of making these assessments, and the rate at which discovered health hazards are to be removed, shall be the responsibility of the owner. Every effort shall be made by the owner, to the extent of his jurisdiction, to prevent the degradation of the quality of water supplies.

B. The department is required to perform sanitary surveys and site visits to assess the condition of a waterworks and its source water. Pursuant to § 32.1-25 of the Code of Virginia, the department shall, upon presentation of appropriate credentials and with the owner's consent, have the right of entry onto the waterworks property and the facilities to inspect, investigate, evaluate, conduct tests, and collect samples for testing for the purposes of determining compliance with the provisions of any law, regulation, or order administered by the board or commissioner or any conditions in a permit, license, or certificate issued by the board or commissioner. The owner shall provide any existing information requested by the department that will enable the department to conduct the sanitary survey or site visit.

C. A sanitary survey includes an evaluation of all of the following eight components:

1. Source;

2. Treatment;

3. Distribution system;

4. Finished water storage;

5. Pumps, pumping facilities, and controls;

6. Monitoring, reporting, data verification, and a special monitoring evaluation during each sanitary survey to determine whether the waterworks monitoring is appropriate or needs modification;

7. Waterworks system management and operation; and

8. Number and classification of operators. Operators shall also comply with all applicable regulations promulgated by the Virginia Board for Waterworks and Wastewater Works Operators and Onsite Sewage System Professionals and DPOR.

D. Significant deficiencies discovered as a result of a sanitary survey shall be addressed in accordance with the following:

1. The department shall issue written notification describing the significant deficiency to the owner.

2. Within 30 days of the significant-deficiency notification, the owner shall consult with the department regarding the appropriate corrective action with a schedule for implementing the corrective action. A waterworks with one or more significant deficiencies must have a CAP as described in 12VAC5-590-421 A.

3. Within 45 days of the significant-deficiency notification, the owner shall submit to the department a CAP with a schedule for meeting the requirements of 12VAC5-590-421 A.

12VAC5-590-360. Responsibilities of the owner.

A. The owner shall provide and maintain conditions throughout the entirety of the waterworks in a manner that will assure a high degree of capability and reliability to comply with Part II (12VAC5-590-340 et seq.) of this chapter. This requirement shall pertain to the source water, transmission, treatment, storage, and distribution system facilities and the operation thereof. The owner shall identify and evaluate factors with the potential for impairing the quality of the water delivered to the consumers. Preventative control measures identified in Part II of this chapter shall be promptly implemented to protect public health.

B. For the purpose of achieving compliance with this chapter, the owner shall exercise control of the waterworks from the source water to the service connection. This requirement does not imply ownership of or maintenance for any portion of the service line where local agreements and conditions dictate otherwise.

C. The property owner shall exercise control of all buildings, structures, and equipment up to the point of the service connection to the waterworks. This requirement does not limit or modify ownership of or maintenance for the service line, that may be specified by local agreements and conditions.

12VAC5-590-370. Monitoring requirements.

A. Bacteriological monitoring.

1. The owner shall collect total coliform samples at specific sites and according to a schedule that is representative of water quality throughout the distribution system, which shall be documented in a written BSSP. The BSSP shall be established or approved by the department after investigation of the source water, method of treatment and storage, and the final delivery of the drinking water through the distribution system. The BSSP shall include the following:

a. Specific routine, repeat, and triggered source water monitoring sites, identified by address or location.

b. Distribution maps showing the location where specific sampling sites will be selected with all monitoring sites identified.

c. A minimum of three routine sample sites identified for each required routine sample for waterworks serving 3,300 or fewer people.

d. A sample collection schedule with the number of routine samples required per monitoring period in accordance with Table 370.1 and subdivision A 4 of this section.

e. Repeat sample sites for each routine sample site that shall include the original routine location, at least one tap within five service connections upstream, and at least one tap within five service connections downstream with the following exceptions:

(1) Alternative repeat sample sites may be allowed when a routine site is one connection away from or at the end of a distribution system main or as approved by the department;

(2) A groundwater system serving 1,000 or fewer people may propose repeat sample sites, such as an entry point to the distribution system, that differentiate potential source water and distribution system contamination; or

(3) A groundwater system serving 1,000 or fewer people with a single well source and no treatment may propose that one repeat sample be collected at the triggered source water monitoring site, provided that representative sampling of the distribution system is still achieved.

f. A repeat sampling site shall not be eliminated from future collections solely based on a history of questionable water quality unless the sampling point is unacceptable as determined by the department.

g. A seasonal waterworks may collect special samples in accordance with an approved start-up procedure pursuant to subdivision A 12 a of this section.

2. The minimum number of bacteriological samples for total coliform evaluation to be collected and analyzed monthly from the distribution system of a community waterworks, or a NTNC shall be in accordance with Table 370.1. The owner of a (i) TNC that uses a surface water source or a groundwater source under the direct influence of surface water or (ii) a large TNC (serving 1,000 or more persons per day) shall collect and submit samples monthly for analysis in accordance with Table 370.1. For all other TNCs, the owner shall collect and submit samples for analysis each calendar quarter in accordance with Table 370.1. The minimum number of samples must be collected and submitted even if the waterworks has exceeded the E. coli PMCL or the total coliform treatment technique triggers.

3. The samples shall be collected at evenly spaced time intervals as practical throughout the month, except that a waterworks that uses only groundwater and serves 4,900 or fewer people may have the required samples collected on a single day if the samples are collected from different sites.

4. If the results of a sanitary survey or other factors determine that some other frequency is more appropriate than that stated in subdivisions A 2 and A 3 of this section, then a modified BSSP may be required. The altered frequency shall be confirmed or changed on the basis of subsequent sanitary surveys or as otherwise determined by the department.

5. The owner may conduct more compliance monitoring than is required by this section to investigate potential problems in the distribution system and to assist in uncovering problems. The owner may collect more than the minimum number of required routine samples. If the samples are collected in accordance with the existing BSSP and are representative of water quality throughout the distribution system, then all of the results shall be included in determining whether a coliform treatment technique has been triggered.

6. The owner may propose repeat monitoring locations believed to be representative of a pathway for contamination of the distribution system. The owner may elect to specify either alternative fixed locations or criteria for selecting repeat sampling sites on a situational basis in a SOP in its BSSP. The owner shall design the SOP to focus on the collection of repeat samples at locations that best verify and determine the extent of potential contamination of the distribution system based on specific situations. The department shall require modifications to the SOP or require alternative monitoring locations as needed.

TABLE 370.1
Bacteriological Monitoring

POPULATION SERVED PER DAY	MINIMUM NUMBER OF SAMPLES[a]
25 to 1,000[b]	1
1,001 to 2,500	2
2,501 to 3,300	3
3,301 to 4,100	4
4,101 to 4,900	5
4,901 to 5,800	6
5,801 to 6,700	7
6,701 to 7,600	8
7,601 to 8,500	9
8,501 to 12,900	10
12,901 to 17,200	15
17,201 to 21,500	20
21,501 to 25,000	25
25,001 to 33,000	30
33,001 to 41,000	40

TABLE 370.1 Bacteriological Monitoring (*continued*)	
POPULATION SERVED PER DAY	MINIMUM NUMBER OF SAMPLES[a]
41,001 to 50,000	50
50,001 to 59,000	60
59,001 to 70,000	70
70,001 to 83,000	80
83,001 to 96,000	90
96,001 to 130,000	100
130,001 to 220,000	120
220,001 to 320,000	150
320,001 to 450,000	180
450,001 to 600,000	210
600,001 to 780,000	240
780,001 to 970,000	270
970,001 to 1,230,000	300
1,230,001 to 1,520,000	330
1,520,001 to 1,850,000	360
1,850,001 to 2,270,000	390
2,270,001 to 3,020,000	420
3,020,001 to 3,960,000	450
3,960,001 or more	480

[a]Monthly monitoring is required for the following waterworks: (i) community, (ii) nontransient noncommunity, (iii) all noncommunity waterworks that use a surface water source, a GUDI source, or both, (iv) all seasonal waterworks, and (v) large noncommunity (serving more than 1,000 people per day). Quarterly monitoring is required for noncommuntity waterworks not specifically identified in the monthly requirements. Annual monitoring may be allowed at a TNC that meets the criteria specified in subdivision A 8 of this section.

[b]Includes a waterworks that have at least 15 service connections, but serve fewer than 25 persons.

7. All bacteriological analyses shall be performed in accordance with 12VAC5-590-440 by the DCLS or by a laboratory certified by the DCLS for drinking water samples.

8. Annual monitoring. The department may reduce the bacteriological monitoring frequency at a well-operated TNC from a quarterly sample to one annual sample, and the waterworks may remain at the annual monitoring frequency provided that all of the following conditions are continuously met:

a. The waterworks serves 1,000 or fewer people per day.

b. The waterworks uses groundwater only and is not under the influence of surface water.

c. The waterworks has a clean compliance history for a minimum of 12 consecutive months.

d. The most recent sanitary survey shows that the waterworks is free of sanitary defects or has corrected all identified sanitary defects.

e. The waterworks has a protected water source.

f. The waterworks meets existing approved construction standards.

g. The department has conducted an annual site visit within the last 12 months, and all identified sanitary defects have been corrected. For the purposes of this section, an annual site visit is equivalent to a voluntary Level 2 assessment that meets the criteria in 12VAC5-590-392 C. A sanitary survey may meet the requirement for an annual site visit in the year in which the sanitary survey is completed if all identified sanitary defects have been corrected.

9. Increased monitoring.

a. A TNC on quarterly or annual monitoring shall begin monthly monitoring in the month following an event if any of the following occurs: (i) the waterworks triggers a Level 2 assessment or two Level 1 assessments under the provisions of 12VAC5-590-392 in a rolling 12-month period, (ii) the waterworks has an E. coli PMCL violation, (iii) the waterworks has a coliform treatment technique violation, (iv) the owner has two monitoring violations under 12VAC5-590-370 A 2, or (v) the owner has one monitoring violation under 12VAC5-590-370 A 2 and one Level 1 assessment under 12VAC5-590-392 in a rolling 12-month period. The owner shall continue monthly monitoring until the requirements in subdivisions A 10 a and A 10 b of this section are met. A waterworks on monthly monitoring for other reasons is not considered to be on increased monitoring for the purpose of this subdivision.

b. A TNC on annual monitoring that experiences one monitoring violation of 12VAC5-590-370 must begin quarterly monitoring in the quarter following the event. The owner shall continue quarterly monitoring until the conditions in subdivision A 11 of this section are continuously met and the department reduces the monitoring frequency.

10. Returning to quarterly routine monitoring. The department may return the monitoring frequency of a TNC subject to subdivision A 9 a of this section and using groundwater not under the influence of surface water to quarterly monitoring if:

a. The department has completed a sanitary survey or a site visit within the last 12 months, and the TNC is free of sanitary defects and has a protected water source; and

b. The waterworks has maintained a clean compliance history for a minimum of 12 consecutive months following the event.

11. Returning to annual routine monitoring. The department may reduce the monitoring frequency of a TNC subject to subdivision A 9 of this section and using groundwater not under the influence of surface water to annual monitoring if:

a. An annual site visit or sanitary survey is conducted by the department, and all identified sanitary defects are corrected. The waterworks may substitute a voluntary Level 2 assessment for the annual site visit.

b. The waterworks has a protected water source and maintained a clean compliance history for a minimum of 12 consecutive months following the event.

c. The waterworks has in place or has adopted one or more of the following additional barriers to contamination: (i) an approved cross-connection control program, (ii) a licensed operator, (iii) continuous disinfection and maintenance of a residual in the distribution system in accordance with criteria specified by the department, (iv) demonstration of maintenance of at least a 4-log removal or inactivation of viruses in accordance with 12VAC5-590-379 A, or (v) other equivalent enhancements approved by the department.

12. Seasonal waterworks monitoring.

a. A seasonal waterworks shall demonstrate completion of an approved start-up procedure that may include start-up sampling before serving water.

b. A seasonal waterworks shall monitor every month that it is in operation.

c. The department may waive any seasonal waterworks from some or all of the requirements for seasonal waterworks if the entire distribution system remains pressurized during the entire period that the waterworks is not operating.

d. Failure to complete an approved start-up procedure before serving water is a treatment technique violation and requires the owner to provide public notification under Tier 2 conditions in 12VAC5-590-540 A 2.

e. Failure to submit certification of completion to the department after the owner completes an approved start-up procedure is a reporting violation and requires the owner to provide public notification under Tier 3 conditions in 12VAC5-590-540 A 3.

13. Additional routine monitoring in the month following a total coliform-positive sample.

a. The owner collecting samples on a quarterly or annual frequency shall collect at least three additional routine samples during the month following one or more total coliform-positive samples, with or without a Level 1 treatment trigger. The owner shall use the results of additional routine samples in coliform treatment technique trigger calculations under 12VAC5-590-392 B.

b. The requirements specified in subdivision A 13 a of this section may be waived by the department if:

(1) The department conducts a site visit before the end of the next month in which the waterworks provides water and has determined whether additional monitoring or corrective action is needed;

(2) The department has determined why the sample was total coliform positive and has established that the owner corrected the problem or will correct the problem before the end of the next month in which the waterworks serves water. In this case, the decision and the rationale for the decision shall be documented and approved in writing by the department. The department shall make this document available to EPA and the public. The documentation shall describe the specific cause of the total coliform-positive sample and what action the owner has taken or will take to correct this problem; or

(3) The department determines that the owner has corrected the contamination problem before collecting the set of repeat samples required in 12VAC5-590-380 D 3, and all repeat samples are total coliform negative. The department may waive the requirement for additional routine monitoring the next month.

c. The requirements specified in subdivision A 13 a of this section may not be waived by the department solely on the grounds that all repeat samples are total coliform negative.

14. Any one of the following is a monitoring violation: (i) failure to collect every required routine or additional routine sample in a compliance period, and (ii) failure to analyze for E. coli following a total coliform-positive sample. For each violation, the owner is required to provide public notification under Tier 3 conditions in 12VAC5-590-540 A 3.

15. Any one of the following is a reporting violation: (i) failure to submit monitoring results after the owner properly conducts monitoring, (ii) failure to submit a completed assessment form, and (iii) failure to notify the department following an E. coli-positive sample. The reporting requirements in 12VAC5-590-530 are applicable to this subdivision. For each violation, the owner is required to provide public notification under Tier 3 conditions in 12VAC5-590-540 A 3.

B. Chemical monitoring. The location of sampling points, the chemicals measured, the frequency, and the timing of sampling within each compliance period shall be established or approved by the department at the time of issuance of a waterworks operation permit because of changes in this chapter or conditions at the waterworks.

1. The department may increase required monitoring where necessary to detect variations within the waterworks and to provide quality control for any treatment processes that are employed.

2. Analysis of field composite samples shall not be allowed.

3. Samples for contaminants that may exhibit seasonal variations shall be collected during the period of the year when contamination is most likely to occur.

4. Failure to comply with the sampling schedules in this section, which includes the collection of confirmation samples cited in 12VAC5-590-382 A for inorganic chemicals, 12VAC5-590-382 B for nitrate and nitrite, and 12VAC5-590-383 A for organic chemicals, is a monitoring violation and shall require public notification pursuant to 12VAC5-590-540 A 3.

C. The department may allow a consecutive waterworks that obtains potable water from another waterworks to limit monitoring to bacteriological, residual disinfectant, DBPs, and lead and copper.

D. Monitoring requirements for a waterworks developing new sources of source water are provided in 12VAC5-590-820, 12VAC5-590-830, and 12VAC5-590-840.

E. The department may require an owner to collect additional samples to provide quality control for any treatment processes that are employed.

F. Surface water sampling requirements specified in 12VAC5-590-372 through 12VAC5-590-378 apply to GUDI sources.

12VAC5-590-372. Inorganic chemicals monitoring.

A. The owner of a community waterworks or a NTNC shall conduct monitoring to determine compliance with the PMCLs and SMCLs listed in Table 340.1 in accordance with this section. The owner of a TNC shall conduct monitoring to determine compliance with the nitrate, nitrite, and nitrate-nitrite PMCLs listed in Table 340.1 in accordance with this section.

B. If a waterworks draws water from more than one source and the sources are combined before distribution, then the owner shall sample at an entry point to the distribution system during periods of normal operating conditions (i.e., when water is representative of all sources being used).

C. When the results of sampling for antimony, arsenic, asbestos, barium, beryllium, cadmium, cyanide (as free cyanide), chromium, fluoride, mercury, nickel, selenium, or thallium exceed the applicable PMCL, the owner shall collect a confirmation sample, at the same sampling site, within two weeks of notification of the analytical results of the first sample.

D. Monitoring frequency.

1. Asbestos. The department has granted a statewide waiver for asbestos. If the statewide waiver is removed or if site-specific waterworks conditions warrant monitoring for asbestos, then monitoring to determine compliance with the PMCL for asbestos specified in Table 340.1 shall be conducted as follows:

a. The owner of a community waterworks or a NTNC shall monitor for asbestos during the first three-year compliance period of each nine-year compliance cycle.

b. If the statewide waiver is removed, and the owner believes the waterworks is not vulnerable to asbestos contamination from either its source water or due to corrosion of its asbestos-cement pipe, then the owner may apply to the department for a monitoring waiver for asbestos. If the department grants the monitoring waiver, then the owner is not required to monitor.

c. The department may grant a waiver based on a consideration of the following factors:

(1) Potential asbestos contamination of the source water; and

(2) The use of asbestos-cement pipe for finished water distribution and the corrosive nature of the water.

d. A waiver remains in effect until the completion of the compliance period (i.e., three years).

e. The owner of a waterworks vulnerable to asbestos contamination due solely to corrosion of its asbestos-cement pipe shall collect one sample at a tap served by the asbestos-cement pipe and under conditions where asbestos contamination is most likely to occur.

f. The owner of a waterworks vulnerable to asbestos contamination due to its source water shall monitor at the entry points.

g. The owner of a waterworks vulnerable to asbestos contamination due both to its source water and corrosion of its asbestos-cement pipe shall collect one sample at a tap served by the asbestos-cement pipe and under conditions where asbestos contamination is most likely to occur.

h. The owner of a waterworks that exceeds the PMCL as determined in 12VAC5-590-382 A shall monitor quarterly beginning in the next quarter after the exceedance occurred.

i. The department may decrease the quarterly monitoring requirement to the frequency specified in subdivision D 1 a of this section provided the department has determined that the waterworks is reliably and consistently below the PMCL. In no case shall the department make this determination unless the owner of a groundwater system collects a minimum of two quarterly samples or the owner of a waterworks that uses a surface water source, in whole or in part, collects a minimum of four quarterly samples.

2. Antimony, arsenic, barium, beryllium, cadmium, chromium, cyanide (as free cyanide), fluoride, mercury, nickel, selenium, and thallium. Monitoring to determine compliance with the PMCL for these contaminants specified in Table 340.1 shall be conducted as follows:

a. The owner shall collect one sample at each groundwater source entry point during each compliance period.

b. The owner shall collect one sample annually at each surface water source entry point, in whole or in part.

c. The owner may apply to the department for a waiver from the monitoring frequencies specified in subdivisions D 2 a and D 2 b of this section.

(1) A condition of the waiver shall require that the owner collect a minimum of one sample while the waiver is effective. The waiver remains in effect for one compliance cycle (i.e., nine years).

(2) The department may grant a waiver provided the owner has monitored surface water source entry points, in whole or in part, annually for at least three years and has conducted a minimum of three rounds of monitoring at groundwater source entry points. At least one sample shall have been collected since January 1, 1990. The owner shall demonstrate that all previous analytical results were less than the PMCL. A waterworks that uses a new groundwater or surface water source is not eligible for a waiver until three rounds of monitoring from the new source have been completed.

(3) In determining the appropriate reduced monitoring frequency, the department shall consider:

(a) The reported concentrations from all previous monitoring;

(b) The degree of variation in reported concentrations; and

(c) Other factors that may affect contaminant concentrations such as changes in groundwater pumping rates, changes in the waterworks configuration, changes in the waterworks operating procedures, or changes in stream flows or characteristics.

(4) A decision by the department to grant a waiver shall be made in writing and shall set forth the basis for the determination. The request for a waiver may be initiated by the department or upon an application by the owner. The owner shall specify the basis for the request. The department shall evaluate and, where appropriate, revise the determination of the appropriate monitoring frequency when the owner submits new monitoring data or when other data relevant to the appropriate monitoring frequency become available.

(5) No arsenic waivers shall be granted by the department.

d. The owner of a waterworks that exceed the PMCLs as calculated in 12VAC5-590-382 shall monitor quarterly beginning in the next quarter after the exceedance occurred. The department may decrease the quarterly monitoring requirement to the frequencies specified in subdivision D 2 a, D 2 b, or D 2 c of this section provided a determination has been made that the analytical results are reliably and consistently below the PMCL. In no case may the department make this determination unless the owner collects a minimum of two quarterly samples from each groundwater source entry point and a minimum of four quarterly samples from each surface water source entry point, in whole or in part.

3. Nitrate and combined nitrate-nitrite as nitrogen. Monitoring to determine compliance with the PMCL for nitrate and combined nitrate-nitrite as nitrogen specified in Table 340.1 shall be conducted as follows:

a. The owner shall collect one sample annually at each groundwater source entry point.

b. The owner shall collect one sample quarterly at each surface water source entry point, in whole or in part.

c. For groundwater source entry points at community and NTNCs, the repeat monitoring frequency shall be quarterly for at least one year following any one sample in which the concentration is greater than 50% of the PMCL. After four consecutive quarters of monitoring, the department may allow the owner to reduce the sampling frequency to annually after determining the results are reliably and consistently less than the PMCL.

d. For surface water source entry points, in whole or in part, the department may allow the owner to reduce the sampling frequency to annually if all analytical results from four consecutive quarters are less than 50% of the PMCL. The waterworks shall return to quarterly monitoring if the concentration found in any one sample is greater than or equal to 50% of the PMCL.

e. After any round of quarterly sampling is completed as required by subdivisions D 3 c and D 3 d of this section, the owner who is monitoring annually shall collect subsequent samples during the quarter that previously resulted in the highest analytical result.

f. No monitoring waivers shall be issued for nitrate or combined nitrate-nitrite as nitrogen.

4. Nitrite. Monitoring to determine compliance with the PMCL for nitrite specified in Table 340.1 shall be conducted as follows:

a. The owner shall collect one sample at each entry point during the initial compliance period.

b. After the initial sample, the owner of a waterworks where an analytical result for nitrite is less than 50% of the PMCL shall monitor at the frequency specified by the department.

c. The repeat monitoring frequency for an owner shall be quarterly for at least one year following any one sample in which the concentration is greater than 50% of the PMCL. The department may allow an owner to reduce the sampling frequency to annually after determining the analysis results are reliably and consistently less than the PMCL.

d. The owner of a waterworks that is monitoring annually shall collect each subsequent sample during the quarter that previously resulted in the highest analytical result.

e. No monitoring waivers shall be issued for nitrite.

5. Aluminum, chloride, copper, corrosivity, fluoride, foaming agents (surfactants), iron, manganese, silver, sulfate, and zinc. Monitoring to determine compliance with the SMCL for these contaminants specified in Table 340.1 shall be conducted as follows:

a. The owner shall collect one sample at each groundwater source entry point during each compliance period.

b. The owner shall collect one sample annually at each surface water source entry point, in whole or in part.

6. Sodium. All community waterworks shall monitor for sodium as follows:

a. The number of samples to be collected shall be determined by the department based on the waterworks infrastructure and occurrence concentrations where applicable.

(1) The owner shall collect at least one sample annually at each surface water source entry point, in whole or in part.

(2) The owner shall collect one sample at each groundwater source entry point at least every three years.

(3) The department may require the owner to collect and analyze water samples for sodium more frequently where sodium content is variable.

b. Sodium shall be analyzed in accordance with methods and laboratory requirements identified in 12VAC5-590-440.

c. Sample results shall be submitted to the department in accordance with 12VAC5-590-530.

d. The department shall notify local and state health officials of the sodium levels.

e. The results of the special monitoring for sodium shall be included in the Consumer Confidence Report in accordance with 12VAC5-590-545 C 5 f.

12VAC5-590-373. Organic chemicals monitoring.

A. The owner of a community waterworks or a NTNC shall conduct monitoring to determine compliance with PMCLs listed in Table 340.2 in accordance with this section. Where two or more sources are combined before distribution, the owner shall sample at the entry point for the combined sources during periods of normal operation conditions.

1. The owner of a waterworks that uses groundwater shall collect a minimum of one sample at each entry point.

2. The owner of a waterworks that uses surface water, in whole or in part, shall collect a minimum of one sample at each entry point.

B. During the initial compliance period and each subsequent compliance period, the owner shall monitor during four consecutive calendar quarters for each contaminant listed in Table 340.2. A minimum of one sample at each entry point shall be collected during each calendar quarter.

C. Reduced monitoring.

1. Volatile organic chemicals (VOCs).

a. The requirement for four quarterly samples during initial monitoring as specified in subsection B of this section may not be reduced.

b. The department may decrease the requirement for quarterly monitoring during subsequent compliance periods provided it has been determined that the analytical results are reliably and consistently below the PMCL. In no case shall the department make this determination unless:

(1) The owner collects a minimum of two quarterly samples at each groundwater source entry point; or

(2) The owner collects a minimum of four quarterly samples at each surface water source entry point, in whole or in part.

c. If the department determines that the waterworks is reliably and consistently below the PMCL, then the department may allow the owner to monitor annually. The owner who monitors annually shall monitor during the quarter that previously yielded the highest analytical result.

d. For a groundwater system only. After a minimum of three years of annual sampling, the department may allow the owner with no previous detection of any VOCs listed in Table 340.2 to collect one sample during each compliance period.

e. The owner of a groundwater system that has three consecutive annual samples with no detection of a contaminant may apply to the department for a waiver, in accordance with 12VAC5-590-373 F.

2. Synthetic organic chemicals (SOCs).

a. The owner of a waterworks serving more than 3,300 persons that does not detect any SOCs listed in Table 340.2 in the initial compliance period may reduce the sampling frequency to a minimum of two quarterly samples in one year during each repeat compliance period.

b. The owner of a waterworks serving fewer than or equal to 3,300 persons that does not detect any SOCs listed in Table 340.2 in the initial compliance period may reduce the sampling frequency to a minimum of one sample during each repeat compliance period.

c. The department may reduce the quarterly monitoring required by subdivision B or D of this section provided the department has determined that the analytical results are reliably and consistently below the PMCL. In no case shall the department make this latter determination unless:

(1) The owner collects a minimum of two quarterly samples at each groundwater source entry point.

(2) The owner collects a minimum of four quarterly samples at each surface water source entry point, in whole or in part.

d. If the department determines that the analytical results are reliably and consistently below the PMCL, the department may allow the owner to monitor annually. The owner of a waterworks that monitors annually shall monitor during the quarter that previously yielded the highest analytical result.

e. The owner of a waterworks that has three consecutive annual samples with no detection of a contaminant may apply to the department for a waiver for SOC monitoring by submitting a waiver application as specified in subdivisions F 1 b and F 2 b of this section. The waiver remains in effect for one compliance period (i.e., three years).

D. Increased monitoring.

1. If the owner of a waterworks that is on reduced monitoring detects a contaminant listed in Table 340.2 (see 12VAC5-590-383 A regarding confirmation samples), then the owner shall monitor quarterly at each sampling point where the contaminant was detected unless:

a. That contaminant was previously detected and the department determined it was reliably and consistently below the PMCL according to subdivisions C 1 b and C 2 c of this section;

b. The historical sampling data do not indicate a meaningful increase in the contaminant concentration; and

c. The contaminant concentration does not exceed the PMCL.

2. The owner of a waterworks that exceeds the PMCLs listed in Table 340.2 for VOCs or SOCs, as determined by 12VAC5-590-383, shall monitor quarterly.

a. If, after a minimum of four consecutive quarterly samples that show the waterworks is in compliance as specified in 12VAC5-590-383; and

b. The department determines that the analytical results are reliably and consistently below the PMCL; then

c. The owner may monitor at the frequency and time specified in subdivisions C 1 c and C 2 d of this section.

E. Other monitoring requirements.

1. Vinyl chloride.

a. The owner of a groundwater system that has detected one or more of the following two-carbon organic compounds: trichloroethylene, tetrachloroethylene, 1,2-dichloroethane, 1,1,1-trichloroethane, cis-1,2-dichloroethylene, trans-1,2-dichloroethylene, or 1,1-dichloroethylene, shall monitor quarterly for vinyl chloride. A vinyl chloride sample shall be collected at each sampling point at which one or more of the two-carbon organic compounds were detected. If the results of the first analysis do not detect vinyl chloride, then the department may reduce the quarterly monitoring frequency of vinyl chloride monitoring to one sample during each compliance period.

b. The owner of a waterworks that uses surface water in whole or in part is required to monitor for vinyl chloride as specified by the department.

2. If monitoring detects one or more of certain related contaminants (heptachlor and heptachlor epoxide), then subsequent monitoring shall analyze for all related contaminants.

3. For entry points sampled and analyzed for contaminants listed in Table 340.2, the following detection limits apply:

a. A VOC is detected at a level equal to or greater than 0.0005 mg/L; and

b. A SOC is detected at a level equal to or greater than defined by EPA under 40 CFR 141.24(h)(18) or by the department.

F. Monitoring waivers.

1. Groundwater source entry points.

a. The owner of a waterworks that does not detect a VOC contaminant listed in Table 340.2 may apply to the department for a waiver from the subsequent compliance period requirements of subsection B and subdivision C 1 c of this section after completing the initial monitoring. A waiver shall be effective for no more two compliance periods (i.e., six years).

b. The owner of a waterworks may apply to the department for a SOC monitoring waiver from the requirements of subsection B and subdivision C 2 of this section. The owner must reapply for a waiver for each subsequent compliance period (i.e., three years).

2. Surface water source entry points, in whole or in part.

a. No VOC monitoring waivers shall be issued.

b. The owner of a waterworks that does not detect a SOC contaminant listed in Table 340.2 may apply to the department for a SOC monitoring waiver from the requirements of subsection B and subdivision C 2 of this section. The owner must reapply for a waiver for each subsequent compliance period (i.e., three years).

3. Monitoring waiver applications. The owner shall submit a monitoring waiver application for evaluation on a form approved by the department. The department may grant a waiver after an evaluation of the use, transport, storage, or disposal of any organic contaminant within the watershed or zone of influence of the source.

a. If an evaluation by the department reveals no previous use of the contaminants within the watershed or zone of influence, then a waiver may be granted.

b. If an evaluation by the department reveals either previous use of the contaminants or that use is unknown, then the following factors shall be used to determine whether a waiver is granted:

(1) Previous analytical results.

(2) The proximity of the source water to land use activities that are potential point or nonpoint sources of organic contamination and to potential conduits to groundwater. Point sources include spills and leaks of chemicals at or near a waterworks or at manufacturing, distribution, or storage facilities or from hazardous or municipal waste landfills and other waste handling or treatment facilities. Nonpoint sources for SOCs include the use of pesticides to control insects and weed pests on agricultural areas, forest lands, home and gardens, and other land application uses.

(3) The environmental persistence and transport of the contaminants listed in Table 340.2.

(4) The implementation of a watershed protection program for surface water systems and wellhead protection measures for groundwater systems by the owner.

(5) For groundwater well sources: well construction, well depth, soil type, geological conditions, and well structure integrity.

(6) Special factors, as follows:

(a) For VOCs, the number of persons served by the waterworks and the proximity of a smaller waterworks to a larger waterworks.

(b) For SOCs, elevated nitrate levels at the waterworks' source water.

(c) For SOCs, use of PCBs in equipment used in the production, storage, or distribution of water (i.e., PCBs used in pumps, transformers, and other equipment).

c. An entry point at which treatment has been installed to remove VOCs or SOCs is not eligible for a monitoring waiver for the VOCs or SOCs for which treatment has been installed.

d. All waterworks are granted a waiver from monitoring dioxin, endothall, and glyphosate unless the department determines that there is a source of these contaminants that poses a threat to the source water.

4. Condition for waivers.

a. Groundwater source entry points.

(1) As a condition of the VOC waiver, the owner shall collect one sample at each entry point during the time the waiver is effective (i.e., one sample during two compliance periods or six years) and update the waterworks vulnerability assessment. Based on this data, the department may reconfirm that the source is nonvulnerable. If the department does not make this reconfirmation within three years of the initial determination, then the waiver is invalidated and the owner is required to sample annually.

(2) There are no conditions to SOC waivers.

b. Surface water source entry points, in whole or in part. There are no conditions to VOC and SOC waivers for waterworks in regard to these entry points.

12VAC5-590-374. Residual disinfectant, disinfection byproducts, and disinfection byproduct precursors monitoring.

A. Unless otherwise noted, an owner of a waterworks that uses a chemical disinfectant shall comply with the requirements of this section as follows:

1. The owner of a community waterworks or a NTNC shall comply with this section.

2. The owner of a TNC that uses any combination of a surface water source, a GUDI source, or a groundwater source and uses chlorine dioxide as a disinfectant or oxidant shall comply with all the requirements for chlorine dioxide in this section.

B. The owner shall collect all samples during normal operating conditions.

1. Analysis under this section for DBPs (TTHM, HAA5, chlorite, and bromate) shall be conducted by laboratories that have received certification by EPA or DCLS as specified in 12VAC5-590-440, except as noted in subdivisions B 2 and B 3 of this section.

2. Measurement under this section of daily chlorite samples at the entry point to the distribution system, residual disinfectant (free chlorine, combined chlorine, total chlorine, and chlorine dioxide), alkalinity, bromide, TOC, SUVA (DOC and UV_{254}), pH, and magnesium shall be made by a party approved by the department.

3. Residual disinfectant concentrations for free chlorine, combined chlorine, total chlorine, and chlorine dioxide shall be made using equipment deemed satisfactory by the department.

C. Monitoring plan. The owner required to monitor under this section shall develop and implement a monitoring plan. The owner shall maintain the plan and make it available for inspection by the department and the general public. The owner of a community waterworks or a NTNC that uses a surface water source, a GUDI source, or both and serves more than 3,300 people shall submit a copy of the monitoring plan to the department no later than the date of the first report required under 12VAC5-590-531 A. The department may also require the plan to be submitted by any other owner. After evaluation, the department may require changes in any of the plan elements. The plan shall include at least the following:

1. Specific locations and schedules with monitoring dates for collecting samples for any parameters included in this section.

2. How the owner will calculate compliance with PMCLs, MRDLs, and treatment techniques.

3. The sampling plan for a consecutive waterworks shall reflect the entire consecutive distribution system.

4. All new waterworks shall comply with the monitoring location requirements of 40 CFR 141 Subpart U, Initial distribution system evaluations, in the development of the waterworks monitoring plan.

D. Failure to monitor in accordance with the monitoring plan required under subsection C of this section is a monitoring violation. Failure to monitor shall be treated as a violation for the entire period covered by the annual average where compliance is based on an RAA of monthly or quarterly samples or averages, and the owner's failure to monitor makes it impossible to determine compliance with PMCLs or MRDLs.

E. The owner may use only data collected under the provisions of this section to qualify for reduced monitoring.

F. TTHM and HAA5 monitoring. The owner of a community waterworks or a NTNC shall conduct the LRAA monitoring for TTHM and HAA5 at the frequency given below, unless otherwise indicated.

1. This subdivision establishes monitoring and other requirements for achieving compliance with PMCLs based on the LRAA for TTHM and HAA5, and for achieving compliance with MRDLs for chlorine and chloramines for certain consecutive waterworks.

2. This subdivision applies to a community waterworks or a NTNC that uses a primary or secondary disinfectant other than UV light or delivers water that has been treated with a primary or secondary disinfectant other than UV light.

3. Routine monitoring.

a. If the waterworks is a NTNC serving fewer than 10,000 people, then the owner shall monitor at the location or locations and dates identified in the monitoring plan in subsection C of this section, updated as required by subdivision F 3 e of this section.

b. The owner shall monitor at no fewer than the number of locations identified in Table 374.1:

TABLE 374.1
Monitoring Frequency by Source Water Type for TTHM and HAA5

SOURCE WATER TYPE	POPULATION SIZE CATEGORY	MONITORING FREQUENCY[a]	DISTRIBUTION SYSTEM MONITORING LOCATION TOTAL PER MONITORING PERIOD[b]
Surface water or GUDI Source	Less than 500	per year	2
	500 - 3,300	per quarter	2
	3,301 - 9,999	per quarter	2
	10,000 - 49,999	per quarter	4
	50,000 - 249,999	per quarter	8
	250,000 - 999,999	per quarter	12
	1,000,000 - 4,999,999	per quarter	16
	Equal to or greater than 5,000,000	per quarter	20
Groundwater	Less than 500	per year	2
	500 - 9,999	per year	2
	10,000 - 99,999	per quarter	4
	100,000 - 499,999	per quarter	6
	Equal to or greater than 500,000	per quarter	8

[a]The owner shall monitor during the month of highest DBP concentrations.

[b]The owner of a waterworks on quarterly monitoring (except those using a surface water source, a GUDI source, or both and serving 500 to 3,300 people) shall collect dual sample sets every 90 days at each monitoring location. A groundwater system serving 500 to 9,999 people shall collect dual sample sets annually at each monitoring location. A waterworks serving fewer than 500 people and a waterworks using a surface water source, a GUDI source, or both and serving 500 to 3,300 people shall collect individual TTHM and HAA5 samples (instead of a dual sample set) at the locations with the highest TTHM and HAA5 concentrations, respectively. A waterworks serving fewer than 500 people shall sample annually, and a waterworks using a surface water source, a GUDI source, or both and serving 500 to 3,300 people shall sample every 90 days. For a waterworks serving fewer than 500 people, only one location with a dual sample set per monitoring period is needed if the highest TTHM and HAA5 concentrations occur at the same location (and month, if monitoring annually).

c. The owner of a waterworks not using disinfection that then begins using a disinfectant other than UV light shall consult with the department to identify compliance monitoring locations. The owner shall develop a monitoring plan under subdivision F 3 e of this section to include those monitoring locations.

d. The owner shall use an approved method listed in 12VAC5-590-440 for TTHM and HAA5 analyses. Analyses shall be conducted by laboratories that have received certification by EPA or DCLS as specified in 12VAC5-590-440.

e. The owner may revise the monitoring plan to reflect changes in treatment, distribution system operations and layout (including new service areas), or other factors that may affect TTHM or HAA5 formation, or for reasons approved by the department after consultation with the department regarding the need for changes and the appropriateness of the changes. If the owner changes monitoring locations, then the owner shall replace existing compliance monitoring locations with the lowest LRAA with new locations that reflect the current distribution system locations with expected high TTHM or HAA5 levels. The department may also require modifications in the monitoring plan. The owner of a waterworks using a surface water source, a GUDI source, or both and serving more than 3,300 people shall submit a copy of the modified monitoring plan to the department before the date the owner is required to comply with the revised monitoring plan.

4. Reduced monitoring.

a. The owner may reduce monitoring to the level specified in Table 374.2 any time the LRAA is less than or equal to 0.040 mg/L for TTHM and less than or equal to 0.030 mg/L for HAA5 at all monitoring locations. The owner may only use data collected under the provisions of this section to qualify for reduced monitoring. In addition, the source water annual average TOC level, before any treatment, shall be less than or equal to 4.0 mg/L at each water treatment plant treating a surface water source, a GUDI source, or both based on monitoring conducted under subsection J of this section.

TABLE 374.2 Reduced Monitoring for TTHM and HAA5			
SOURCE WATER TYPE	POPULATION SIZE CATEGORY	MONITORING FREQUENCY[a]	DISTRIBUTION SYSTEM MONITORING LOCATION PER MONITORING PERIOD
Surface water or GUDI Source	Less than 500		Monitoring may not be reduced.
	500 - 3,300	per year	One TTHM and one HAA5 sample: one at the location and during the quarter with the highest TTHM single measurement, one at the location and during the quarter with the highest HAA5 single measurement; one dual sample set per year if the highest TTHM and HAA5 measurements occurred at the same location and quarter.
	3,301 - 9,999	per year	Two dual sample sets: one at the location and during the quarter with the highest TTHM single measurement, one at the location and during the quarter with the highest HAA5 single measurement.
	10,000 - 49,999	per quarter	Two dual sample sets: at the locations with the highest TTHM and highest HAA5 LRAAs.
	50,000 - 249,999	per quarter	Four dual sample sets: at the locations with the two highest TTHM and two highest HAA5 LRAAs.
	250,000 - 999,999	per quarter	Six dual sample sets: at the locations with the three highest TTHM and three highest HAA5 LRAAs.
	1,000,000 - 4,999,999	per quarter	Eight dual sample sets: at the locations with the four highest TTHM and four highest HAA5 LRAAs.
	Equal to or greater than 5,000,000	per quarter	Ten dual sample sets: at the locations with the five highest TTHM and five highest HAA5 LRAAs.

TABLE 374.2 Reduced Monitoring for TTHM and HAA5 (*continued*)			
SOURCE WATER TYPE	POPULATION SIZE CATEGORY	MONITORING FREQUENCY[a]	DISTRIBUTION SYSTEM MONITORING LOCATION PER MONITORING PERIOD
Groundwater	Less than 500	every third year	One TTHM and one HAA5 sample: one at the location and during the quarter with the highest TTHM single measurement, one at the location and during the quarter with the highest HAA5 single measurement; one dual sample set per year if the highest TTHM and HAA5 measurements occurred at the same location and quarter.
	500 - 9,999	per year	One TTHM and one HAA5 sample: one at the location and during the quarter with the highest TTHM single measurement, one at the location and during the quarter with the highest HAA5 single measurement; one dual sample set per year if the highest TTHM and HAA5 measurements occurred at the same location and quarter.
	10,000 - 99,999	per year	Two dual sample sets: one at the location and during the quarter with the highest TTHM single measurement, one at the location and during the quarter with the highest HAA5 single measurement.
	100,000 - 499,999	per quarter	Two dual sample sets: at the locations with the highest TTHM and highest HAA5 LRAAs.
	Equal to or greater than 500,000	per quarter	Four dual sample sets: at the locations with the two highest TTHM and two highest HAA5 LRAAs.
[a]The owner of a waterworks on quarterly monitoring shall collect dual sample sets every 90 days.			

b. The owner may remain on reduced monitoring as long as the TTHM LRAA is less than or equal to 0.040 mg/L and the HAA5 LRAA is less than or equal to 0.030 mg/L at each monitoring location (for waterworks with quarterly reduced monitoring) or each TTHM sample is less than or equal to 0.060 mg/L and each HAA5 sample is less than or equal to 0.045 mg/L (for waterworks with annual or less frequent monitoring). In addition, the source water annual average TOC level, before any treatment, shall be less than or equal to 4.0 mg/L at each water treatment plant treating a surface water source or a GUDI source, based on monitoring conducted under subsection J of this section.

c. If the LRAA based on quarterly monitoring at any monitoring location exceeds either 0.040 mg/L for TTHM or 0.030 mg/L for HAA5 or if the annual (or less frequent) sample at any location exceeds either 0.060 mg/L for TTHM or 0.045 mg/L for HAA5, or if the source water

annual average TOC level, before any treatment, is greater than 4.0 mg/L at any water treatment plant treating a surface water source, a GUDI source, or both then the owner shall resume routine monitoring under subdivision F 3 of this section or begin increased monitoring if subdivision F 5 of this section applies.

d. A waterworks may return to routine monitoring at the department's discretion.

5. Increased monitoring.

a. The owner of a waterworks required to monitor at a particular location annually or less frequently than annually under subdivision F 3 or F 4 of this section, shall increase monitoring to dual sample sets once per quarter (collected every 90 days) at all locations if a TTHM sample is greater than 0.080 mg/L or a HAA5 sample is greater than 0.060 mg/L at any location.

b. The owner may return to routine monitoring once the waterworks has conducted increased monitoring for at least four consecutive quarters and the LRAA for every monitoring location is less than or equal to 0.060 mg/L for TTHM and less than or equal to 0.045 mg/L for HAA5.

G. Chlorite. The owner of a community waterworks or a NTNC using chlorine dioxide, for disinfection or oxidation, shall conduct monitoring for chlorite.

1. Routine monitoring.

a. The owner shall collect daily samples at the entry point to the distribution system. For any daily sample that exceeds the chlorite PMCL listed in Table 340.6, the owner shall collect additional samples in the distribution system the following day at the locations required by subdivision G 1 c of this section, in addition to the sample required at the entrance to the distribution system.

b. The owner shall collect a three-sample set each month in the distribution system. The owner shall collect one sample at each of the following locations: near the first customer, at a location representative of average residence time, and at a location reflecting maximum residence time in the distribution system. Any additional routine sampling shall be conducted in the same manner (as three-sample sets, at the specified locations). The owner may use the results of additional monitoring conducted under subdivision G 1 c of this section to meet the requirement for monitoring in this subdivision G 1 b.

c. On each day following a routine sample monitoring result that exceeds the chlorite PMCL listed in Table 340.6 at the entrance to the distribution system, the owner is required to collect three chlorite distribution system samples at the following locations: as close to the first customer as possible, in a location representative of average residence time, and as close to the end of the distribution system as possible (reflecting maximum residence time in the distribution system).

2. Reduced monitoring.

a. Chlorite monitoring at the entrance to the distribution system required by subdivision G 1 a of this subsection may not be reduced.

b. Chlorite monitoring in the distribution system required by subdivision G 1 b of this section may be reduced to one three-sample set per quarter after one year of monitoring where no individual chlorite sample collected in the distribution system under subdivision G 1 b of this section has exceeded the chlorite PMCL listed in Table 340.6 and the owner has not been required to conduct monitoring under subdivision G 1 c of this section. The owner may remain on the reduced monitoring schedule until either any of the three individual chlorite samples collected quarterly in the distribution system under subdivision G 1 b of this section exceeds the chlorite PMCL or the owner is required to conduct monitoring under subdivision G 1 c of this section, at which time the owner shall revert to routine monitoring.

H. Bromate.

1. The owner of a community waterworks or a NTNC water treatment plant using ozone for disinfection or oxidation shall collect one sample per month and analyze it for bromate. The owner shall collect samples monthly at the entrance to the distribution system while the ozonation system is operating under normal conditions.

2. The owner required to analyze for bromate may reduce monitoring from monthly to quarterly if the waterworks RAA bromate concentration is less than or equal to 0.0025 mg/L based on monthly bromate measurements under subdivision H 1 of this section for the most recent four quarters. If a waterworks has qualified for reduced bromate monitoring under this subdivision, then the owner may remain on reduced monitoring as long as the RAA of quarterly bromate samples is equal to or less than 0.0025 mg/L. If the RAA bromate concentration is greater than 0.0025 mg/L, then the owner shall resume routine monitoring required by subdivision H 1 of this section.

I. Monitoring requirements for the residual disinfectant.

1. Chlorine and chloramines.

a. The owner of a waterworks that uses chlorine or chloramines shall measure the residual disinfectant level in the distribution system at the same point in the distribution system and at the same time as total coliform bacteria are sampled, as specified in 12VAC5-590-370 A and 12VAC5-590-380 D. The owner of a waterworks using a surface water source, a GUDI source, or both may use the results of the residual disinfectant concentration sampling found in 12VAC5-590-376 D instead of collecting separate samples.

b. Residual disinfectant level monitoring may not be reduced.

2. Chlorine dioxide.

a. The owner of a waterworks that uses chlorine dioxide for disinfection or oxidation shall collect daily samples at the entrance to the distribution system. For any daily sample that exceeds the MRDL listed in Table 340.7, the owner shall collect samples in the distribution system the following day at the locations required by subdivision I 2 b of this section, in addition to the sample required at the entrance to the distribution system.

b. On each day following a routine sample monitoring result that exceeds the MRDL listed in Table 340.7, the owner is required to collect three chlorine dioxide distribution system samples. If chlorine dioxide or chloramines are used to maintain a residual disinfectant in the distribution system, or if chlorine is used to maintain a residual disinfectant in the distribution system and there is no rechlorination after the entry point, then the owner shall collect three samples as close to the first customer as possible, at intervals of at least six hours. If chlorine is used to maintain a residual disinfectant in the distribution system and there are one or more rechlorination points after the entry point, then the owner shall collect one sample at each of the following locations: as close to the first customer as possible, in a location representative of average residence time, and as close to the end of the distribution system as possible (reflecting maximum residence time in the distribution system).

c. Chlorine dioxide monitoring may not be reduced.

3. Ozone. Ozone residual levels shall be monitored continuously and recorded. A portable ozone meter is recommended as a backup.

4. Additional monitoring and reporting requirements are specified in 12VAC5-590-500 to demonstrate log inactivation or removal of Giardia lamblia, virus, and Cryptosporidium.

J. Monitoring requirements for DBPPs.

1. The owner of a community waterworks or a NTNC using a surface water source, a GUDI source, or both and using conventional filtration treatment, as defined in 12VAC5-590-10, shall monitor each water treatment plant for TOC no later than the point of CFE turbidity monitoring and

representative of the treated water. The owner shall also monitor for TOC in the source water before any treatment at the same time as monitoring for TOC in the treated water. These samples (source water and treated water) are referred to as paired samples. At the same time as the source water sample is collected, the owner shall monitor for alkalinity in the source water before any treatment. The owner shall collect one paired sample and one source water alkalinity sample per month per water treatment plant at a time representative of normal operating conditions and influent water quality.

2. The owner of a community waterworks or a NTNC that uses a surface water source, a GUDI source, or both with an average treated water TOC of less than 2.0 mg/L for two consecutive years, or less than 1.0 mg/L for one year, may reduce monitoring for both TOC and alkalinity to one paired sample and one source water alkalinity sample per water treatment plant per quarter. The owner shall revert to routine monitoring in the month following the quarter when the annual average treated water TOC is equal to or greater than 2.0 mg/L.

12VAC5-590-375. Lead and copper monitoring.

A. The owner of a community waterworks or a NTNC shall monitor for lead and copper in tap water (subsection B of this section), water quality (corrosion) parameters in the distribution system and at entry points (subsection C of this section), and lead and copper in water supplies (subsection D of this section).

B. Monitoring requirements for lead and copper in tap water.

1. Sample site location.

a. By the date determined by the department for commencement of monitoring under subdivision B 4 a of this section, the owner shall complete a materials evaluation of the distribution system to identify a pool of targeted sampling sites that meets the requirements of this subdivision, and that is sufficiently large to ensure that the owner can collect the number of lead and copper tap samples required in subdivision B 3 of this section. All sites from which first-draw samples are collected shall be selected from this pool of targeted sampling sites. Sampling sites may not include faucets that have POU devices or POE devices designed to remove inorganic contaminants.

b. When the distribution system evaluation required in subdivision B 1 a of this section is insufficient to locate the requisite number of lead and copper sampling sites that meet the targeting criteria of this section, the owner shall review the sources of information listed in subdivisions B 1 b (1), B 1 b (2), and B 1 b (3) of this section to identify a sufficient number of sampling sites. In addition, the owner shall seek to collect such information where possible in the course of its normal operations (e.g., checking service line materials when reading water meters or performing maintenance activities):

(1) All plumbing codes, permits, and records in the files of the building department that indicate the plumbing materials that are installed within publicly and privately owned structures connected to the distribution system;

(2) All inspections and records of the distribution system that indicate the material composition of the service connections that connect a structure to the distribution system; and

(3) All existing water quality information, which includes the results of all prior analyses of the waterworks or individual structures connected to the waterworks, indicating locations that may be particularly susceptible to high lead or copper concentrations.

c. The sampling sites selected for a community waterworks' sampling pool (Tier 1 sampling sites) shall consist of single-family structures that:

(1) Contain copper pipes with lead solder installed between January 1983 and April 1986 or contain lead pipes; or

(2) Are served by a lead service line.

When multiple-family residences comprise at least 20% of the structures served by a waterworks, the owner may include these types of structures in the sampling pool.

d. The owner of a community waterworks with insufficient Tier 1 sampling sites shall complete the sampling pool with Tier 2 sampling sites consisting of buildings, including multiple-family residences that:

(1) Contain copper pipes with lead solder installed between January 1983 and April 1986 or contain lead pipes; or

(2) Are served by a lead service line.

e. The owner of a community waterworks with insufficient Tier 1 and Tier 2 sampling sites shall complete the sampling pool with Tier 3 sampling sites, consisting of single family structures that contain copper pipes with lead solder installed before 1983. The owner of a community waterworks with insufficient Tier 1, Tier 2, and Tier 3 sampling sites shall complete the sampling pool with representative sites throughout the distribution system. For the purpose of this subdivision, a representative site is a site in which the plumbing materials used at that site would be commonly found at other sites served by the waterworks.

f. The sampling sites selected for a NTNC (Tier 1 sampling sites) shall consist of buildings that:

(1) Contain copper pipes with lead solder installed between January 1983 and April 1986 or contain lead pipes; or

(2) Are served by a lead service line.

g. The owner of a NTNC with insufficient Tier 1 sites that meet the targeting criteria in subdivision B 1 f of this section shall complete the sampling pool with sampling sites that contain copper pipes with lead solder installed before 1983. If additional sites are needed to complete the sampling pool, the owner of a NTNC shall use representative sites throughout the distribution system. For the purpose of this subdivision, a representative site is a site in which the plumbing materials used at that site would be commonly found at other sites served by the waterworks.

h. The owner of a waterworks whose distribution system contains lead service lines shall draw 50% of the samples the owner collects during each monitoring period from sites that contain lead pipes, or copper pipes with lead solder, and 50% of the samples the owner collects from sites served by a lead service line. The owner who cannot identify a sufficient number of sampling sites served by a lead service line shall collect first-draw tap samples from all of the sites identified as being served by these lines.

2. Sample collection methods.

a. All tap samples for lead and copper, with the exception of lead service line samples collected under 12VAC5-590-405 C 4 and samples collected under subdivision B 2 e of this section, shall be first-draw samples.

b. Each first-draw tap sample for lead and copper shall be one liter in volume, have stood motionless in the plumbing system of each sampling site for at least six hours, and have been collected without flushing the tap. First-draw samples from residential housing shall be collected from the cold-water kitchen tap or from a bathroom sink tap. First-draw samples from a nonresidential building shall be one liter in volume and shall be collected at an interior tap from which water is typically drawn for consumption. Non-first-draw samples collected instead of first-draw samples pursuant to subdivision B 2 e of this section shall be one liter in volume and shall be collected at an interior tap from which water is typically drawn for consumption. First-draw samples may be collected by the owner or the owner may allow residents to collect first-draw samples after instructing the residents of the sampling procedures specified in this subdivision. To avoid problems of residents handling nitric acid, acidification of first-draw

samples may be done up to 14 days after the sample is collected. After acidification to resolubilize the metals, the sample must stand in the original container for the time specified in the approved EPA method before the sample can be analyzed. If an owner allows residents to perform sampling, then the owner may not challenge, based on alleged errors in sample collection, the accuracy of sampling results.

c. Each lead service line sample collected pursuant to 12VAC5-590-405 C 4 for the purpose of avoiding replacement shall be one liter in volume and have stood motionless in the lead service line for at least six hours. Lead service line samples shall be collected in one of the following three ways:

(1) At the tap after flushing the volume of water between the tap and the lead service line. The volume of water shall be calculated based on the interior diameter and length of the pipe between the tap and the lead service line;

(2) Tapping directly into the lead service line; or

(3) If the sampling site is a building constructed as a single-family residence, then allowing the water to run until there is a significant change in temperature that would be indicative of water that has been standing in the lead service line.

d. The owner shall collect each first-draw tap sample from the same sampling site from which the owner collected a previous sample. If, for any reason, the owner cannot gain entry to a sampling site to collect a follow-up tap sample, then the owner may collect the follow-up tap sample from another sampling site in the sampling pool as long as the new site meets the same targeting criteria and is within reasonable proximity of the original site.

e. The owner of a NTNC, or a community waterworks that meets the criteria of 12VAC5-590-405 D 2 e (2) that does not have enough taps that can supply first-draw samples, as defined in subdivision B 2 b of this section, may apply to the department in writing to substitute non-first-draw samples. If approved by the department, then an owner shall collect as many first-draw samples from appropriate taps as possible and identify sampling times and locations that would likely result in the longest standing time for the remaining sites.

3. Number of samples.

a. The owner shall collect at least one sample during each monitoring period specified in subdivision B 4 of this section from the number of sites listed in the first column (standard monitoring) of Table 375.1. The owner of a waterworks conducting reduced monitoring under subdivision B 4 d of this section shall collect at least one sample from the number of sites specified in the second column (reduced monitoring) of Table 375.1 during each monitoring period specified in subdivision B 4 d of this section. Reduced monitoring sites shall be representative of the sites required for standard monitoring. The department may specify sampling locations when an owner is conducting reduced monitoring.

b. The owner of a waterworks that has fewer than five drinking water taps that are normally used for human consumption meeting the sample site criteria of subdivision B 1 of this section to reach the required number of sample sites listed in Table 375.1 shall collect at least one sample from each tap and then shall collect additional samples from those taps on different days during the monitoring period to meet the required number of sites. Alternatively, the department may allow the owner to collect a number of samples less than the number of sites specified in Table 375.1, provided that 100% of all taps that are normally used for human consumption are sampled. The department shall approve this reduction of the minimum number of samples in writing based on a request from the owner or onsite verification by the designated department representative.

c. The lead and copper tap sample table is as follows:

TABLE 375.1 Tap Samples for Lead and Copper		
WATERWORKS SIZE (Number of People Served)	NUMBER OF SITES (Standard Monitoring)	NUMBER OF SITES (Reduced Monitoring)
Greater than 100,000	100	50
10,001-100,000	60	30
3,301 to 10,000	40	20
501 to 3,300	20	10
101 to 500	10	5
Less than or equal to 100	5	5

4. Timing of monitoring.

a. Initial tap sampling. The first six-month monitoring period for small (serving less than 3,300 population), medium (serving 3,301 to 50,000 population), and large waterworks (serving greater than 50,000 population) shall be established by the department.

(1) The owner of a large waterworks shall monitor during two consecutive six-month periods.

(2) The owner of a small or a medium waterworks shall monitor during each six-month monitoring period until the waterworks exceeds the lead or copper AL and is therefore required to implement the corrosion control treatment requirements under 12VAC5-590-405 A 2, in which case the owner shall continue monitoring in accordance with subdivision B 4 b of this section, or the waterworks meets the lead and copper ALs during two consecutive six-month monitoring periods, in which case the owner may reduce monitoring in accordance with subdivision B 4 d of this section.

b. Monitoring after installation of corrosion control and source water treatment.

(1) The owner of a large waterworks that installs optimal corrosion control treatment pursuant to 12VAC5-590-405 A 2 d (4) shall monitor during two consecutive six-month monitoring periods by the date specified in 12VAC5-590-405 A 2 d (5).

(2) The owner of a small or a medium waterworks that installs optimal corrosion control treatment pursuant to 12VAC5-590-405 A 2 e (5) shall monitor during two consecutive six-month monitoring periods by the date specified in 12VAC5-590-405 A 2 e (6).

(3) The owner of a waterworks that installs source water treatment pursuant to 12VAC5-590-405 B 1 c shall monitor during two consecutive six-month monitoring periods by the date specified in 12VAC5-590-405 B 1 d.

c. Monitoring after the department specifies water quality parameter values for optimal corrosion control. After the department specifies the values for water quality control parameters under 12VAC5-590-405 A 1 f, the owner shall monitor during each subsequent six-month monitoring period, with the first monitoring period to begin on the date the department specifies the optimal values.

d. Reduced monitoring.

(1) The owner of a small or a medium waterworks that meets the lead and copper ALs during each of two consecutive six-month monitoring periods may reduce the number of samples in accordance with subdivision B 3 of this section, and reduce the frequency of sampling to once per year. The owner of a small or a medium waterworks collecting fewer than five samples, as

specified in subdivision B 3 b of this section, that meets the lead and copper ALs during each of two consecutive six-month monitoring periods may reduce the frequency of sampling to once per year. In no case may the owner reduce the number of samples required below the minimum of one sample per available tap. This sampling shall begin during the calendar year immediately following the end of the second consecutive six-month monitoring period.

(2) The owner of a waterworks that meets the lead AL and maintains the range of values for the water quality control parameters reflecting optimal corrosion control treatment specified by the department under 12VAC5-590-405 A 1 f during each of two consecutive six-month monitoring periods may reduce the frequency of monitoring to once per year and to reduce the number of lead and copper samples in accordance with subdivision B 3 of this section if the owner receives written approval from the department. This sampling shall begin during the calendar year immediately following the end of the second consecutive six-month monitoring period. The department shall evaluate monitoring, treatment, and other relevant information submitted by the owner in accordance with 12VAC5-590-532 and shall notify the owner in writing when a determination is made that the owner is eligible to commence reduced monitoring pursuant to this subdivision. The department shall evaluate and, where appropriate, revise the determination when the owner submits new monitoring or treatment data or when other data relevant to the number and frequency of tap sampling becomes available.

(3) The owner of a small or a medium waterworks that meets the lead and copper ALs during three consecutive years of monitoring may reduce the frequency of monitoring for lead and copper from annually to once every three years. The owner of a waterworks that meets the lead AL and maintains the range of values for the water quality control parameters reflecting optimal corrosion control treatment specified by the department under 12VAC5-590-405 A 1 f during three consecutive years of monitoring may reduce the frequency of monitoring from annually to once every three years if the owner receives written approval from the department. Samples collected once every three years shall be collected no later than every third calendar year. The department shall evaluate monitoring, treatment, and other relevant information submitted by the owner in accordance with 12VAC5-590-532 and shall notify the owner in writing when a determination is made that the owner is eligible to commence reduced monitoring pursuant to this subdivision. The department shall evaluate and where appropriate, revise the determination when the owner submits new monitoring or treatment data, or when other data relevant to the number and frequency of tap sampling becomes available.

(4) The owner of a waterworks that reduces the number and frequency of sampling shall collect these samples from representative sites included in the pool of targeted sampling sites identified in subdivision B 1 of this section. The owner sampling annually or less frequently shall conduct the lead and copper tap sampling during the months of June, July, August, or September. For a NTNC that does not operate during the months of June through September, the department shall designate an alternate monitoring period that represents a time of normal operation for the waterworks. This sampling shall begin in the calendar year immediately following the end of the second consecutive six-month monitoring period for the owner initiating annual monitoring, and during the three-year period following the end of the third consecutive calendar year of annual monitoring for the owner initiating triennial monitoring.

(5) The owner of a waterworks that demonstrates for two consecutive six-month monitoring periods that the tap water lead level computed under 12VAC5-590-385 C is less than or equal to 0.005 mg/L and the tap water copper level computed under 12VAC5-590-385 C is less than or equal to 0.65 mg/L may reduce the number of samples in accordance with subdivision B 3 of this section and reduce the frequency of sampling to once every three calendar years.

(6) The owner of a small or a medium waterworks subject to reduced monitoring that exceeds the lead or copper AL shall resume sampling in accordance with subdivision B 4 c of this section and collect the number of samples specified for standard monitoring under subdivision

B 3 of this section. The owner shall also conduct water quality parameter monitoring in accordance with subdivisions C 2, C 3, and C 4 of this section (as appropriate) during the monitoring period in which the AL is exceeded. The owner of a waterworks may resume annual monitoring for lead and copper at the tap at the reduced number of sites specified in subdivision B 3 of this section after it has completed two subsequent consecutive six-month rounds of monitoring that meet the criteria of subdivision B 4 d (1) of this section or may resume triennial monitoring for lead and copper at the reduced number of sites after it demonstrates through subsequent rounds of monitoring that it meets the criteria of either subdivision B 4 d (3) or B 4 d (5) of this section.

(7) The owner of a waterworks subject to the reduced monitoring frequency that fails to meet the lead ALs during any four-month monitoring period or that fails to operate at or above the minimum value or within the range of values for the water quality parameters specified by the department under 12VAC5-590-405 A 1 f for more than nine days in any six-month period specified in subdivision C 4 of this section shall conduct tap water sampling for lead and copper at the frequency specified in subdivision B 4 c of this section, collect the number of samples specified for standard monitoring under subdivision B 3 of this section, and resume monitoring for water quality parameters within the distribution system in accordance with subdivision C 4 of this section. This standard tap water sampling shall begin no later than the six-month period beginning January 1 of the calendar year following the lead AL exceedance or water quality parameter excursion. The owner of such a waterworks may resume reduced monitoring for lead and copper at the tap and for water quality parameters within the distribution system under the following conditions:

(a) The owner may resume annual monitoring for lead and copper at the tap at the reduced number of sites specified in subdivision B 3 of this section after completion of two subsequent six-month rounds of monitoring that meet the criteria of subdivision B 4 d (2) of this section and the owner has received written approval from the department that it is appropriate to resume reduced monitoring on an annual frequency. This sampling shall begin during the calendar year immediately following the end of the second consecutive six-month monitoring period.

(b) The owner may resume triennial monitoring for lead and copper at the tap at the reduced number of sites after demonstration through subsequent rounds of monitoring that it meets the criteria of either subdivision B 4 d (3) or B 4 d (5) of this section and the owner has received written approval from the department that it is appropriate to resume triennial monitoring.

(c) The owner may reduce the number of water quality parameter tap water samples required in accordance with subdivision C 5 a of this section and the frequency with which it collects these samples in accordance with subdivision C 5 b of this section. The owner of such a waterworks may not resume triennial monitoring for water quality parameters at the tap until it demonstrates, in accordance with the requirements of subdivision C 5 b of this section, that it has requalified for triennial monitoring.

(8) The owner of a waterworks subject to a reduced monitoring frequency under subdivision B 4 d of this section shall notify the department in writing in accordance with 12VAC5-590-530 and 12VAC5-590-532 of any upcoming long-term change in the treatment or addition of a new source water as described in this section. The department shall evaluate and approve the addition of a new source water or long-term change in the water treatment before it is implemented by the owner. The department may require the owner to resume sampling in accordance with subdivision B 4 c of this section and collect the number of samples specified for standard monitoring under subdivision B 3 of this section or take other appropriate steps such as increased water quality parameter monitoring or re-evaluation of its corrosion control treatment given the potentially different water quality considerations.

5. Additional monitoring by owner. The results of monitoring conducted in addition to the minimum requirements of this section shall be considered by the owner and the department in making determinations (i.e., calculating the 90th percentile lead or copper level) under 12VAC5-590-385 C.

6. Invalidation of lead or copper tap water samples. A sample invalidated under this subdivision does not count toward determining lead or copper 90th percentile levels under 12VAC5-590-385 C or toward meeting the minimum monitoring requirements of subdivision B 3 of this section.

a. The department may invalidate a lead or copper tap water sample if at least one of the following conditions is met:

(1) The laboratory establishes that improper sample analysis caused erroneous results.

(2) The department determines that the sample was collected from a site that did not meet the site selection criteria of this section.

(3) The sample container was damaged in transit.

(4) There is substantial reason to believe that the sample was subject to tampering.

b. The owner shall report the results of all samples to the department and all supporting documentation for samples the owner believes should be invalidated.

c. To invalidate a sample under subdivision B 6 a of this section, the decision and the rationale for the decision shall be documented in writing. The department may not invalidate a sample solely on the grounds that a follow-up sample result is higher or lower than that of the original sample.

d. The owner shall collect a replacement sample for a sample invalidated under this section if after the invalidation of one or more samples, the owner has too few samples to meet the minimum requirements of subdivision B 3 of this section. A replacement sample shall be collected as soon as possible, but no later than 20 days after the date the department invalidates the sample or by the end of the applicable monitoring period, whichever occurs later. Replacement samples collected after the end of the applicable monitoring period shall not also be used to meet the monitoring requirements of a subsequent monitoring period. The replacement samples shall be collected at the same locations as the invalidated samples or, if that is not possible, at locations other than those already used for sampling during the monitoring period.

7. Monitoring waivers for small waterworks. The owner of a small waterworks that meets the criteria of this subdivision may apply to the department to reduce the frequency of monitoring for lead and copper to once every nine years (i.e., a full waiver) if the owner meets all of the materials criteria specified in subdivision B 7 a of this section and all of the monitoring criteria specified in subdivision B 7 b of this section. The owner of a small waterworks that meets the criteria in subdivisions B 7 a and B 7 b of this section only for lead, or only for copper, may apply to the department for a waiver to reduce the frequency of tap water monitoring to once every nine years for that contaminant only (i.e., a partial waiver).

a. Materials criteria. The owner shall demonstrate that the distribution system service lines and plumbing connected to the waterworks, including plumbing conveying drinking water within all residences and buildings connected to the waterworks, are free of lead-containing materials or copper-containing materials, as those terms are defined in this subdivision, as follows:

(1) Lead. To qualify for a full waiver, or a waiver of the tap water monitoring requirements for lead (i.e., a lead waiver), the owner shall provide certification and supporting documentation to the department that the waterworks is free of all lead-containing materials, as follows:

(a) It contains no plastic pipes that contain lead plasticizers, or plastic service lines that contain lead plasticizers;

(b) Solders and flux contain no more than 0.2% lead; and

(c) The weighted average of wetted surface of pipes, pipe fittings, plumbing fittings, and plumbing fixtures contain no more than 0.25% lead.

(2) Copper. To qualify for a full waiver, or a waiver of the tap water monitoring requirements for copper (i.e., a copper waiver), the owner shall provide certification and supporting documentation to the department that the waterworks contains no copper pipes or copper service lines.

b. Monitoring criteria for waiver issuance. The owner shall have completed at least one six-month round of standard tap water monitoring for lead and copper at sites approved by the department and from the number of sites required by subdivision B 3 of this section and demonstrate that the 90th percentile levels for any and all rounds of monitoring conducted since the owner became free of all lead-containing or copper-containing materials, as appropriate, meet the following criteria:

(1) Lead levels. To qualify for a full waiver, or a lead waiver, the owner shall demonstrate that the 90th percentile lead level does not exceed 0.005 mg/L.

(2) Copper levels. To qualify for a full waiver, or a copper waiver, the owner shall demonstrate that the 90th percentile copper level does not exceed 0.65 mg/L.

c. Department approval of waiver application. The department shall notify the owner of the waiver determination, in writing, setting forth the basis of the decision and any condition of the waiver. As a condition of the waiver, the department may require the owner to perform specific activities (e.g., limited monitoring, periodic outreach to customers to remind them to avoid installation of materials that might void the waiver) to avoid the risk of lead or copper concentration of concern in tap water. The owner of a small waterworks shall continue monitoring for lead and copper at the tap as required by subdivisions B 4 a through B 4 d of this section, as appropriate, until it receives written notification from the department that the waiver has been approved.

d. Monitoring frequency for owners with waivers.

(1) The owner with a full waiver shall conduct tap water monitoring for lead and copper in accordance with subdivision B 4 d (4) of this section at the reduced number of sampling sites identified in subdivision B 3 of this section at least once every nine years and provide the materials certification specified in subdivision B 7 a of this section for both lead and copper to the department along with the monitoring results. Samples collected every nine years shall be collected no later than every ninth calendar year.

(2) The owner with a partial waiver shall conduct tap water monitoring for the waived contaminant in accordance with subdivision B 4 d (4) of this section at the reduced number of sampling sites specified in subdivision B 3 of this section at least once every nine years and provide the materials certification specified in subdivision B 7 a of this section pertaining to the waived contaminant along with the monitoring results. The owner also shall continue to monitor for the nonwaived contaminant in accordance with requirements of subdivisions B 4 a through B 4 d of this section, as appropriate.

(3) The owner with a full or partial waiver shall notify the department in writing in accordance with 12VAC5-590-532 B 3 of any upcoming long-term change in the treatment or addition of a new source water, as described in 12VAC5-590-532. The department shall evaluate and approve the addition of a new source water or a long-term change in water treatment before it is implemented by the owner. The department has the authority to require the owner to add or modify waiver conditions (e.g., require recertification that the waterworks is free of lead-containing or copper-containing materials; require additional round or rounds of monitoring),

if it deems these modifications are necessary to address treatment or source water changes at the waterworks.

(4) If an owner with a full or partial waiver becomes aware that it is no longer free of lead-containing or copper-containing materials, as appropriate (e.g., as a result of new construction or repairs), then the owner shall notify the department in writing no later than 60 days after becoming aware of the change.

e. Continued eligibility. If the owner continues to satisfy the requirements of subdivision B 7 d of this section, then the waiver will be renewed automatically, unless any of the conditions listed in subdivision B 7 e (1), B 7 e (2), or B 7 e (3) of this section occurs. The owner whose waiver has been revoked may reapply for a waiver when the owner again meets the appropriate materials and monitoring criteria of subdivisions B 7 a and B 7 b of this section.

(1) A waterworks with a full waiver or a lead waiver no longer satisfies the materials criteria of subdivision B 7 a (1) of this section or has a 90th percentile lead level greater than 0.005 mg/L.

(2) A waterworks with a full waiver or a copper waiver no longer satisfies the materials criteria of subdivision B 7 a (2) of this section or has a 90th percentile copper level greater than 0.65 mg/L.

(3) The department notifies the owner, in writing, that the waiver has been revoked, setting forth the basis of the decision.

f. Requirements following waiver revocation. A waterworks whose full or partial waiver has been revoked by the department is subject to the corrosion control treatment and lead and copper tap water monitoring requirements, as follows:

(1) If the waterworks exceeds the lead or copper AL, then the owner shall implement corrosion control treatment in accordance with the deadlines specified in 12VAC5-590-405 A 2 e and any other applicable requirements of this section.

(2) If the waterworks meets both the lead and the copper ALs, then the owner shall monitor for lead and copper at the tap no less frequently than once every three years using the reduced number of sample sites specified in subdivision B 3 of this section.

g. Pre-existing waivers. Waivers for small waterworks approved by the department in writing before April 11, 2000, shall remain in effect under the following conditions:

(1) If the waterworks has demonstrated that it is both free of lead-containing and copper-containing materials, as required by subdivision B 7 a of this section and that its 90th percentile lead levels and 90th percentile copper levels meet the criteria of subdivision B 7 b of this section, then the waiver will remain in effect so long as the owner continues to meet the waiver eligibility criteria of subdivision B 7 e of this section. The first round of tap water monitoring conducted pursuant to subdivision B 7 d of this section shall be completed no later than nine years after the last time the owner has monitored for lead and copper at the tap.

(2) If the waterworks has met the materials criteria of subdivision B 7 a of this section but has not met the monitoring criteria of subdivision B 7 b of this section, then the owner shall conduct one six-month round of standard tap water monitoring for lead and copper at sites approved by the department demonstrating that it meets the criteria of subdivision B 7 b of this section. Thereafter, the waiver shall remain in effect as long as the owner meets the continued eligibility criteria of subdivision B 7 e of this section. The first round of tap water monitoring conducted pursuant to subdivision B 7 d of this section shall be completed no later than nine years after the round of monitoring conducted pursuant to subdivision B 7 b of this section.

C. Monitoring requirements for water quality parameters. The owners of all large waterworks and all small and medium waterworks that exceed the lead or copper AL shall monitor for water quality parameters in addition to lead and copper in accordance with this section.

1. General requirements.

a. Sample collection methods.

(1) Tap samples shall be representative of water quality throughout the distribution system taking into account the number of persons served, the different sources of water, the different treatment methods employed by the waterworks, and seasonal variability. Tap sampling under this section is not required to be conducted at taps targeted for lead and copper sampling under subdivision B 1 of this section. The owner may find it convenient to conduct tap sampling for water quality parameters at sites approved for coliform sampling.

(2) Samples collected at the entry point or points to the distribution system shall be from locations representative of each source water after treatment. If a waterworks draws water from more than one source water and the source waters are combined before distribution, then the owner shall sample at an entry point to the distribution system during periods of normal operating conditions (i.e., when water is representative of all source waters being used).

b. Number of samples.

(1) The owner shall collect two tap samples from the standard monitoring number of sites given in Table 375.2 for applicable water quality parameters during each monitoring period specified under subdivisions C 2 through C 5 of this section.

TABLE 375.2
Water Quality Monitoring for Lead and Copper

	NUMBER OF SITES FOR WATER QUALITY PARAMETERS	
WATERWORKS SIZE (Number of People Served)	STANDARD MONITORING	REDUCED MONITORING
Greater than 100,000	25	10
10,001-100,000	10	7
3,301 to 10,000	3	3
501 to 3,300	2	2
101 to 500	1	1
Less than or equal to 100	1	1

(2) Except as provided in subdivision C 3 c of this section, the owner shall collect two samples for each applicable water quality parameter at each entry point to the distribution system during each monitoring period specified in subdivision C 2 of this section. During each monitoring period specified in subdivisions C 3, C 4, and C 5 of this section, the owner shall collect one sample for each applicable water quality parameter at each entry point to the distribution system.

2. Initial sampling. The owner of a large waterworks shall measure the applicable water quality parameters as specified below at taps and at each entry point to the distribution system during each six-month monitoring period specified in subdivision B 4 a of this section. The owner of a small or a medium waterworks shall measure the applicable water quality parameters at the locations specified below during each six-month monitoring period specified in subdivision B 4 a of this section during which the waterworks exceeds the lead or copper AL.

a. At taps:

(1) pH;

(2) Alkalinity;

(3) Orthophosphate, when an inhibitor containing a phosphate compound is used;

(4) Silica, when an inhibitor containing a silicate compound is used;

(5) Calcium;

(6) Conductivity; and

(7) Water temperature.

b. At each entry point to the distribution system: all of the applicable parameters listed in subdivision C 2 a of this section.

3. Monitoring after installation of corrosion control. The owner of a large waterworks that installs optimal corrosion control treatment pursuant to 12VAC5-590-405 A 2 d (4) shall measure the water quality parameters at the locations and frequencies specified below during each six-month monitoring period specified in subdivision B 4 b (1) of this section. The owner of a small or a medium waterworks that installs optimal corrosion control treatment shall conduct monitoring during each six-month monitoring period specified in subdivision B 4 b (2) of this section in which the waterworks exceeds the lead or copper AL.

a. At taps, two samples for:

(1) pH;

(2) Alkalinity;

(3) Orthophosphate, when an inhibitor containing a phosphate compound is used;

(4) Silica, when an inhibitor containing a silicate compound is used; and

(5) Calcium, when calcium carbonate stabilization is used as part of corrosion control.

b. Except as provided in subdivision C 3 c of this section, at each entry point to the distribution system, at least one sample no less frequently than every two weeks (biweekly) for:

(1) pH;

(2) When alkalinity is adjusted as part of optimal corrosion control, a reading of the dosage rate of the chemical used to adjust the alkalinity and the alkalinity concentration; and

(3) When a corrosion inhibitor is used as part of optimal corrosion control, a reading of the dosage rate of the inhibitor used and the concentration of orthophosphate or silica (whichever is applicable).

c. The owner of a groundwater system may limit entry point sampling described in subdivision C 3 b of this section to those entry points that are representative of water quality and treatment conditions throughout the waterworks. If water from untreated groundwater sources mixes with water from treated groundwater sources, then the owner shall monitor for water quality parameters both at representative entry points receiving treatment and representative entry points receiving no treatment. Before the start of any monitoring under this subdivision, the owner shall provide to the department written information identifying the selected entry points and documentation, including information on seasonal variability, sufficient to demonstrate that the sites are representative of water quality and treatment conditions throughout the waterworks.

4. Monitoring after the department specifies water quality parameter values for optimal corrosion control. After the department specifies the values for applicable water quality control parameters reflecting optimal corrosion control treatment under 12VAC5-590-405 A 1 f, the owner of a large waterworks shall measure the applicable water quality parameters in accordance with subdivision C 3 of this section and determine compliance with the requirements of 12VAC5-590-405 A 1 g every six months with the first six-month period to begin on either January 1 or July 1, whichever

comes first, after the department specifies the optimal values under 12VAC5-590-405 A 1 f. The owner of a small or a medium waterworks shall conduct monitoring during each six-month monitoring period specified in this subdivision in which the waterworks exceeds the lead or copper AL. For the owner of a small or a medium waterworks that is subject to a reduced monitoring frequency pursuant to subdivision B 4 d of this section at the time of the AL exceedance, the start of the applicable six-month period under this subdivision shall coincide with the start of the applicable monitoring period under subdivision B 4 d of this section. Compliance with the department-designated optimal water quality parameter values shall be determined as specified under 12VAC5-590-405 A 1 g.

5. Reduced monitoring.

a. The owner of a waterworks that maintains the range of values for the water quality parameters reflecting optimal corrosion control treatment during each of two consecutive six-month monitoring periods under subdivision C 4 of this section shall continue monitoring at the entry point or points to the distribution system as specified in subdivision C 3 b of this section. The owner of the waterworks may collect two tap samples for applicable water quality parameters from the reduced number of sites during each six-month monitoring period shown in Table 375.2.

b. The owner of a waterworks that maintains the range of values for the water quality parameters reflecting optimal corrosion control treatment specified by the department under 12VAC5-590-405 A 1 f during three consecutive years of monitoring may reduce the frequency with which the owner collects the number of tap samples for applicable water quality parameters specified in subdivision C 5 of this section from every six months to annually. This sampling begins during the calendar year immediately following the end of the monitoring period in which the third consecutive year of six-month monitoring occurs. The owner of a waterworks that maintains the range of values for the water quality parameters reflecting optimal corrosion control treatment specified by the department under 12VAC5-590-405 A 1 f during three consecutive years of annual monitoring under this subdivision may reduce the frequency with which it collects the number of tap samples for applicable water quality parameters specified in subdivision C 5 a of this section from annually to every three years. This sampling begins during the calendar year immediately following the end of the monitoring period in which the third consecutive year of six-month monitoring occurs.

c. The owner of a waterworks may reduce the frequency with which tap samples are collected for applicable water quality parameters specified in subdivision C 5 a of this section to every three years if the owner demonstrates during two consecutive monitoring periods that the tap water lead level at the 90th percentile is less than or equal to the PQL for lead (0.005 mg/L), that the tap water copper level at the 90th percentile is less than or equal to 0.65 mg/L for copper, and that the owner also has maintained the range of values for water quality parameters reflecting optimal corrosion control treatment specified by the department under 12VAC5-590-405 A 1 f. Monitoring conducted every three years shall be done no later than every third calendar year.

d. The owner of a waterworks that conducts sampling annually shall collect these samples evenly throughout the year so as to reflect seasonal variability.

e. The owner of a waterworks subject to the reduced monitoring frequency that fails to operate at or above the minimum value or within the range of values for the water quality parameters specified by the department under 12VAC5-590-405 A 1 f for more than nine days in any six-month period specified in 12VAC5-590-405 A 1 g shall resume distribution system tap water sampling in accordance with the number and frequency requirements in subdivision C 4 of this section. The owner may resume annual monitoring for water quality parameters at the tap at the reduced number of sites specified in subdivision C 5 of this section after completion of two

subsequent consecutive six-month rounds of monitoring that meet the criteria of that subdivision or may resume triennial monitoring for water quality parameters at the tap at the reduced number of sites after demonstration through subsequent rounds of monitoring that the criteria of either subdivision C 5 b or C 5 c of this section has been met.

6. Additional monitoring by owners. The results of any monitoring conducted in addition to the minimum requirements of this section shall be considered by the owner and the department in making any determinations under this section or 12VAC5-590-405 A 1.

D. Monitoring requirements for lead and copper in water supplies (source water).

1. Sample location, collection methods, and number of samples.

a. The owner of a waterworks that fails to meet the lead or copper AL on the basis of tap samples collected in accordance with subsection A of this section shall collect lead and copper source water samples in accordance with the following requirements regarding sample location, number of samples, and collection methods:

(1) The owner of a waterworks served by groundwater sources shall collect a minimum of one sample at every entry point to the distribution system. The owner shall collect one sample at the same sampling point unless conditions make another sampling point more representative of each source water or water treatment plant.

(2) The owner of a waterworks served by surface water sources shall collect a minimum of one sample at every entry point to the distribution system. The owner shall collect each sample at the same sampling point unless conditions make another sampling point more representative of each source water or water treatment plant. Note that for the purpose of this subdivision, a waterworks served by a surface water source includes waterworks served by a combination of surface water and groundwater sources.

(3) If a waterworks draws water from more than one source water and the source waters are combined before distribution, then the owner shall collect samples at an entry point to the distribution system during periods of normal operating conditions (i.e., when water is representative of all source waters being used).

(4) The department may reduce the total number of samples that must be analyzed by allowing the use of compositing. Compositing of samples shall be done by certified laboratory personnel. Composite samples from a maximum of five samples are allowed, provided that if the lead concentration in the composite sample is greater than or equal to 0.001 mg/L or the copper concentration is greater than or equal to 0.160 mg/L, then either a follow-up sample shall be collected and analyzed within 14 days at each sampling point included in the composite; or if duplicates or sufficient quantities from the original samples from each sampling point used in the composite are available, then the owner may use these instead of resampling.

b. Where the results of sampling indicate an exceedance of maximum permissible source water levels established under 12VAC5-590-405 B 4, the department may require that one additional sample be collected as soon as possible after the initial sample was collected (but not to exceed two weeks) at the same sampling point. If a confirmation sample required by the department is collected for lead or copper, then the results of the initial and confirmation sample shall be averaged in determining compliance with the department-specified maximum permissible levels. A sample value below the MDL shall be considered to be zero. A value above the MDL but below the PQL shall either be considered as the measured value or be considered one-half the PQL. The PQL for lead is equal to 0.005 mg/L, and the PQL for copper is equal to 0.050 mg/L.

2. Monitoring frequency after a waterworks exceeds a tap AL. The owner of a waterworks that exceeds the lead or copper AL at the tap shall collect one source water sample from each entry point to the distribution system no later than six months after the end of the monitoring period

during which the lead or copper AL was exceeded. For monitoring periods that are annual or less frequent, the end of the monitoring period is September 30 of the calendar year in which the sampling occurs, or if the department has established an alternate monitoring period, the last day of that period.

3. Monitoring frequency after installation of source water treatment. The owner of a waterworks that installs source water treatment pursuant to 12VAC5-590-405 B 1 c shall collect an additional source water sample from each entry point to the distribution system during two consecutive six-month monitoring periods by the deadline specified in 12VAC5-590-405 B 1 d.

4. Monitoring frequency after the department specifies maximum permissible source water lead and copper levels or determines that source water treatment is not needed.

a. The owner shall monitor at the frequency specified in subdivisions D 4 a (1) and D 4 a (2) of this section in cases where the department specifies maximum permissible source water lead and copper levels under 12VAC5-590-405 B 1 e or determines that the owner is not required to install source water treatment under 12VAC5-590-405 B 2 b.

(1) The owner of a waterworks using only groundwater shall collect samples once during the three-year compliance period in effect when the applicable department determination under subdivision D 4 a of this section is made. The owner shall collect samples once during each subsequent compliance period. Triennial samples shall be collected every third calendar year.

(2) The owner of a waterworks using surface water (or a combination of surface water and groundwater) shall collect samples once during each year, the first annual monitoring period to begin during the year in which the applicable department determination is made under subdivision D 4 a of this section.

b. The owner is not required to conduct source water sampling for lead or copper if the waterworks meets the AL for the specific contaminant in tap water samples during the entire source water sampling period applicable to the waterworks under subdivision D 4 a (1) or D 4 a (2) of this section.

5. Reduced monitoring frequency.

a. The owner of a waterworks using only groundwater may reduce the monitoring frequency for lead and copper in source waters to once during each nine-year compliance cycle provided that the samples are collected no later than every ninth calendar year and if the owner meets one of the following criteria:

(1) The owner demonstrates that the finished water entering the distribution system has been maintained below the maximum permissible lead and copper concentrations specified by the department under 12VAC5-590-405 B 1 e during at least three consecutive compliance periods under subdivision D 4 a of this section; or

(2) The department has determined that source water treatment is not needed and the owner demonstrates that, during the last three consecutive compliance periods in which sampling was conducted under subdivision D 4 a of this section, the concentration of lead in the source water was less than or equal to 0.005 mg/L and the concentration of copper in the source water was less than or equal to 0.65 mg/L.

b. The owner of a waterworks using surface water (or a combination of surface water and groundwater sources) may reduce the monitoring frequency for lead and copper in source waters to once during each nine-year compliance cycle provided that the samples are collected no later than every ninth calendar year and if the owner meets one of the following criteria:

(1) The owner demonstrates that finished water entering the distribution system has been maintained below the maximum permissible lead and copper concentrations specified by the department under 12VAC5-590-405 B 1 e for at least three consecutive years; or

(2) The department has determined that source water treatment is not needed and the owner demonstrates that, during the last three consecutive years, the concentration of lead in the source water was less than or equal to 0.005 mg/L and the concentration of copper in the source water was less than or equal to 0.65 mg/L.

c. The owner of a waterworks that uses a new source water is not eligible for reduced monitoring for lead or copper until concentrations in samples collected from the new source water during three consecutive monitoring periods are below the maximum permissible lead and copper concentrations specified in 12VAC5-590-405 B 1 e.

12VAC5-590-376. Surface water and GUDI sources treatment monitoring.

A. The owner of a waterworks that uses a surface water source, a GUDI source, or both and provides filtration treatment shall monitor in accordance with this section.

B. Turbidity measurements shall be performed on representative samples of the filtered water every four hours (or more frequently) that the waterworks serves water to the public. The owner may substitute continuous turbidity monitoring for grab sample monitoring if the owner validates the continuous measurement for accuracy on a regular basis using a protocol approved by the department. For a waterworks using slow sand filtration or filtration treatment other than conventional treatment, direct filtration, or diatomaceous earth filtration, the department may reduce the sampling frequency to once per day if the department determines that less frequent monitoring is sufficient to indicate effective filtration performance. For a waterworks serving 500 or fewer persons, the department may reduce the turbidity sampling frequency to once per day, regardless of the type of filtration treatment used, if the department determines that less frequent monitoring is sufficient to indicate effective filtration performance.

1. The owner of a waterworks supplied by a surface water source, a GUDI source, or both using conventional filtration treatment or direct filtration shall conduct continuous monitoring of turbidity for each individual filter. The turbidimeter shall be calibrated using the procedure specified by the turbidimeter manufacturer. The owner shall record the results of individual filter turbidity monitoring a minimum of every 15 minutes.

2. If there is a failure in the continuous turbidity monitoring equipment, then the owner shall conduct grab sampling every four hours instead of continuous monitoring but for no more than five working days (for a waterworks serving 10,000 or more persons) or 14 days (for a waterworks serving fewer than 10,000 persons) following the failure of the equipment.

3. If a waterworks serving fewer than 10,000 persons consists of two or fewer filters, continuous monitoring of the CFE may be used instead of individual filter monitoring.

C. The residual disinfectant concentration of the water entering the distribution system shall be monitored continuously, and the lowest and highest values shall be recorded each day. If there is a failure in the continuous monitoring equipment, then grab sampling every four hours shall be conducted instead of continuous monitoring, but such grab sampling shall be conducted for no more than five working days following the failure of the equipment. The owner of a waterworks serving 3,300 or fewer persons may collect grab samples instead of continuous monitoring on an ongoing basis at the frequencies prescribed in Table 376.1.

1. The day's samples cannot be collected at the same time.

2. The sampling intervals are subject to department's evaluation and approval.

3. If at any time the residual disinfectant concentration falls below 0.2 mg/L in a waterworks using grab sampling instead of continuous monitoring, then the owner shall collect a grab sample every four hours until the residual disinfectant concentration is equal to or greater than 0.2 mg/L.

TABLE 376.1 Grab Sample Monitoring Frequency	
WATERWORKS SIZE BY POPULATION	SAMPLES/DAY
500 or less	1
501 - 1,000	2
1,000 - 2,500	3
2,501 - 3,300	4

D. The residual disinfectant concentration shall be measured at least at the same points in the distribution system and at the same time as total coliform bacteria are sampled, as specified in 12VAC5-590-370 A and 12VAC5-590-380 D, except that the department may allow the owner of a waterworks that uses a groundwater source along with a surface water source, a GUDI source, or both to collect residual disinfectant samples at points other than the total coliform sampling points if the department determines that these points are more representative of treated (disinfected) water quality within the distribution system. Heterotrophic bacteria, measured as HPC as specified in 12VAC5-590-395 A 2 a (3), may be measured instead of residual disinfectant concentration.

E. The following information on the samples collected in the distribution system in conjunction with total coliform monitoring pursuant to 12VAC5-590-395 A 2 shall be reported monthly to the department by the owner:

1. Number of instances where the residual disinfectant concentration is measured;

2. Number of instances where the residual disinfectant concentration is not measured but heterotropic plate count (HPC) is measured;

3. Number of instances where the residual disinfectant concentration is measured but not detected and no HPC is measured;

4. Number of instances where no residual disinfectant concentration is detected and where the HPC is greater than 500/mL;

5. Number of instances where the residual disinfectant concentration is not measured and HPC is greater than 500/mL; and

6. For the current and previous month the waterworks serves water to the public, the value of "V," in percent, in the following formula:

$$V = [(c + d + e) / (a + b)] \text{ X } 100$$

where

a = the value in subdivision E 1 of this section;

b = the value in subdivision E 2 of this section;

c = the value in subdivision E 3 of this section;

d = the value in subdivision E 4 of this section;

e = the value in subdivision E 5 of this section.

12VAC5-590-377. Physical constituent monitoring.

A. Monitoring to determine compliance with the SMCLs for color, odor, pH, and total dissolved solids as specified in Table 340.3 shall be conducted as follows:

1. The owner shall collect one sample at each groundwater source entry point during each compliance period.

2. The owner shall collect one sample annually at each surface water source entry point, in whole or in part.

B. Onsite daily turbidity measurements may be required to be performed on representative samples collected at each entry point for groundwater sources not required to filter, to determine compliance set forth in 12VAC5-590-379 B. The turbidity monitoring requirements for a waterworks required to filter are specified in 12VAC5-590-376 B.

12VAC5-590-378. Radiological monitoring.

A. The location of sampling points, the radionuclides measured in community waterworks, the frequency, and the timing of sampling within each compliance period shall be established or approved by the department. The department may increase required monitoring where necessary to detect variations within the waterworks. Failure to comply with the sampling schedules in this section will require public notification pursuant to 12VAC5-590-540 A 3.

B. The owner of a community waterworks shall conduct monitoring to determine compliance with the PMCLs listed in Table 340.4 and 12VAC5-590-388 in accordance with this section.

1. Monitoring requirements for gross alpha particle activity, radium-226, radium-228, and uranium.

a. The owner shall conduct initial monitoring to determine compliance with the PMCLs listed in Table 340.4 for gross alpha particle activity, radium-226, radium-228, and uranium. For the purposes of monitoring for gross alpha particle activity, radium-226, radium-228, uranium, and beta particle and photon radioactivity in drinking water, "detection limit" is defined as specified in Table 378.1.

(1) Applicability and sampling location for an existing community waterworks or its sources. The owner using groundwater, surface water, or both groundwater and surface water shall sample at every entry point to the distribution system that is representative of all sources being used under normal operating conditions. The owner shall collect each sample at the same entry point unless conditions make another sampling point more representative of each source.

(2) Applicability and sampling location for a new community waterworks or its sources. A new community waterworks or a community waterworks that uses a new source water shall begin to conduct initial monitoring for the new source water within the first quarter after initiating use. The owner shall conduct more frequent monitoring when directed by the department in the event of possible contamination or when changes in the distribution system or treatment processes occur that may increase the concentration of radioactivity in the finished water.

b. Initial monitoring. The owner shall conduct initial monitoring for gross alpha particle activity, radium-226, radium-228, and uranium as follows:

(1) The owner shall collect four consecutive quarterly samples at all entry points.

(2) For gross alpha particle activity, uranium, radium-226, and radium-228 monitoring, the department may waive the final two quarters of initial monitoring for an entry point if the results of the samples from the previous two quarters are below the detection limit as defined by and as specified in Table 378.1.

(3) If the average of the initial monitoring results for an entry point is above the PMCL, then the owner shall collect and analyze quarterly samples at that entry point until the owner has results from four consecutive quarters that are at or below the PMCL, unless the owner enters into another schedule as part of a formal compliance agreement with the department.

c. Reduced monitoring. The department may allow the owner to reduce the future frequency of monitoring from once every three years to once every six or nine years at each entry point, based on the following criteria:

(1) If the average of the initial monitoring results for each contaminant (i.e., gross alpha particle activity, uranium, radium-226, or radium-228) is below the detection limit as specified in Table 378.1, then the owner shall collect and analyze for that contaminant using at least one sample at that entry point every nine years.

(2) For gross alpha particle activity, combined radium, and uranium, if the average of the initial monitoring results for each contaminant is at or above the detection limit as specified in Table 378.1, but at or below half of the PMCL, then the owner shall collect and analyze for that contaminant using at least one sample at that entry point every six years.

(3) For gross alpha particle activity, combined radium, and uranium, if the average of the initial monitoring results for each contaminant is above half the PMCL but at or below the PMCL, then the owner shall collect and analyze at least one sample at that entry point every three years.

(4) The owner shall use the samples collected during the reduced monitoring period to determine the monitoring frequency for subsequent monitoring periods (e.g., if a waterworks entry point is on a nine-year monitoring period, and the sample result is above half the PMCL, then the next monitoring period for that entry point is three years).

(5) If the owner has a monitoring result that exceeds the PMCL while on reduced monitoring, then the owner shall collect and analyze quarterly samples at that entry point until the results from four consecutive quarters are below the PMCL, unless the waterworks enters into another schedule as part of a formal compliance agreement with the department.

d. Compositing. To fulfill quarterly monitoring requirements for gross alpha particle activity, radium-226, radium-228, or uranium, the owner may composite up to four consecutive quarterly samples from a single entry point if analysis is done within a year of the first sample. The department will treat analytical results from the composited sample as the average analytical result to determine compliance with the PMCLs and the future monitoring frequency. If the analytical result from the composited sample is greater than half the PMCL, then the department may direct the owner to collect additional quarterly samples before allowing the owner to sample under a reduced monitoring schedule.

e. A gross alpha particle activity measurement may be substituted for the required radium-226 measurement provided that the measured gross alpha particle activity does not exceed 5 pCi/L. A gross alpha particle activity measurement may be substituted for the required uranium measurement provided that the measured gross alpha particle activity does not exceed 15 pCi/L. The gross alpha measurement shall have a confidence interval of 95% (1.65 σ, where σ is the standard deviation of the net counting rate of the sample) for radium-226 and uranium. When an owner uses a gross alpha particle activity measurement instead of a radium-226 or uranium measurement, the gross alpha particle activity analytical result will be used to determine the future monitoring frequency for radium-226 or uranium. If the gross alpha particle activity result is less than the detection limit as specified in Table 378.1, then half the detection limit will be used to determine compliance and the future monitoring frequency.

2. Monitoring requirements for beta particle and photon radioactivity. To determine compliance with the PMCL in Table 340.4 for beta particle and photon radioactivity, an owner shall monitor at a frequency as follows:

a. The owner (using surface water or groundwater sources) designated by the department as vulnerable shall sample for beta particle and photon radioactivity. The owner shall collect quarterly samples for beta emitters and annual samples for tritium and strontium-90 at each entry point to the distribution system, beginning within one quarter after being notified by the department. A waterworks already designated by the department shall continue to sample until the department evaluates and either reaffirms or removes the designation.

(1) If the gross beta particle activity minus the naturally occurring potassium-40 beta particle activity at an entry point has an RAA (computed quarterly) less than or equal to 50 pCi/L

(screening level), then the department may reduce the frequency of monitoring at that entry point to once every three years. The owner shall collect all samples required in subdivision B 2 a of this section during the reduced monitoring period.

(2) For a waterworks in the vicinity of a nuclear facility, the department may allow the owner to utilize environmental surveillance data collected by the nuclear facility instead of monitoring at the waterworks entry point, where the department determines the data is applicable to a particular waterworks. In the event that there is a release from a nuclear facility, the owner who is using surveillance data shall begin monitoring at the waterworks entry point in accordance with subdivision B 2 a of this section.

b. The owner (using a surface water, a groundwater source, or both) designated by the department as utilizing waters contaminated by effluents from nuclear facilities shall sample for beta particle and photon radioactivity. The owner shall collect quarterly samples for beta emitters and iodine-131 and annual samples for tritium and strontium-90 at each entry point to the distribution system, beginning within one quarter after being notified by the department. The owner of a waterworks already designated by the department as using waters contaminated by effluents from nuclear facilities shall continue to sample until the department evaluates and either reaffirms or removes the designation.

(1) Quarterly monitoring for gross beta particle activity shall be based on the analysis of monthly samples or the analysis of a composite of three monthly samples. The former procedure, analysis of monthly samples, is recommended.

(2) For iodine-131, a composite of five consecutive daily samples shall be analyzed once each quarter. As directed by the department, more frequent monitoring shall be conducted when iodine-131 is identified in the finished water.

(3) Annual monitoring for strontium-90 and tritium shall be conducted by means of the analysis of a composite of four consecutive quarterly samples or analysis of four quarterly samples. The latter procedure, analysis of monthly samples, is recommended.

(4) If the gross beta particle activity minus the naturally occurring potassium-40 beta particle activity at a sampling point has an RAA (computed quarterly) less than or equal to 15 pCi/L (screening level), then the department may reduce the frequency of monitoring at that sampling point to every three years. The owner shall collect all samples required in subdivision B 2 b of this section during the reduced monitoring period.

(5) For a waterworks in the vicinity of a nuclear facility, the department may allow the owner to utilize environmental surveillance data collected by the nuclear facility instead of the monitoring at the waterworks entry point, where the department determines the data is applicable to a particular waterworks. In the event that there is a release from a nuclear facility, the owner who is using surveillance data shall begin monitoring at the waterworks entry point in accordance with subdivision B 2 b of this section.

c. The owner of a waterworks designated by the department to monitor for beta particle and photon radioactivity cannot apply to the department for a waiver from the monitoring frequencies specified in subdivision B 2 a or B 2 b of this section.

d. The owner may analyze for naturally occurring potassium-40 beta particle activity from the same or equivalent sample used for the gross beta particle activity analysis. The owner is allowed to subtract the potassium-40 beta particle activity value from the total gross beta particle activity value to determine if the screening level is exceeded. The potassium-40 beta particle activity shall be calculated by multiplying elemental potassium concentrations (in mg/L) by a factor of 0.82.

e. If the gross beta particle activity minus the naturally occurring potassium-40 beta particle activity exceeds the appropriate screening level, then an analysis of the sample shall be

performed to identify the major radioactive constituents present in the sample and the appropriate doses shall be calculated and summed to determine compliance with the PMCL for beta particles and photon radioactivity. Doses shall also be calculated and combined for measured levels of tritium and strontium to determine compliance.

f. The owner shall monitor monthly at each entry point that exceeds the PMCLs listed in Table 340.4 beginning the month after the exceedance occurs. The owner shall continue monthly monitoring until the waterworks has established, by a rolling average of three monthly samples, that the PMCL is being met. The owner who establishes that the PMCL is being met shall return to quarterly monitoring until the requirements set forth in subdivision B 2 a (1) or B 2 b (4) of this section are met.

3. General monitoring requirements for radionuclides.

a. The department may require more frequent monitoring than specified in subdivisions B 1 and B 2 of this section or may require confirmation samples at the department's discretion. The results of the initial and confirmation samples shall be averaged for use in compliance determinations.

b. The owner shall monitor at the time designated by the department during each compliance period.

c. The department has the discretion to delete results of obvious sampling or analytic errors.

d. Table 378.1 provides the minimum detection limits for radiological analyses.

TABLE 378.1
Minimum Detection Limits for Radiological Analyses

CONTAMINANT	DETECTION LIMIT (pCi/L unless otherwise noted)
Gross alpha	3
Gross beta	4
Cesium-134	10
Iodine-131	1
Radium-226	1
Radium 228	1
Strontium-89	10
Strontium-90	2
Tritium	1,000
Uranium	1 (µg/L)

12VAC5-590-379. Groundwater system monitoring.

A. General monitoring requirements.

1. The owner of a groundwater system, including consecutive and wholesale waterworks, shall conduct monitoring in accordance with this section, except that requirements do not apply to waterworks that combine all of their groundwater sources with surface water sources or with GUDI sources before treatment in accordance with 12VAC5-590-395.

2. Source water monitoring by the owner of a groundwater system that does not provide 4-log treatment of viruses for their groundwater sources before or at the first customer is described in subsection B of this section.

3. The owner of a groundwater system that provides at least 4-log treatment of viruses before or at the first customer is required to conduct compliance monitoring in accordance with 12VAC5-590-421 C.

4. The owner of a groundwater system that has confirmed E. coli contamination, as determined by source water monitoring conducted under subsection B of this section or has been notified of a significant deficiency as described in 12VAC5-590-350 D shall implement one or more of the corrective actions outlined in 12VAC5-590-421 A 1, as prescribed by the department.

5. The owner of a groundwater system that does not provide 4-log treatment of viruses before or at the first customer and is not performing compliance monitoring shall provide a triggered source water monitoring plan to the department.

6. Any source water sample collected in accordance with this section shall be analyzed for E. coli using one of the analytical methods in 40 CFR 141.402(c).

B. Groundwater source microbial monitoring.

1. Triggered source water monitoring.

a. General requirements. The groundwater system owner shall conduct triggered source water monitoring if both the conditions identified in subdivisions B 1 a (1) and B 1 a (2) of this section exist.

(1) The groundwater system owner does not provide at least 4-log treatment of viruses before or at the first customer for each groundwater source; and

(2) The groundwater system owner is notified that a sample collected under 12VAC5-590-370 A is total coliform positive and the sample is not invalidated under 12VAC5-590-380 E.

b. Sampling requirements. The groundwater system owner shall collect, within 24 hours of notification of the total coliform-positive sample, one source water sample from each groundwater source in use at the time the total coliform-positive sample was collected under 12VAC5-590-370 A, except as provided in this subdivision B 1 b.

(1) The department may extend the 24-hour time limit on a case-by-case basis if the owner cannot collect the source water sample within 24 hours due to circumstances beyond his control. In the case of an extension, the department shall specify how much time the owner has to collect the sample.

(2) If approved by the department, the owner of a waterworks with more than one groundwater source may meet the requirements of this subdivision B 1 by sampling representative groundwater sources. The owner shall submit for the department's approval a triggered source water monitoring plan that identifies one or more groundwater sources that are representative of each monitoring site in the waterworks' bacteriological sample siting report or that identifies groundwater sources that are hydrogeologically similar and clearly identifies which sources will be sampled.

(3) A groundwater system serving 1,000 people or fewer may use a triggered source water sample collected from a groundwater source to meet both the requirements of 12VAC5-590-380 and to satisfy the monitoring requirements of this subdivision B 1 for a groundwater source.

c. Additional requirements.

(1) If an E. coli-positive triggered source water sample collected under this subdivision B 1 is not invalidated under subdivision B 2 of this section, then the groundwater system owner shall provide public notification and collect five additional source water samples from the same source within 24 hours of being notified of the E. coli-positive sample.

(a) If the E. coli-positive triggered source water sample is also used as a repeat sample, then an E. coli PMCL violation is incurred under 12VAC5-590-380 B 1 a.

(b) If a waterworks collects more than one repeat sample at the monitoring location required for triggered source water monitoring, then the number of additional source water samples required under subdivision B 1 c (1) of this section may be reduced by the number of repeat samples collected at that location that were not E. coli positive.

(2) If any of the five additional samples are E. coli positive, the groundwater system owner shall comply with the treatment technique requirements of 12VAC5-590-421.

d. Consecutive and wholesale waterworks.

(1) A consecutive groundwater system owner that has a total coliform-positive sample collected in accordance with 12VAC5-590-370 A shall notify the wholesale waterworks owner and the department within 24 hours of being notified of the total coliform-positive sample.

(2) The wholesale groundwater system owner shall comply with the following:

(a) The wholesale groundwater system owner that receives notice from a consecutive waterworks it serves that a sample collected in accordance with 12VAC5-590-370 A is total coliform positive shall, within 24 hours of being notified, collect a sample from each groundwater source as described in subdivision B 1 of this section.

(b) If the sample collected under this subdivision B 1 is E. coli positive, then the wholesale groundwater system owner shall within 24 hours notify all consecutive waterworks served by that groundwater source of the E. coli-positive source water sample as described in 12VAC5-590-540 and shall meet the requirements of subdivision B 1 c of this section.

e. Exception to the triggered source water monitoring requirements. A groundwater system owner is not required to comply with the source water monitoring requirements of this subdivision B 1 if the department determines and documents in writing that:

(1) The total coliform-positive sample collected in accordance with 12VAC5-590-370 A is invalidated under 12VAC5-590-380 E.

(2) The total coliform-positive sample collected in accordance with 12VAC5-590-370 A is caused by a distribution system deficiency (sanitary defect).

(3) The total coliform-positive sample collected in accordance with 12VAC5-590-370 A was caused by distribution system conditions that will cause total coliform-positive samples.

2. Invalidation of an E. coli-positive groundwater source sample.

a. The groundwater system owner may obtain the department's invalidation of an E. coli-positive groundwater source sample collected under subdivision B 1 of this section only under the following conditions:

(1) The groundwater system owner provides the department with written notice from the laboratory that improper sample analysis occurred; or

(2) The department determines and documents in writing that there is substantial evidence that the E. coli-positive groundwater source sample is not related to source water quality.

b. If the department invalidates an E. coli-positive groundwater source sample, then the groundwater system owner shall collect another source water sample under subdivision B 1 of this section within 24 hours of being notified by the department of the invalidation decision and have the source water sample analyzed for E. coli.

3. Sampling location. All groundwater source samples required under subdivision B 1 of this section shall be collected at a location before any treatment of the groundwater source unless otherwise approved by the department.

4. Public notification. The owner of a groundwater system with a source water sample collected under this subsection that is E. coli positive and that is not invalidated under subdivision B 2 of this section, including consecutive waterworks served by the groundwater source, shall conduct public notification as required in 12VAC5-590-540 A 1.

5. Monitoring violations. Failure to meet the monitoring requirements of subdivision B 1 of this section is a violation and requires the groundwater system owner to provide public notification as required in 12VAC5-590-540 A 3.

C. Monitoring requirements for source water.

1. The owner of a groundwater source utilizing chlorine disinfection or any other treatment or chemical addition that may alter or affect the bacteriological quality of the source water shall collect source water samples for bacteriological analysis in accordance with this section.

2. All bacteriological samples under this section shall be collected from the source water before any treatment or chemical addition.

a. The owner shall provide a suitable source water sample tap at each groundwater source.

b. If conditions indicate that it is not possible to install a source water sample tap, then an alternate sample location acceptable to the department may be utilized for this monitoring.

3. All samples shall be analyzed by a test method that will yield a most probable number (MPN) result for both total coliforms and E. coli.

4. Number of samples.

a. The number of routine source water samples to be collected and the frequency of sampling shall be determined by the department. The department will notify the owner of the source water sampling requirements.

b. As a minimum, the owner shall collect source water samples in accordance with Table 379.1.

TABLE 379.1
Monitoring Requirements for Source Water Samples

SOURCE TYPE	MINIMUM ROUTINE SOURCE WATER MONITORING FREQUENCY	PARAMETERS
Well located in non-karst geology	One sample per year	Total coliforms MPN and E coli MPN
Well located in karst geology	One sample per calendar quarter	Total coliforms MPN and E coli MPN
Spring	One sample per month	Total coliforms MPN and E coli MPN

c. When a single sample result from a groundwater source that requires a routine source water monitoring frequency of less than monthly indicates total coliforms in excess of 50 colonies/100 mL or the presence of E. coli, the owner shall collect one confirmation sample within seven calendar days after notification of the results.

d. The department may require that additional source water samples be collected and will establish the specific number of samples and the monitoring frequency.

12VAC5-590-380. Bacteriological compliance.

A. The owner needs only to determine the presence or absence of total coliforms and E. coli for routine bacteriological monitoring at entry points or distribution system locations.

B. PMCLs for microbial contaminants.

1. A waterworks is in compliance with the PMCL for E. coli unless any of the conditions identified in this subdivision occur. A violation may pose an acute risk to public health and is a Tier 1 condition requiring public notification as described in 12VAC5-590-540 A 1 when:

a. A repeat sample following a total coliform-positive routine sample is E. coli positive;

b. A repeat sample following an E. coli-positive routine sample is total coliform positive;

c. The owner fails to collect all required repeat samples following an E. coli-positive routine sample; or

d. The owner fails to test for E. coli when any repeat sample tests positive for total coliform.

2. Compliance shall be determined with the PMCL for E. coli for each monitoring period for which monitoring for total coliforms is required.

C. The best available technology (BAT), treatment techniques, or other means available for achieving compliance with the PMCL for E. coli shall be:

1. Protection of wells from contamination by coliforms by appropriate placement, construction, and maintenance of the wells;

2. Maintenance of a detectable residual disinfectant throughout the distribution system;

3. Proper maintenance of the distribution system including appropriate pipe replacement and repair procedures, water main flushing programs, proper operation and maintenance of storage tanks and reservoirs, continual maintenance of positive water pressure in all parts of the distribution system, and an approved cross-connection control program;

4. Filtration and disinfection of a surface water source, a GUDI source, or both; and

5. Disinfection of groundwater using strong oxidants such as chlorine, chlorine dioxide, or ozone.

D. A total coliform-positive result is indicative of a breakdown in the protective barriers and shall be cause for repeat monitoring and special follow-up action to locate and eliminate the cause of contamination.

1. For each routine sample found to be total coliform positive, the owner shall collect a set of three repeat samples within 24 hours of being notified of the positive result. The department may extend the 24-hour limit on a case-by-case basis. For groundwater systems, the requirements of 12VAC5-590-379 shall also apply, and all repeat samples must be analyzed for E. coli using one of the analytical methods in 40 CFR 141.402(c).

a. The owner shall collect at least one repeat sample from the sampling tap where the original total coliform-positive sample was collected, and at least one repeat sample at a tap within five service connections upstream and at least one repeat sample at a tap within five service connections downstream of the original sampling site. If a total coliform-positive sample is at the end of the distribution system or one service connection away from the end of the distribution system, the owner must still collect all required repeat samples.

b. The owner shall collect an additional set of repeat samples if one or more repeat samples in the current set of repeat samples is total coliform positive. The owner shall collect the additional set of repeat samples within 24 hours of being notified of the positive results, unless the department extends the limit as provided in this section. The owner shall continue to collect additional sets of repeat samples until either total coliforms are not detected in one complete set of repeat samples or the owner determines that a coliform treatment technique trigger specified in 12VAC5-590-392 B has been exceeded as a result of a repeat sample being total coliform positive and notifies the department. If a trigger identified in 12VAC5-590-392 B is

exceeded as a result of a routine sample being total coliform positive, then the owner is required to conduct only one round of repeat monitoring for each total coliform-positive routine sample.

c. If the owner collects a routine sample before learning the results of the previous routine sample, and the sample is collected within five service connections of the initial routine sample, then the owner may count the subsequent sample as a repeat sample when the initial sample results are found to be total coliform positive.

d. If one or more repeat samples collected at the monitoring location required for triggered source water monitoring are E. coli positive, then the owner has exceeded the E. coli PMCL and must comply with the groundwater system treatment technique requirements specified in 12VAC5-590-421.

e. If all repeat samples collected at the monitoring location required for triggered source water monitoring are E. coli negative, and a repeat sample collected at a monitoring location other than the one required for triggered source water monitoring is E. coli positive, then the owner has exceeded the E. coli PMCL. However, the owner is not required to collect five additional source water samples from the same source within 24 hours of learning the E. coli-positive result.

f. The owner shall collect all repeat samples on the same day, except the department may allow the owner of a waterworks with a single service connection to collect the required set of repeat samples over a three-day period or to collect a larger volume repeat sample in one or more sample containers of any size as long as the total volume collected is at least 300 ml.

g. If a repeat sample collected at the monitoring location required for triggered source water monitoring is E. coli-positive, then the owner has exceeded the E. coli PMCL and must collect five additional source water samples from the same source within 24 hours of learning the E. coli-positive result.

2. Results of all routine and repeat samples not invalidated by the department shall be used to determine compliance with the PMCL for E. coli and whether a treatment technique trigger specified in 12VAC5-590-392 B has been exceeded.

3. Special-purpose samples, such as those collected to determine whether disinfection practices are sufficient following pipe placement, replacement, or repair, and samples collected before start-up of a seasonal waterworks, shall not be used to determine compliance. Repeat samples are not considered special-purpose samples.

E. A total coliform-positive sample invalidated under this subsection does not count toward meeting the minimum monitoring requirements of this section. To invalidate a total coliform-positive sample under this subsection, the written decision and rationale shall be evaluated, approved, and signed by the department. The department shall make this document available to EPA and the public. The written documentation shall state the specific cause of the total coliform-positive sample and what action the owner has taken, or will take, to correct this problem. The department shall not invalidate a total coliform-positive sample solely on the grounds that all repeat samples are total coliform negative.

1. The department may invalidate a total coliform positive sample if any of the following conditions are met:

a. The laboratory establishes that improper sample analysis caused the total coliform-positive result;

b. The department, on the basis of the results of repeat samples collected as required by subdivision D 1 of this section, determines that the total coliform-positive sample resulted from a domestic or other nondistribution system plumbing problem. The department cannot invalidate a sample on the basis of repeat sample results unless all repeat samples collected at the same tap as the original total coliform-positive sample are also total coliform positive, and all repeat samples collected at a location other than the original tap are total coliform negative

(e.g., the department cannot invalidate a total coliform-positive sample on the basis of repeat samples if all the repeat samples are total coliform negative or if the waterworks has only one service connection); or

c. The department has substantial grounds to believe that a total coliform-positive result is due to a circumstance or condition that does not reflect water quality in the distribution system. In this case, the owner shall still collect all repeat samples required under subdivision D 1 of this section, and use them to determine whether a coliform treatment technique trigger in 12VAC5-590-392 B has been exceeded.

2. A laboratory must invalidate a sample because of sampling interference (i.e., turbid culture in absence of (i) gas production, or (ii) acid reaction; exhibition of confluent growth; or production of colonies too numerous to count). The owner shall collect a replacement sample from the same location within 24 hours, and have it analyzed for the presence of total coliforms. The owner must continue to resample within 24 hours and have the samples analyzed until a valid result is obtained. The department may waive the 24-hour time limit on a case-by-case basis.

F. Escherichia coli (E. coli).

1. If a routine, repeat, or replacement sample is total coliform positive, then the owner shall analyze the total coliform-positive culture medium to determine if E. coli are present. If E. coli are present, then the owner shall notify the department by the end of the day when the owner is notified of the test result, unless the department is closed, in which case the department must be notified before the end of the next business day.

2. The department has the discretion to allow an owner, on a case-by-case basis, to forgo E. coli testing on a total coliform-positive sample if the owner assumes that the total coliform-positive sample is E. coli positive. Accordingly, the owner must notify the department as specified in subdivision F 1 of this subsection and the provisions of subdivision B 1 of this section apply.

G. Groundwater sources.

1. Groundwater sources shall be disinfected in accordance with 12VAC5-590-421 A 1 d when the results of the source water monitoring samples specified in 12VAC5-590-430 B 2 or 12VAC5-590-840 K 1 a indicate a total coliform concentration (geometric mean) of the 20 samples to be greater than 3 colonies/100 mL but less than 100 colonies/100 mL. The value 1.0 shall be used to represent a zero coliform result in the calculation of the geometric mean.

2. Groundwater source monitoring results conducted in accordance with 12VAC5-590-430 B 2 or 12VAC5-590-840 K 1 a that indicate a total coliform concentration equal to or greater than 100 colonies/100 ml constitutes contamination that is not treatable by single-barrier disinfection treatment alone.

3. Groundwater sources shall be disinfected in accordance the requirements of 12VAC5-590-421 A 1 d when the source water quality contributes to the waterworks' failure to meet the bacteriological PMCL specified in subsection B of this section.

4. If the results of the source water monitoring required by 12VAC5-590-379 C or 12VAC5-590-430 B 2 indicate the presence of E. coli in two or more samples collected during any running six-month period, then the owner shall:

a. Issue a Tier 1 public notice in accordance with 12VAC5-590-540 A 1.

b. Provide disinfection treatment to achieve a 4-log virus inactivation and removal as specified in 12VAC5-590-421 A 1 d.

c. Conduct compliance monitoring as specified in 12VAC5-590-421 B and 12VAC5-590-421 C.

5. If the results of the source water monitoring required in 12VAC5-590-379 C indicate total coliform concentration in excess of 50 colonies/100 mL in three or more samples collected during

any running six-month period or the presence of E. coli in two or more samples collected during any running six-month period, then the source water shall be reevaluated for GUDI determination in accordance with 12VAC5-590-430.

6. The department may require that any groundwater source be disinfected in accordance with the requirements of 12VAC5-590-421 A 1 d.

H. All samples shall be analyzed by laboratories that have received certification by EPA or DCLS as specified in 12VAC5-590-440 for drinking water analyses.

12VAC5-590-382. Inorganic chemicals compliance.

A. When the results of sampling for antimony, arsenic, asbestos, barium, beryllium, cadmium, cyanide (as free cyanide), chromium, fluoride, mercury, nickel, selenium, or thallium exceed the applicable PMCL, the owner shall collect a confirmation sample at the same sampling point within two weeks of notification of the analytical results of the first sample. The fluoride PMCL applies only to community waterworks.

1. The results of the initial and confirmation samples shall be averaged to determine compliance with subsection A of this section. The department has the discretion to delete results of obvious sampling errors.

2. Compliance with the PMCLs for antimony, arsenic, asbestos, barium, beryllium, cadmium, cyanide (as free cyanide), chromium, fluoride, mercury, nickel, selenium, and thallium listed in Table 340.1 shall be determined based on the analytical results obtained at each sampling point.

a. For the owner of a waterworks that conducts monitoring more frequently than annually, compliance with the PMCL for antimony, arsenic, asbestos, barium, beryllium, cadmium, cyanide (as free cyanide), chromium, fluoride, mercury, nickel, selenium, or thallium is determined by an RAA at each sampling point. If the average at any sampling point is greater than the PMCL, then the waterworks is out of compliance. If any single sample would cause the annual average to be exceeded, then the waterworks is out of compliance immediately. A sample result below the MDL shall be calculated as zero for the purpose of determining the annual average. If the owner fails to collect the required number of samples, compliance (average concentration) shall be based on the total number of samples collected.

b. For the owner of a waterworks that monitors annually or less frequently, the waterworks is not out of compliance with the PMCL for antimony, arsenic, asbestos, barium, beryllium, cadmium, cyanide (as free cyanide), chromium, fluoride, mercury, nickel, selenium, or thallium if the average of the original sample and a confirmation sample of a contaminant at any sampling point is greater than the PMCL. If sample results for the owner monitoring annually or less frequently exceed the PMCL, the owner shall begin quarterly sampling. The owner shall not be considered in violation of the PMCL until one year of quarterly sampling has been completed and the RAA is exceeded. However, if the confirmation sample is not collected, the owner is in violation of the PMCL for antimony, arsenic, asbestos, barium, beryllium, cadmium, cyanide (as free cyanide), chromium, fluoride, mercury, nickel, selenium, or thallium. If the owner fails to collect the required number of samples, then compliance (average concentration) shall be based on the total number of samples collected.

B. Compliance with the PMCLs for nitrate and nitrite shall be determined based on the analytical results obtained at each sampling point. The waterworks is not out of compliance with the PMCL if the concentrations of these contaminants are equal to or below the PMCLs. Where nitrate or nitrite sample results exceed the PMCL, the owner shall collect a confirmation sample, from the same sampling point that exceeded the PMCL within 24 hours of the owner's receipt of the analytical results of the first sample. The results of the initial and confirmation sample shall be averaged to determine compliance. The owner unable to comply with the 24-hour sampling requirement shall immediately notify the consumers in the area served by the waterworks in accordance with 12VAC5-590-540 A 1. The owner exercising this option shall collect and analyze a confirmation sample within two weeks of notification of the analytical results of the first

sample. The department may require more frequent monitoring. The department has the discretion to delete results of obvious sampling errors.

1. Nitrate nitrogen (NO_3-N) levels not exceeding 20 mg/L may be allowed in a noncommunity waterworks if the owner:

a. Demonstrates to the satisfaction of the department that this water will not be available to children under six months of age;

b. Provides continuous posting of the fact that NO_3-N levels exceed 10 mg/L and the potential health effects of exposure;

c. Notifies health officials annually of NO_3-N levels that exceed 10 mg/L; and

d. The department shall determine that no adverse health effects will result.

2. Nitrite in water poses a significant health hazard. Water with nitrite-nitrogen concentrations over 1 mg/L should not be used for infant feedings.

C. Compliance with the SMCLs for aluminum, chloride, copper, corrosivity, fluoride, foaming agents, iron, manganese, silver, sulfate, or zinc shall be determined based on the analytical results obtained at each sampling point. When the result of a sample exceeds the applicable SMCL, the owner shall collect a confirmation sample at the same sampling point within two weeks of notification of the analytical results of the first sample. The results of the initial and confirmation samples shall be averaged to determine compliance. If the average concentration level of any of these constituents exceeds the SMCL, then the department shall determine whether treatment for the constituents can be accomplished or more suitable source waters are, or can be made, available. This determination shall be made as quickly as possible. If either of these alternatives is feasible, then corrective action shall be promptly implemented by the owner if deemed necessary by the department. Exceeding the fluoride SMCL requires annual public notice in accordance with 12VAC5-590-540 G.

12VAC5-590-383. Organic chemicals compliance.

A. When the results of sampling indicate positive results for contaminants listed in Table 340.2, the owner shall collect a confirmation sample at the same sampling point within two weeks of notification of the analytical results of the first sample.

B. The results of the initial and confirmation samples shall be averaged to determine waterworks compliance in accordance with subsection C of this section. The department has the discretion to delete results of obvious sampling errors.

C. Compliance with Table 340.2 shall be determined based on the analytical results obtained at each sampling point. A sample result below the detection limit shall be calculated as zero for the purposes of determining the annual average. If the owner fails to collect the required number of samples, then compliance (average concentration) shall be based on the total number of samples collected.

1. For the owner of a waterworks that conducts monitoring more frequently than annually, compliance is determined by an RAA of all samples collected at each sampling point. If the annual average of any sampling point is greater than the PMCL, then the waterworks is out of compliance. If the initial sample or a subsequent sample would cause the annual average to be exceeded, then the waterworks is out of compliance immediately. A sample result below the detection limit shall be calculated as zero for purposes of determining the annual average.

2. If the owner is conducting monitoring annually or less frequently, then the owner is not in violation if the average of the initial and confirmation samples is greater than the PMCL for that contaminant; however, the owner shall begin quarterly sampling. The owner will not be considered in violation of the PMCL until one year of quarterly sampling has been completed and the RAA is exceeded. If any sample will cause the RAA to exceed the PMCL at any sampling point, then the waterworks is immediately out of compliance with the PMCL.

12VAC5-590-384. Residual disinfectant, DBPs, and DBPPs compliance.

A. General requirements.

1. Where compliance is based on an RAA of monthly or quarterly samples or averages and the owner fails to monitor for TTHM, HAA5, or bromate, this failure to monitor shall be treated as a monitoring violation for the entire period covered by the annual average. Where compliance is based on an RAA of monthly or quarterly samples or averages and the owner's failure to monitor makes it impossible to determine compliance with MRDLs for chlorine and chloramines, this failure to monitor shall be treated as a monitoring violation for the entire period covered by the annual average.

2. All samples collected and analyzed under the provisions of this section shall be included in determining compliance, even if that number is greater than the minimum required.

3. The owner is in violation of the PMCL when the LRAA exceeds the PMCLs listed in Table 340.6 calculated based on four consecutive quarters of monitoring, or the LRAA calculated based on fewer than four quarters of data if the PMCL would be exceeded regardless of the monitoring results of subsequent quarters. The owner is in violation of the monitoring requirements for each quarter that a monitoring result would be used in calculating the LRAA if the owner fails to monitor.

B. Disinfection byproducts.

1. TTHM and HAA5.

a. The owner of a waterworks required to monitor quarterly shall calculate the LRAAs for TTHM and HAA5 using monitoring results collected under 12VAC5-590-374 F and determine that each LRAA does not exceed the PMCL in order to comply with the PMCLs listed in Table 340.6. If the owner fails to complete four consecutive quarters of monitoring, then the owner shall calculate compliance with the PMCL based on the average of the available data from the most recent four quarters. If the owner collects more than one sample per quarter at a monitoring location, then the owner shall average all samples collected in the quarter at that location to determine a quarterly average to be used in the LRAA calculation.

b. The owner of a waterworks required to monitor annually or less frequently shall determine that each sample collected is less than the PMCL in order to determine compliance with the PMCLs listed in Table 340.6. If any sample result exceeds the PMCL, then the owner shall comply with the requirements of 12VAC5–590-374 F 5. If no sample result exceeds the PMCL, then the sample result for each monitoring location is considered the LRAA for that monitoring location.

c. The owner is in violation of the monitoring requirements for each quarter that a monitoring result would be used in calculating an LRAA if the owner fails to monitor.

d. A waterworks has exceeded the operational evaluation level at any monitoring location where the sum of the two previous quarters' TTHM results plus twice the current quarter's TTHM result, divided by four to determine an average, exceeds 0.080 mg/L, or where the sum of the two previous quarters' HAA5 results plus twice the current quarter's HAA5 result, divided by four to determine an average, exceeds 0.060 mg/L.

(1) The owner of a waterworks that exceeds the operational evaluation level shall conduct an operational evaluation and submit a written report of the evaluation to the department on a form approved by the department no later than 90 days after being notified of the analytical result that caused the waterworks to exceed the operational evaluation level. The written report shall be made available to the public upon request.

(2) The operational evaluation report shall include an examination of the waterworks treatment and distribution operational practices, including source water conditions, storage tank operations, excess storage capacity, distribution system flushing, changes in source water or

source water quality, and treatment changes or problems that may contribute to TTHM and HAA5 formation and what steps could be considered to minimize future exceedances.

(3) The owner may request and the department may allow the owner to limit the scope of the evaluation if the owner is able to identify the cause of the operational evaluation level exceedance. The request to limit the scope of the evaluation does not extend the schedule in subdivision B 1 d (1) of this section for submitting the written report. The department shall approve this limited scope of evaluation in writing, and the owner shall keep that approval with the completed report.

2. Bromate. Compliance shall be based on a running annual arithmetic average, computed quarterly, of monthly samples collected by the owner as prescribed by 12VAC5-590-374 H. For months in which the owner collects more than one sample, compliance is based on the average of all samples collected during the month. If the average result of the samples covering any consecutive four-quarter period exceeds the PMCL listed in Table 340.6, then the owner is in violation of the PMCL and shall notify the public pursuant to 12VAC5-590-540 A 2, in addition to reporting to the department pursuant to 12VAC5-590-530 and 12VAC5-590-531. If the owner fails to complete 12 consecutive months of monitoring, then compliance with the PMCL for the last four-quarter compliance period shall be based on the average of the available data.

3. Chlorite. Compliance shall be based on an arithmetic average of each three-sample set collected in the distribution system as prescribed by 12VAC5-590-374 G. If the arithmetic average of any three-sample set exceeds the PMCL listed in Table 340.6, then the owner is in violation of the PMCL and shall notify the public pursuant to 12VAC5-590-540 A 2, in addition to reporting to the department pursuant to 12VAC5-590-530 and 12VAC5-590-531.

C. Residual disinfectant.

1. Chlorine and chloramines.

a. Compliance shall be based on a running annual arithmetic average, computed quarterly, of monthly averages of all samples collected by the owner under 12VAC5-590-374 I 1 a. If the average covering any consecutive four-quarter period exceeds the MRDL listed in Table 340.7, then the owner is in violation of the MRDL and shall notify the public pursuant to 12VAC5-590-540 A 2, in addition to reporting to the department pursuant to 12VAC5-590-530 and 12VAC5-590-531.

b. In cases where the owner switches between the use of chlorine and chloramines for residual disinfection during the year, compliance shall be determined by including together all monitoring results of both chlorine and chloramines in calculating compliance. Reports submitted pursuant to 12VAC5-590-530 and 12VAC5-590-531 shall clearly indicate which residual disinfectant was analyzed for each sample.

c. Notwithstanding the MRDLs listed in Table 340.7, operators may increase the residual disinfectant levels of chlorine or chloramines in the distribution system to a level and for a time necessary to protect public health to address specific microbiological contamination problems caused by circumstances such as water main breaks in the distribution system, storm runoff events, source water contamination, or cross-connections.

2. Chlorine dioxide.

a. Acute violations. Compliance shall be based on consecutive daily samples collected by the owner under 12VAC5-590-374 I 2 a. If any daily sample collected at the entrance to the distribution system exceeds the MRDL listed in Table 340.7, and on the following day one or more of the three samples collected in the distribution system exceed the MRDL, then the owner is in violation of the MRDL and shall take immediate corrective action to lower the level of chlorine dioxide below the MRDL and shall notify the public pursuant to the procedures for Tier 1 conditions in 12VAC5-590-540 A 1 in addition to reporting to the department pursuant

to 12VAC5-590-530 and 12VAC5-590-531. Failure to collect samples in the distribution system the day following an exceedance of the chlorine dioxide MRDL at the entrance to the distribution system shall also be considered an MRDL violation, and the owner shall notify the public of the violation in accordance with the provisions for Tier 1 conditions in 12VAC5-590-540 A 1 in addition to reporting to the department pursuant to 12VAC5-590-530 and 12VAC5-590-531.

b. Nonacute violations. Compliance shall be based on consecutive daily samples collected by the owner under 12VAC5-590-374 I 2 a. If any two consecutive daily samples collected at the entrance to the distribution system exceed the MRDL listed in Table 340.7 and all distribution system samples collected are below the MRDL, then the owner is in violation of the MRDL and shall take corrective action to lower the level of chlorine dioxide below the MRDL at the point of sampling and shall notify the public pursuant to the procedures for Tier 2 conditions in 12VAC5-590-540 A 2 in addition to reporting to the department pursuant to 12VAC5-590-530 and 12VAC5-590-531. Failure to monitor at the entrance to the distribution system the day following an exceedance of the chlorine dioxide MRDL at the entrance to the distribution system is also an MRDL violation, and the owner shall notify the public of the violation in accordance with the provisions for Tier 2 conditions in 12VAC5-590-540 A 2 in addition to reporting to the department pursuant to 12VAC5-590-530 and 12VAC5-590-531.

D. Disinfection byproduct precursors (DBPPs).

1. Compliance shall be determined as specified by 12VAC5-590-411 A 3.

2. For the owner required to meet Step 1 TOC removals, if the value calculated under 12VAC5-590-411 A 3 a (4) is less than 1.00, then the owner is in violation of the treatment technique requirements and shall notify the public pursuant to 12VAC5-590-540 A 2 in addition to reporting to the department pursuant to 12VAC5-590-530 and 12VAC5-590-531.

12VAC5-590-385. Lead and copper AL compliance.

A. The lead AL is exceeded if the concentration of lead in more than 10% of tap water samples collected during any monitoring period conducted in accordance with 12VAC5-590-375 B is greater than 0.015 mg/L (i.e., if the 90th percentile lead level is greater than 0.015 mg/L).

B. The copper AL is exceeded if the concentration of copper in more than 10% of tap water samples collected during any monitoring period conducted in accordance with 12VAC5-590-375 B is greater than 1.3 mg/L (i.e., if the 90th percentile copper level is greater than 1.3 mg/L).

C. The 90th percentile lead and copper levels shall be computed as follows:

1. The results of all lead or copper samples taken during a monitoring period shall be placed in ascending order from the sample with the lowest concentration to the sample with the highest concentration. Each sampling result shall be assigned a number, ascending by single integers beginning with the number 1 for the sample with the lowest contaminant level. The number assigned to the sample with the highest contaminant level shall be equal to the total number of samples taken.

2. The number of samples taken during the monitoring period shall be multiplied by 0.9.

3. The contaminant concentration in the numbered sample yielded by the calculation in subdivision C 2 of this section is the 90th percentile contaminant level.

4. For a waterworks serving fewer than 100 people, and the owner collects five samples per monitoring period, the 90th percentile is computed by taking the average of the highest and second highest concentrations.

5. For the owner that has been allowed by the department to collect fewer than five samples in accordance with 12VAC5-590-375 B 3, the sample result with the highest concentration is considered the 90th percentile value.

12VAC5-590-388. Radiological compliance.

A. MCLGs for radionuclides are listed in Table 546.1 of 12VAC5-590-546 B.

B. PMCLs for radionuclides are applicable to community waterworks only and are listed in Table 340.4. Compliance with PMCLs will be determined based on the analytical results obtained at each entry point. If the sample result at one entry point exceeds the PMCL, then the owner is in violation of the PMCL.

1. For the owner that is monitoring more than once per year, compliance with the PMCL is determined by an RAA of the analytical results at each entry point. If the average result at any entry point is greater than the PMCL, then the waterworks is out of compliance with the PMCL.

2. For the owner of a waterworks that monitors more than once per year, if any sample result will cause the RAA to exceed the PMCL at any entry point, then the waterworks is out of compliance with the PMCL immediately.

3. All samples collected and analyzed under the provisions 12VAC5-590-378 shall be included in determining compliance, even if that number is greater than the minimum required.

4. If the owner does not collect all required samples when compliance is based on an RAA result of quarterly samples, then compliance will be based on the RAA result of the samples collected.

5. If a sample result is less than the detection limit as specified in Table 378.1, then zero will be used to calculate the RAA unless a gross alpha particle activity result is being used instead of radium-226 or uranium. If the gross alpha particle activity result is less than the detection limit as specified in Table 378.1, then one half the detection limit will be used to calculate the RAA.

C. Radiological (gross alpha, combined radium-226 and radium-228, uranium, and man-made radioactivity).

1. Compliance with the radiological PMCLs shall be based on the RAA results. PMCLs are indicated in Table 340.4. Sampling for radiological analysis shall be in compliance with 12VAC5-590-378.

2. Compliance shall be determined by rounding off results to the same number of significant figures as the PMCL for the radionuclide in question.

D. If a PMCL for radioactivity listed in Table 340.4 is exceeded, then the owner shall give notice to the department pursuant to 12VAC5-590-530 and to the public as required by 12VAC5-590-540 A 2.

12VAC5-590-390. Physical constituent compliance.

A. Color, odor, pH, and total dissolved solids.

1. When the sampling results for color, odor, pH, or total dissolved solids exceed the applicable SMCL, the owner shall collect a confirmation sample at the same sampling site within two weeks of notification of the analytical results of the first sample.

2. The results of the initial and confirmation samples shall be averaged to determine compliance with 12VAC5-590-340 C. The department has the discretion to void results of obvious sampling errors.

3. If the average concentration level of any contaminant of color, odor, pH, or total dissolved solids is greater than the SMCL listed in Table 340.3, then the department shall determine whether treatment to remove that contaminant can be accomplished or more suitable supplies of source water are, or can be made, available.

B. Turbidity in groundwater sources not required to filter shall not:

1. Interfere with disinfection throughout the distribution system;

2. Cause taste and odors upon disinfection; or

3. Cause consumers to question the safety of their drinking water.

12VAC5-590-391. Treatment technique requirements.

A. When it is not technically or economically feasible to monitor for a particular PMCL or a contaminant, one or more specific treatment techniques that lead to a reduction in the concentration level of that contaminant shall be required. The application of that treatment technique reduces the contaminant in question to a concentration level that achieves compliance with this chapter.

B. Failure to continuously maintain the treatment technique is a violation of this chapter and public notification in accordance with 12VAC5-590-540 A 2 is required.

12VAC5-590-392. Coliform treatment technique triggers and assessment requirements.

A. Assessments shall be conducted in accordance with subsections C, D, and E of this section after exceeding treatment technique triggers.

B. Treatment technique triggers.

1. Level 1 treatment technique triggers:

a. For the owner required to collect 40 or more samples per month, the number of total coliform-positive samples exceeds 5.0% of the number of samples collected for the month.

b. For the owner required to collect fewer than 40 samples per month, when there are two or more total coliform-positive samples in the same month.

c. The owner fails to collect every required repeat sample after any single total coliform-positive sample.

2. Level 2 treatment technique triggers:

a. An E. coli PMCL violation, as specified in 12VAC5-590-380 B 2.

b. A second Level 1 trigger occurs within a rolling 12-month period, unless the department has determined a likely reason for the first Level 1 treatment technique trigger and that the owner has corrected the problem.

C. Assessment requirements.

1. Level 1 and 2 assessments shall be conducted to identify the possible presence of sanitary defects and defects in the distribution system coliform monitoring practices. The owner shall be responsible for conducting Level 1 assessments. Level 2 assessments shall be conducted by the department.

2. When conducting Level 1 and Level 2 assessments, the assessor shall include:

a. An evaluation and identification of inadequacies in sample sites, sampling protocol, and sample processing;

b. An evaluation of atypical events that could affect distributed water quality or indicate that distributed water quality was impaired;

c. An evaluation of changes in distribution system maintenance and operation that could affect distributed water quality, including water storage;

d. An evaluation of source and treatment considerations that impact distributed water quality; and

e. An evaluation of existing water quality monitoring data.

3. Level 1 assessment.

a. The owner shall complete the assessment and document the assessment on a form approved by the department. The owner shall submit the assessment form, as soon as practical, but within 30 days after the owner learns that a trigger in subdivision B 1 of this section has been exceeded.

b. If the department evaluates the completed Level 1 assessment and determines that the assessment is not sufficient, including any proposed timetable for any corrective actions, then the department shall consult with the owner. If the department requires revisions after the

consultation, then the owner shall submit a revised assessment form to the department on an agreed upon schedule not to exceed 30 days from the date of consultation.

c. Upon completion and submission of the assessment form by the owner, the department shall determine if the owner has identified a likely cause for the Level 1 trigger and, if so, confirm that the owner has corrected the problem or has included a schedule acceptable to the department for correcting the problem.

4. Level 2 assessment.

a. The department will complete the assessment and document the assessment on a form approved by the department. The department will consult with the owner during the assessment and complete the assessment within 30 days upon learning that the waterworks has exceeded any trigger in subdivision B 2 of this section.

b. The department will send to the owner the completed assessment form, which will describe any detected sanitary defects, corrective actions completed or needed and, if needed, a timetable to complete the corrective actions. The owner will return the form within seven days with a signature that indicates concurrence with the listed actions needed and timetable to complete the corrective actions. If the owner does not concur with either an action or timetable to complete a corrective action, then the owner shall notify the department, complete consultation with the department, and develop a revised corrective action schedule. The owner shall submit the revised schedule to the department for evaluation and approval within 30 days of the date of the consultation.

D. Corrective actions.

1. The owner shall correct sanitary defects found through either the Level 1 or the Level 2 assessment conducted under subsection C of this section.

2. The owner shall complete the corrective actions in compliance with the timetable approved by the department in consultation with the owner. The owner shall notify the department no later than seven days after each scheduled corrective action is completed.

E. Consultation.

1. At any time during the assessment or corrective action phase, either the owner or the department may request a consultation with the other party to determine the appropriate actions to be taken.

2. The owner may consult with the department on all relevant information that may impact the ability to comply with subsection D of this section.

F. Violations. Failure to conduct the required assessment or corrective actions in accordance with subsections C and D of this section, after exceeding a treatment technique trigger specified in subsection B of this section, is a treatment technique violation. The owner shall provide public notification as required under Tier 2 conditions specified in 12VAC5-590-540 A 2.

12VAC5-590-395. Surface water and GUDI sources, polymers, and recycle treatment techniques.

A. Surface water and GUDI source treatment techniques.

1. The filtration and disinfection provisions of this section are required treatment techniques for a waterworks supplied by a surface water source, a GUDI source, or both. These treatment technique requirements are in place of a PMCL for the following contaminants: Giardia lamblia, viruses, heterotrophic bacteria, Cryptosporidium, Legionella, and turbidity. A waterworks that uses a surface water source, a GUDI source, or both shall provide treatment of that source water that complies with these treatment technique requirements. See 12VAC5-590-401 for filtration log removal credits and required log inactivation for Cryptosporidium. See 12VAC5-590-500 for log removal credits and required log inactivation for Giardia lamblia and viruses. These treatment technique requirements consist of installing and properly operating water treatment processes that reliably achieve:

a. At least 99.9% (3-log) removal or inactivation of Giardia lamblia between a point where the source water is not subject to recontamination by surface water runoff and a point downstream before or at the first customer;

b. At least 99.99% (4-log) removal or inactivation of viruses between a point where the source water is not subject to recontamination by surface water runoff and a point downstream before or at the first customer; and

c. At least 99% (2-log) removal of Cryptosporidium between a point where the source water is not subject to recontamination by surface water runoff and a point downstream before or at the first customer.

2. A waterworks that uses a surface water source, a GUDI source, or both is considered to be in compliance with the requirements of subdivision A 1 of this section if it meets the following disinfection and filtration requirements:

a. Disinfection requirements.

(1) The disinfection treatment shall be sufficient to ensure that the total treatment processes of that waterworks achieve at least 99.9% (3-log) inactivation or removal of Giardia lamblia and at least 99.99% (4-log) inactivation or removal of viruses. If any physical process can achieve at least a 3-log removal of Giardia lamblia but cannot adequately remove pathogens, then the disinfection treatment shall provide a second treatment barrier for Giardia lamblia, Legionella, heterotrophic bacteria, and viruses. The disinfection treatment shall be sufficient to assure at least a 0.5 log inactivation of Giardia lamblia.

(2) The residual disinfectant concentration in the water entering the distribution system shall not be less than 0.2 mg/L for more than four hours.

(3) The residual disinfectant concentration in the distribution system, measured as total chlorine, free chlorine, combined chlorine, or chlorine dioxide, shall not be undetectable in more than 5% of the samples each month, for any two consecutive months that the waterworks serves water to the public. If the department determines that a waterworks is experiencing excessive coliform occurrences in its distribution system, then the department may require the owner to maintain minimum chlorine residual levels of 0.2 mg/L or monochloramine levels of 0.5 mg/L throughout the distribution system. Water in the distribution system with a heterotrophic bacteria concentration less than or equal to 500/mL, measured as HPC, is deemed to have a detectable residual disinfectant for the purposes of determining compliance with this requirement. Thus, the value "V," in percent, in the following formula shall not exceed 5% in one month, for any two consecutive months.

$$V = [(c + d + e) / (a + b)] \text{ X } 100$$

where

a = number of instances where the residual disinfectant concentration is measured;

b = number of instances where the residual disinfectant concentration is not measured but HPC is measured;

c = number of instances where the residual disinfectant concentration is measured but not detected and no HPC is measured;

d = number of instances where no residual disinfectant concentration is detected and where the HPC is greater than 500/mL; and

e = number of instances where the residual disinfectant concentration is not measured and HPC is greater than 500/mL.

(4) The department may determine that the HPC compliance requirements of subdivision A 2 a (3) of this section do not apply based on site-specific considerations or if an owner has no means for having a sample transported and analyzed for HPC by a certified laboratory under

the requisite time and temperature conditions and the waterworks is providing adequate disinfection in the distribution system.

b. Filtration requirements. A waterworks that uses a surface water source, a GUDI source, or both shall provide filtration treatment by using one of the following methods:

(1) Conventional filtration.

(a) Achieve a filtered water turbidity of less than or equal to 0.3 NTU in at least 95% of the measurements taken each month. Samples shall be representative of the waterworks' filtered water.

(b) The turbidity level of representative samples of a waterworks' filtered water shall at no time exceed one NTU, measured as specified in 12VAC5-590-440.

(c) A waterworks that uses lime softening may acidify representative samples before analysis using a protocol approved by the department.

(d) Water treatment plants utilizing conventional or direct filtration with gravity flow granular media filters are capable of producing filtered water with turbidity consistently less than 0.10 NTU. Therefore, for these types of water treatment plants, the operational goal for filter effluent turbidity for each filter, before any post-filtration chemical addition, shall be 0.10 NTU.

(2) Diatomaceous earth filtration.

(a) The turbidity level of representative samples of a waterworks' filtered water shall be less than or equal to one NTU in at least 95% of the measurements taken each month.

(b) The turbidity level of representative samples of a waterworks' filtered water shall at no time exceed five NTU.

(3) Slow sand filtration.

(a) The turbidity level of representative samples of a waterworks' filtered water shall be less than or equal to one NTU in at least 95% of the measurements taken each month, except that if the department determines there is no significant interference with disinfection at a higher turbidity level, then the department may substitute this higher turbidity limit for that waterworks.

(b) The turbidity level of representative samples of a waterworks' filtered water shall at no time exceed five NTU.

(4) Membrane filters, bag filters, and cartridge filters.

(a) The turbidity level of representative samples of a waterworks' filtered water shall be less than or equal to 0.3 NTU in at least 95% of the measurements taken each month, except that if the department determines there is no significant interference with disinfection at a higher turbidity level, then the department may substitute this higher turbidity limit for that waterworks.

(b) Water treatment plants utilizing membrane filtration are capable of producing filtered water with turbidity consistently less than 0.05 NTU. Therefore, for these types of water treatment plants, the operational goal for filter effluent turbidity for each filter, before any post-filtration chemical addition, is 0.05 NTU.

(c) The turbidity level of representative samples of a waterworks' filtered water shall at no time exceed one NTU.

(5) The owner may use a filtration technology not listed in this section if the owner demonstrates to the satisfaction of the department by full-scale, pilot plant, or challenge studies, or by other approved means that the alternative filtration technology, in combination with disinfection, will meet the requirements of this section.

3. Once the department has determined that a waterworks utilizes a surface water source, a GUDI source, or both (see 12VAC5-590-430), then filtration and disinfection treatments are required. The owner shall install and have in operation treatment units that meet the requirements described in subdivisions A 1 and A 2 of this section no later than 18 months following the department's determination. During the interim period, and until filtration and disinfection treatments are installed and in operation, the owner shall discontinue use of the surface water source, GUDI source, or both unless the source must remain in service because discontinuing the source is not a viable option, at which point the owner shall:

a. Issue a continuous boil water notice through the public notification procedure in 12VAC5-590-540 A 1 until the required filtration and disinfection treatments are installed and are in operation;

b. Provide disinfection treatment to achieve a 4-log inactivation of virus during the interim period before the filtration treatment is installed. Monitoring equipment shall be installed that will ensure compliance with this requirement; and

c. Increase bacteriological sampling frequency in the distribution system. For the owner required to collect routine distribution system bacteriological samples at a monthly frequency, the owner shall collect twice the number of samples required for that population each month. For the owner required to collect routine bacteriological samples at a quarterly frequency, the owner shall increase the sampling frequency to monthly.

B. Polymer treatment techniques.

1. The owner shall certify annually in writing to the department (using third-party or manufacturer's certification) that, when polymers containing acrylamide or epichlorohydrin are used by the waterworks, the combination (or product) of dose and monomer level does not exceed the following specified levels:

a. Acrylamide = 0.05% dosed at one ppm (or equivalent) of polymer.

b. Epichlorohydrin = 0.01% dosed at 20 ppm (or equivalent) of polymer.

2. Certifications may rely on the manufacturers or third parties as approved by the department.

C. Recycle treatment techniques.

1. If spent filter backwash water, thickener supernatant, or liquids from dewatering processes are recycled, in a waterworks supplied by a surface water source, a GUDI source, or both that employ conventional filtration or direct filtration treatment, then the waterworks is subject to the treatment technique requirement described in subsection A of this section.

2. Under this requirement, recycle flows shall be returned through all the processes of the treatment system or an alternative location approved by the department.

12VAC5-590-401. Enhanced filtration and disinfection for Cryptosporidium treatment techniques.

A. A waterworks using a surface water source, a GUDI source, or both shall comply with the requirements of this section based on their population or if the waterworks is a wholesaler, based on the population of the largest waterworks in the combined distribution system.

B. The owner shall conduct an initial and a second round of source water monitoring for each water treatment plant that treats a surface water source, a GUDI source, or both. This monitoring may include sampling for Cryptosporidium, E. coli, and turbidity to determine what level, if any, of additional Cryptosporidium treatment is required.

1. Initial round of source water monitoring. The owner shall conduct the following monitoring on the schedule in subdivision B 3 of this section unless the monitoring avoidance criteria in subdivision B 4 of this section are met.

a. The owner of a waterworks serving at least 10,000 people shall sample the source water for Cryptosporidium, E. coli, and turbidity at least monthly for 24 months.

b. The owner of a waterworks serving fewer than 10,000 people:

(1) Shall sample the source water for E. coli at least once every two weeks for 12 months, or

(2) May avoid E. coli monitoring if the owner notifies the department that the owner will monitor for Cryptosporidium as described in subdivision B 1 c of this section. The owner shall notify the department no later than three months before the date at which the owner is otherwise required to start E. coli monitoring.

c. The owner of a waterworks serving fewer than 10,000 people shall sample the source water for Cryptosporidium at least twice per month for 12 months or at least monthly for 24 months if the owner meets one of the following, based on monitoring conducted under subdivision B 1 b of this section:

(1) For a waterworks using source water from a lake or reservoir, the annual mean E. coli concentration is greater than 10 E. coli/100 mL.

(2) For a waterworks using source water from flowing stream, the annual mean E. coli concentration is greater than 50 E. coli/100 mL.

(3) The waterworks does not conduct E. coli monitoring as described in subdivision B 1 b of this section.

(4) The waterworks using a GUDI source shall comply with the requirements of this subdivision B 1 c based on the E. coli level that applies to the nearest surface water body. If no surface water body is nearby, the waterworks shall comply based on the requirements that apply to a waterworks using source water from a lake or reservoir.

d. For the waterworks serving fewer than 10,000 people, the department may approve monitoring for an indicator other than E. coli under subdivision B 1 b (1) of this section. The department also may approve an alternative to the E. coli concentration in subdivision B 1 c (1), B 1 c (2), or B 1 c (4) of this section to trigger Cryptosporidium monitoring. This approval by the department shall be provided to the owner in writing and shall include the basis for the department's determination that the alternative indicator or trigger level will provide a more accurate identification of whether a waterworks will exceed the Bin 1 Cryptosporidium level in subdivision B 1 a of this section.

e. The waterworks may sample more frequently than required under this section if the sampling frequency is evenly spaced throughout the monitoring period.

2. Second round of source water monitoring. The owner shall conduct a second round of source water monitoring that meets the requirements for monitoring parameters, frequency, and duration described in subdivision B 1 of this section, unless the monitoring exemption criteria in subdivision B 4 of this section are met. The owner shall conduct this monitoring on the schedule in subdivision B 3 of this section.

3. Monitoring schedule. The owner shall begin the monitoring required in subdivisions B 1 and B 2 of this section no later than the month beginning with the date listed in Table 401.1:

TABLE 401.1 Source Water Monitoring Starting Dates		
OWNERS OF WATERWORKS THAT SERVE...	SHALL BEGIN THE FIRST ROUND OF SOURCE WATER MONITORING NO LATER THAN THE MONTH BEGINNING...	AND SHALL BEGIN THE SECOND ROUND OF SOURCE WATER MONITORING NO LATER THAN THE MONTH BEGINNING...
At least 100,000 people	October 1, 2006	April 1, 2015
From 50,000 - 99,999 people	April 1, 2007	October 1, 2015
From 10,000 - 49,999 people	April 1, 2008	October 1, 2016
Fewer than 10,000 and monitor for E. coli	October 1, 2008	October 1, 2017
Fewer than 10,000 and monitor for Cryptosporidium[a]	April 1, 2010	April 1, 2019
[a]Applies to a waterworks that meet the conditions of subdivision B 1 c of this section.		

4. Monitoring avoidance.

a. The owner is not required to conduct source water monitoring if the waterworks will provide a total of at least 5.5-log of treatment for Cryptosporidium, equivalent to meeting the treatment requirements of Bin 4 in subdivision D 2 of this section.

b. If the owner chooses to provide the level of treatment in subdivision B 4 a of this section, rather than start source water monitoring, then the owner shall notify the department in writing no later than the date the owner is otherwise required to submit a sampling schedule for monitoring under subdivision B 5 of this section. Alternatively, the owner may choose to stop sampling at any point after initiating monitoring if the owner notifies the department in writing that he will provide this level of treatment. The owner shall install and operate technologies to provide this level of treatment by the applicable treatment compliance date in subdivision D 3 of this section.

5. Sampling schedules.

a. The owner of a waterworks required to conduct source water monitoring in accordance with subsection B of this section shall submit a sampling schedule that specifies the calendar dates when the owner shall collect each required sample.

(1) The owner shall submit a sampling schedule to the department no later than three months before the applicable date listed in subdivision B 3 of this section for each round of required monitoring.

(2) If the department does not respond to the owner regarding the sampling schedule, then the owner shall sample at the reported schedule.

b. The owner shall collect samples within two days before or two days after the dates indicated in the sampling schedule (i.e., within a five-day period around the schedule date) unless one of the conditions of this subdivision b applies:

(1) If an extreme condition or situation exists that may pose danger to the sample collector or that cannot be avoided and causes the owner to be unable to sample in the scheduled five-day period, then the owner shall sample as close to the scheduled date as is feasible unless the

department approves an alternative sampling date. The owner shall submit an explanation for the delayed sampling date to the department concurrent with the shipment of the sample to the laboratory.

(2) If the owner is unable to report a valid analytical result for a scheduled sampling date due to equipment failure, loss of or damage to the sample, failure to comply with the analytical method requirements, including the quality control requirements of 12VAC5-590-440, or the failure of an approved laboratory to analyze the sample, then the owner shall collect a replacement sample. The owner shall collect the replacement sample not later than 21 days after receiving information that an analytical result cannot be reported for the scheduled date unless the owner demonstrates that collecting a replacement sample within this timeframe is not feasible or the department approves an alternative resampling date. The owner shall submit an explanation for the delayed sampling date to the department concurrent with the shipment of the sample to the laboratory.

c. The owner of a waterworks that fails to meet the criteria of subdivision B 5 b of this section for any source water sample required under subsection B of this section shall revise the sampling schedule to add dates for collecting all missed samples. The owner shall submit the revised schedule to the department for approval before the owner begins collecting the missed samples.

6. Sampling locations.

a. The owner of a waterworks required to conduct source water monitoring under subsection B of this section shall collect samples for each water treatment plant that treats a surface water source, a GUDI source, or both. Where multiple water treatment plants draw source water from the same influent, such as the same pipe or intake, the department may approve one set of monitoring results to be used to satisfy the requirements of subsection B of this section for all water treatment plants.

b. The owner shall collect source water samples before chemical treatment, such as coagulants, oxidants, and disinfectants. However, the department may approve the collection of a source water sample after chemical treatment. To grant this approval, the department shall determine that collecting a sample before chemical treatment is not feasible for the owner and that the chemical treatment is unlikely to have a significant adverse effect on the analysis of the sample.

c. The owner of a waterworks that recycles filter backwash water shall collect source water samples before the point of filter backwash water addition.

d. Bank filtration.

(1) The owner that receives Cryptosporidium treatment credit for bank filtration under 12VAC5-590-395 A 2 b (1) shall collect source water samples from the surface water before bank filtration.

(2) The owner that uses bank filtration as pretreatment to a water treatment plant shall collect source water samples from the well (i.e., after bank filtration). The use of bank filtration during monitoring shall be consistent with routine operational practice. The owner collecting samples after a bank filtration process may not receive treatment credit for the bank filtration under subdivision E 4 c of this section.

e. Multiple sources. The owner of a waterworks that uses multiple source waters, including multiple surface water sources and blended surface water and groundwater sources, shall collect samples as specified in subdivision B 6 e (1) or B 6 e (2) of this section. The use of multiple source waters during monitoring shall be consistent with routine operational practice.

(1) If a sampling tap is available where the source waters are combined before treatment, then the owner shall collect samples from the tap.

(2) If a sampling tap is not available where the source waters are combined before treatment, then the owner shall collect samples at each source near the intake on the same day and shall follow either subdivision B 6 e (2) (a) or B 6 e (2) (b) of this section for sample analysis.

(a) The owner may composite samples from each source into one sample before analysis. The volume of sample from each source shall be weighted according to the proportion of the source water in the total water treatment plant flow at the time the sample is collected.

(b) The owner may choose to have samples analyzed from each source separately and calculate a weighted average of the analysis results for each sampling date. The weighted average shall be calculated by multiplying the analysis result for each source water by the fraction the source water contributed to the total water treatment plant flow at the time the sample was collected and then summing these values.

f. Additional requirements. The owner shall submit a description of each sampling location to the department at the same time as the sampling schedule required in subdivision B 3 of this section. This description shall address the position of the sampling location in relation to the waterworks' source waters and treatment processes, including pretreatment, points of chemical treatment, and filter backwash recycle. If the department does not respond to an owner regarding sampling location, then the owner shall sample at each reported location.

7. Analytical methods. All analytical methods shall be conducted in accordance with 12VAC5-590-440.

8. Approved laboratories.

a. Cryptosporidium. The owner shall have Cryptosporidium samples analyzed by a laboratory that has received reciprocal certification approved under the DCLS Laboratory Certification Program for Analysis of Cryptosporidium in Water.

b. E. coli. A laboratory certified by the DCLS for total coliform analysis under 12VAC5-590-440 is approved for E. coli analysis when the laboratory uses the same technique for E. coli that the laboratory uses under 12VAC5-590-440. Laboratories shall use methods for enumeration of E. coli in source water approved in 12VAC5-590-440.

c. Turbidity. Measurements of turbidity shall be made by a party approved by the department.

9. Reporting of the source water results shall be in accordance with 12VAC5-590-531.

10. The owner of a waterworks treating a surface water source, a GUDI source, or both, that operates for only part of the year shall conduct source water monitoring in accordance with this section, but with the following modifications:

a. The owner shall sample the source water only during the months that the waterworks operates unless the department specifies another monitoring period based on waterworks operating practices.

b. The owner of a waterworks that operates less than six months per year and that monitors for Cryptosporidium shall collect at least six Cryptosporidium samples per year during each of two years of monitoring. Samples shall be evenly spaced throughout the period the waterworks operates.

11. New sources.

a. The owner of a waterworks that begins using a surface water source, a GUDI source, or both, is required to begin monitoring under subdivision B 3 of this section and shall monitor the new source on a schedule approved by the department. Source water monitoring shall meet the requirements of this section. The owner shall also meet the bin classification and

Cryptosporidium treatment requirements of subdivisions D 1 and D 2 of this section, for the new source on a schedule approved by the department.

b. The requirements of this section apply to a waterworks using a surface water source, a GUDI source, or both, that begins operation after the monitoring start date applicable to the size of the waterworks under subdivision B 3 of this section.

c. The owner shall begin a second round of source water monitoring no later than six years following the initial bin classification under subdivision D 1 of this section.

12. Failure to collect any source water sample required under this section in accordance with the sampling schedule, sampling location, analytical method, approved laboratory, and reporting requirements of subdivisions B 5 through B 9 of this section is a monitoring violation.

13. Grandparenting monitoring data. The owner may use monitoring data collected before the applicable monitoring start date in subdivision B 3 of this section (grandparented data) to meet the initial source water monitoring requirements in subdivision B 1 of this section. Grandparented data may be substituted for an equivalent number of months at the end of the monitoring period. All data submitted under this subdivision B 13 shall meet the requirements in subdivisions B 13 a through B 13 h of this section and be approved by the department:

a. The owner may grandparent Cryptosporidium samples to meet the requirements of this section when the owner does not have corresponding E. coli and turbidity samples. The owner who grandparents Cryptosporidium samples without E. coli and turbidity samples is not required to collect E. coli and turbidity samples when the owner completes the requirements for Cryptosporidium monitoring under this section.

b. The analysis of E. coli samples shall meet the analytical method and approved laboratory requirements of subdivisions B 7 and B 8 of this section.

c. The analysis of Cryptosporidium samples shall meet the requirements of subdivision B 8 of this section.

d. The sampling location shall meet the conditions in subdivision B 6 of this section.

e. Cryptosporidium sample collection intervals may vary for the conditions specified in subdivisions B 5 b (1) and B 5 b (2) of this section if the owner provides documentation of the condition when reporting monitoring results.

(1) The department may approve grandparenting of previously collected data where there are time gaps in the sampling frequency if the owner conducts additional monitoring the department specifies to ensure that the data used to comply with the initial source water monitoring requirements of subsection B of this section are seasonally representative and unbiased.

(2) The owner may grandparent previously collected data where the sampling frequency within each month varied. If the Cryptosporidium sampling frequency varied, then the owner shall follow the monthly averaging procedure in subdivision D 1 a (5) of this section when calculating the bin classification for a filtered waterworks.

f. The owner of a waterworks that requests to grandparent previously collected monitoring results shall report the following information by the applicable dates listed in the following subdivisions. The owner shall report this information to the department.

(1) The owner shall report the intent to submit previously collected monitoring results for grandparenting. This report shall specify the number of previously collected results the owner shall submit, the dates of the first and last sample, and whether an owner shall conduct additional source water monitoring to meet the requirements in subsection B of this section. The owner shall report this information no later than the date the sampling schedule listed in subdivision B 3 of this section is required.

(2) The owner shall report previously collected monitoring results for grandparenting no later than two months after the applicable date listed in subdivision B 3 of this section.

(a) For each sample result, the owner shall report the applicable data elements in 12VAC5-590-531 A 5.

(b) The owner shall certify that the reported monitoring results include all results the waterworks generated during the time period beginning with the first reported result and ending with the final reported result. This applies to samples that were collected from the sampling location specified for source water monitoring under subdivision B 1 of this section, not spiked, and analyzed using the laboratory's routine process for the analytical methods listed in this section.

(c) The owner shall certify that the samples were representative of a waterworks' source waters and the source waters have not changed. The owner shall report a description of each sampling location, which shall address the position of the sampling location in relation to the waterworks' source waters and treatment processes, including points of chemical addition and filter backwash recycle.

(d) For Cryptosporidium samples, the laboratory that analyzed the samples shall provide a letter certifying that the quality control criteria specified in the methods listed in subdivision B 8 of this section were met for each sample batch associated with the reported results. Alternatively, the laboratory may provide bench sheets and sample examination report forms for each field, matrix spike, initial precision and recovery (IPR), ongoing precision and recovery (OPR), and method blank sample associated with the reported results.

g. If the department determines that a previously collected data set submitted for grandparenting was generated during source water conditions that were not normal for the waterworks, such as a drought, the department may disapprove the data. Alternatively, the department may approve the previously collected data if the owner reports additional source water monitoring data, as determined by the department, to ensure that the data set used under subdivision D 1 of this section represents average source water conditions for the waterworks.

h. If the owner submits previously collected data that fully meets the number of samples required for initial source water monitoring under subdivision B 1 of this section and some of the data are rejected due to not meeting the requirements of this section, then the owner shall conduct additional monitoring to replace rejected data on a schedule approved by the department. The owner is not required to begin this additional monitoring until two months after notification that data have been rejected and additional monitoring is necessary.

C. The owner of a waterworks that plans to make a significant change to the disinfection practice shall develop disinfection profiles and calculate disinfection benchmarks as described in 12VAC5-590-500.

1. The owner shall notify the department before changing the disinfection practice and shall include in this notice the following information:

a. A completed disinfection profile and disinfection benchmark for Giardia lamblia and viruses;

b. A description of the proposed change in disinfection practice; and

c. An analysis of how the proposed change will affect the current level of disinfection.

2. Significant changes to the disinfection practice are defined as follows:

a. Changes to the point of disinfection;

b. Changes to any disinfectant used in the water treatment plant;

c. Changes to the disinfection process; or

d. Any other modification identified by the department as a significant change to disinfection practice.

D. The owner shall determine the Cryptosporidium treatment bin classification as described in subdivision D 1 of this section and provide additional treatment for Cryptosporidium, if required, as described in subdivision D 2 of this section. The owner shall implement Cryptosporidium treatment according to the schedule in subdivision D 3 of this section.

1. Bin classification for waterworks.

a. Following completion of the initial round of source water monitoring required under subdivision B 1 of this section, the owner shall calculate an initial Cryptosporidium bin concentration for each water treatment plant for which monitoring was required. Calculation of the bin concentration shall use the Cryptosporidium results reported under subdivision B 1 of this section and shall follow these procedures:

(1) For the owner who collects a total of at least 48 samples, the bin concentration is equal to the arithmetic mean of all sample concentrations.

(2) For the owner who collects a total of at least 24 samples, but not more than 47 samples, the bin concentration is equal to the highest arithmetic mean of all sample concentrations in any 12 consecutive months during which Cryptosporidium samples were collected.

(3) For the owner of a waterworks that serves fewer than 10,000 people and monitors for Cryptosporidium for only one year (i.e., collect 24 samples in 12 months), the bin concentration is equal to the arithmetic mean of all sample concentrations.

(4) For water treatment plants that operate only part of the year and that monitor fewer than 12 months per year under subdivision B 1 of this section, the bin concentration is equal to the highest arithmetic mean of all sample concentrations during any year of Cryptosporidium monitoring.

(5) If the monthly Cryptosporidium sampling frequency varies, then the owner shall first calculate a monthly average for each month of monitoring. The owner shall then use these monthly average concentrations, rather than individual sample concentrations, in the applicable calculation for bin classification in subdivisions D 1 a (1) through D 1 a (4) of this section.

b. The owner shall determine the initial bin classification from Table 401.2 using the Cryptosporidium bin concentration calculated under subdivision D 1 a of this section:

TABLE 401.2 Bin Classification for Filtered Waterworks		
FOR OWNERS OF WATERWORKS THAT ARE...	WITH A CRYPTOSPORIDIUM BIN CONCENTRATION OF[a]...	THE BIN CLASSIFICATION IS...
Required to monitor for Cryptosporidium under subdivision B 1 of this section	Cryptosporidium less than 0.075 oocysts/L	Bin 1
	Cryptosporidium equal to or greater than 0.075 oocysts/L but less than 1.0 oocysts/L	Bin 2
	Cryptosporidium equal to or greater than 1.0 oocysts/L but less than 3.0 oocysts/L	Bin 3
	Cryptosporidium equal to or greater than 3.0 oocysts/L	Bin 4
Serving fewer than 10,000 people and NOT required to monitor for Cryptosporidium under subdivision B 1 c of this section	Not Applicable	Bin 1
[a]Based on calculations in subdivision D 1 a or D 1 c of this section, as applicable.		

c. Following completion of the second round of source water monitoring required under subdivision B 2 of this section, the owner shall recalculate the Cryptosporidium bin concentration using the Cryptosporidium results reported under subdivision B 2 of this section and following the procedures in subdivisions D 1 a (1) through D 1 a (4) of this section. The owner shall then redetermine the bin classification using this bin concentration and Table 401.3.

d. Reporting of bin classifications.

(1) The owner shall report the initial bin classification under subdivision D 1 b of this section to the department for approval no later than six months after the waterworks is required to complete the initial source water monitoring based on the schedule in subdivision B 3 of this section.

(2) The owner shall report the bin classification under subdivision D 1 c of this section to the department for approval no later than six months after the owner is required to complete the second round of source water monitoring based on the schedule in subdivision D 1 a (3) of this section.

(3) The bin classification report to the department shall include a summary of source water monitoring data and the calculation procedure used to determine bin classification.

e. Failure to comply with the conditions of subdivision D 1 d of this section is a violation of the treatment technique requirement.

2. Waterworks additional Cryptosporidium treatment requirements.

a. A waterworks shall provide the level of additional treatment for Cryptosporidium specified in this subdivision based on the bin classification as determined under subdivision D 1 of this section and according to the schedule in subdivision D 3 b of this section.

TABLE 401.3. Cryptosporidium Treatment Requirements				
IF THE WATERWORKS BIN CLASSIFICATION IS...	AND THE WATERWORKS USES THE FOLLOWING FILTRATION TREATMENT IN FULL COMPLIANCE WITH 12VAC5-590-395 A 1 AND 12VAC5-590-395 A 2, THEN THE ADDITIONAL CRYPTOSPORIDIUM TREATMENT REQUIREMENTS ARE...			
	Conventional filtration treatment (including softening)	Direct filtration	Slow sand or diatomaceous earth filtration	Alternative filtration technologies
Bin 1	No additional treatment	No additional treatment	No additional treatment	No additional treatment
Bin 2	1-log treatment	1.5-log treatment	1-log treatment	a
Bin 3	2-log treatment	2.5-log treatment	2-log treatment	b
Bin 4	2.5-log treatment	3-log treatment	2.5-log treatment	c

[a]As determined by the department such that the total Cryptosporidium removal and inactivation is at least 4.0-log.

[b]As determined by the department such that the total Cryptosporidium removal and inactivation is at least 5.0-log.

[c]As determined by the department such that the total Cryptosporidium removal and inactivation is at least 5.5-log.

b. Additional treatment.

(1) The owner shall use one or more of the treatment and management options listed in subsection E of this section, termed the microbial toolbox, to comply with the additional Cryptosporidium treatment required in subdivision D 2 a of this section.

(2) A waterworks classified in Bin 3 and Bin 4 shall achieve at least 1-log of the additional Cryptosporidium treatment required under subdivision D 2 a of this section using either one or a combination of the following: (i) bag filters, (ii) bank filtration, (iii) cartridge filters, (iv) chlorine dioxide, (v) membranes, (vi) ozone, or (vii) UV as described in subdivisions E 3 through E 7 of this section.

c. Failure by a waterworks in any month to achieve treatment credit by meeting criteria in subdivisions E 3 through E 7 of this section for microbial toolbox options that is at least equal to the level of treatment required in subdivision D 2 a of this section is a violation of the treatment technique requirement.

d. If the department determines during a sanitary survey or an equivalent source water assessment that after an owner completed the monitoring conducted under subdivision B 1 or B 2 of this section, significant changes occurred in the waterworks watershed that could lead to increased contamination of the source water by Cryptosporidium, then the owner shall take actions specified by the department to address the contamination. These actions may include additional source water monitoring or implementing microbial toolbox options listed in subdivision E 2 of this section.

3. Schedule for compliance with Cryptosporidium treatment requirements.

a. Following the initial bin classification in accordance with subdivision D 1 b of this section, the owner shall provide the level of treatment for Cryptosporidium required under subdivision D 2 of this section according to the schedule in subdivision D 3 b of this section.

b. If the bin classification for a filtered waterworks changes following the second round of source water monitoring, as determined under subdivision D 1 c of this section, then the owner shall provide the level of treatment for Cryptosporidium required under subdivision D 2 of this section on a schedule approved by the department.

E. The owner of a waterworks required to provide additional treatment for Cryptosporidium shall implement microbial toolbox options that are designed and operated as described in subdivisions E 1 through E 7 of this section.

1. The owner receives the treatment credits listed in Table 401.4 by meeting the conditions for microbial toolbox options described in subdivisions E 3 through E 7 of this section. The owner shall apply these treatment credits to meet the treatment requirements in subdivision D 2 of this section.

2. Microbial Toolbox Summary Table: Options, Treatment Credits and Criteria.

TABLE 401.4
Microbial Toolbox Summary: Options, Treatment Credits and Criteria

TOOLBOX OPTION	CRYPTOSPORIDIUM TREATMENT CREDIT WITH DESIGN AND IMPLEMENTATION CRITERIA
Source Protection and Management Toolbox Options	
Alternative source and intake management	No prescribed credit. The owner may conduct simultaneous monitoring for treatment bin classification at alternative intake locations or under alternative intake management strategies. Specific criteria are in subdivision E 3 b of this section.

TABLE 401.4 **Microbial Toolbox Summary: Options, Treatment Credits and Criteria (*continued*)**	
TOOLBOX OPTION	CRYPTOSPORIDIUM TREATMENT CREDIT WITH DESIGN AND IMPLEMENTATION CRITERIA
Prefiltration Toolbox Options	
Presedimentation basin with coagulation	0.5-log credit during any month that presedimentation basins achieve a monthly mean reduction of 0.5-log or greater in turbidity or alternative performance criteria approved by the department. To be eligible, basins shall be operated continuously with coagulant addition and all water treatment plant flow shall pass through basins. Specific criteria are in subdivision E 4 a of this section.
Two-stage lime softening	0.5-log credit for two-stage softening where chemical addition and hardness precipitation occur in both stages. All water treatment plant flow shall pass through both stages. Single-stage softening is credited as equivalent to conventional treatment. Specific criteria are in subdivision E 4 b of this section.
Bank filtration	0.5-log credit for 25-foot setback; 1.0-log credit for 50-foot setback; aquifer shall be unconsolidated sand containing at least 10% fines; average turbidity in wells shall be less than 1 NTU. A waterworks using wells followed by filtration when conducting source water monitoring shall sample the well to determine bin classification and is not eligible for additional credit. Specific criteria are in subdivision E 4 c of this section.
Treatment Performance Toolbox Options	
Combined filter performance	0.5-log credit for CFE turbidity less than or equal to 0.15 NTU in at least 95% of measurements each month. Specific criteria are in subdivision E 5 a of this section.
Individual filter performance	0.5-log credit (in addition to 0.5-log combined filter performance credit) if individual filter effluent turbidity is less than or equal to 0.15 NTU in at least 95% of samples each month in each filter and is never greater than 0.3 NTU in two consecutive measurements in any filter. Specific criteria are in subdivision E 5 b of this section.
Additional Filtration Toolbox Options	
Bag or cartridge filters (individual filters)	Up to 2-log credit based on the removal efficiency demonstrated during challenge testing with a 1.0-log factor of safety. Specific criteria are in subdivision E 6 a of this section.
Bag or cartridge filters (in series)	Up to 2.5-log credit based on the removal efficiency demonstrated during challenge testing with a 0.5-log factor of safety. Specific criteria are in subdivision E 6 a of this section.

TABLE 401.4 Microbial Toolbox Summary: Options, Treatment Credits and Criteria (*continued*)	
TOOLBOX OPTION	CRYPTOSPORIDIUM TREATMENT CREDIT WITH DESIGN AND IMPLEMENTATION CRITERIA
Membrane filtration	Log credit equivalent to removal efficiency demonstrated in challenge test for device if supported by direct integrity testing. Specific criteria are in subdivision E 6 b of this section.
Second stage filtration	0.5-log credit for second separate granular media filtration stage if treatment train includes coagulation before first filter. Specific criteria are in subdivision E 6 c of this section.
Slow sand filters	2.5-log credit as a secondary filtration step; 3.0-log credit as a primary filtration process. No prior chlorination for either option. Specific criteria are in subdivision E 6 d of this section.
Inactivation Toolbox Options	
Chlorine dioxide	Log credit based on measured CT in relation to Table 401.5. Specific criteria in subdivision E 7 b of this section.
Ozone	Log credit based on measured CT in relation to Table 401.6. Specific criteria in subdivision E 7 b of this section.
UV	Log credit based on validated UV dose in relation to Table 401.7; reactor validation testing required to establish UV dose and associated operating conditions. Specific criteria in subdivision E 7 c of this section.

3. Source toolbox components.

a. Reserved.

b. Alternative source.

(1) The owner may conduct source water monitoring that reflects a different intake location (either in the same source or for an alternate source) or a different procedure for the timing or level of withdrawal from the source (alternative source water monitoring). If the department approves, then the owner may determine the bin classification under subdivision D 1 of this section based on the alternative source water monitoring results.

(2) If the owner conducts alternative source water monitoring under subdivision E 3 b (1) of this section, then the owner shall also monitor the current water treatment plant intake concurrently as described in subsection B of this section. "Plant intake" means the works or structures at the head of a conduit through which source water is diverted (e.g., river or lake) into the water treatment plant.

(3) Alternative source water monitoring under subdivision E 3 b (1) of this section shall meet the requirements for source water monitoring to determine bin classification, as described in subdivisions B 1 through B 13 of this section. The owner shall report the alternative source water monitoring results to the department, along with supporting information documenting the operating conditions under which the samples were collected.

(4) If the owner determines the bin classification under subdivision D 1 of this section using alternative source water monitoring results that reflect a different intake location or a different procedure for managing the timing or level of withdrawal from the source, then the owner shall relocate the intake or permanently adopt the withdrawal procedure, as applicable, no later than the applicable treatment compliance date in subdivision D 3 of this section.

4. Prefiltration treatment toolbox components.

a. Presedimentation. The owner receives 0.5-log Cryptosporidium treatment credit for a presedimentation basin during any month the process meets the following criteria:

(1) The presedimentation basin shall be in continuous operation and shall treat the entire water treatment plant flow at a waterworks using a surface water source, a GUDI source, or both.

(2) A coagulant shall be continuously added to the presedimentation basin.

(3) The presedimentation basin shall achieve the performance criteria in either of the following:

(a) Demonstrates at least 0.5-log mean reduction of influent turbidity. This reduction shall be determined using daily turbidity measurements in the presedimentation process influent and effluent and shall be calculated as follows: log10 (monthly mean of daily influent turbidity) - log10 (monthly mean of daily effluent turbidity).

(b) Complies with the performance criteria approved by the department that demonstrate at least 0.5-log mean removal of micron-sized particulate material through the presedimentation process.

b. Two-stage lime softening. The owner receives an additional 0.5-log Cryptosporidium treatment credit for a two-stage lime softening plant if chemical addition and hardness precipitation occur in two separate and sequential softening stages before filtration. Both softening stages shall treat the entire plant flow taken from a surface water source, a GUDI source, or both.

c. Bank filtration. The owner receives Cryptosporidium treatment credit for bank filtration that serves as pretreatment to a water filtration plant by meeting the criteria in this subdivision. The owner using bank filtration upon beginning source water monitoring under subdivision B 1 of this section shall collect samples as described in subdivision B 6 d of this section and is not eligible for this credit.

(1) Wells with a groundwater flow path of at least 25 feet receive 0.5-log treatment credit; and wells with a groundwater flow path of at least 50 feet receive 1.0-log treatment credit. The groundwater flow path shall be determined as specified in subdivision E 4 c (4) of this section.

(2) Only wells in granular aquifers are eligible for treatment credit. Granular aquifers are those comprised of sand, clay, silt, rock fragments, pebbles or larger particles, and minor cement. The owner shall characterize the aquifer at the well site to determine aquifer properties. The owner shall extract a core from the aquifer and demonstrate that in at least 90% of the core length, grains less than 1.0 mm in diameter constitute at least 10% of the core material.

(3) Only horizontal and vertical wells are eligible for treatment credit.

(4) For vertical wells, the groundwater flow path is the measured distance from the edge of the surface water body under high flow conditions (determined by the 100-year flood elevation boundary or by the floodway, as defined in Federal Emergency Management Agency flood hazard maps) to the well screen. For horizontal wells, the groundwater flow path is the measured distance from the bed of the river under normal flow conditions to the closest horizontal well lateral screen.

(5) The owner shall monitor each wellhead for turbidity at least once every four hours while the bank filtration process is in operation. If monthly average turbidity levels, based on daily maximum values in the well, exceed 1 NTU, the owner shall report this result to the department

and conduct an assessment within 30 days to determine the cause of the high turbidity levels in the well. If the department determines that microbial removal has been compromised, the department may revoke treatment credit until the owner implements corrective actions approved by the department to remediate the problem.

(6) Springs and infiltration galleries are not eligible for treatment credit under this section.

(7) Bank filtration demonstration of performance. The department may approve Cryptosporidium treatment credit for bank filtration based on a demonstration-of-performance study that meets the criteria in this subdivision. This treatment credit may be greater than 1.0-log and may be awarded to bank filtration that does not meet the criteria in subdivisions E 4 c (1) through E 4 c (5) of this section.

(a) The study shall follow a protocol approved by the department and shall involve the collection of data on the removal of Cryptosporidium or a surrogate for Cryptosporidium and related hydrogeologic and water quality parameters during the full range of operating conditions.

(b) The study shall include sampling both from any production well and from monitoring wells that are screened and located along the shortest flow path between the surface water source and the production well.

5. Treatment performance toolbox components.

a. Combined filter performance. The owner using conventional filtration treatment or direct filtration treatment receives an additional 0.5-log Cryptosporidium treatment credit during any month the waterworks meets the criteria in this subdivision. Combined filter effluent (CFE) turbidity shall be less than or equal to 0.15 NTU in at least 95% of the measurements. Turbidity shall be measured as described in 12VAC5-590-376 B.

b. Individual filter performance. The owner using conventional filtration treatment or direct filtration treatment receives 0.5-log Cryptosporidium treatment credit, which can be in addition to the 0.5-log credit under subdivision E 5 a of this section, during any month the waterworks meets the criteria in this subdivision. Compliance with these criteria shall be based on individual filter turbidity monitoring as described in 12VAC5-590-376 B.

(1) The filtered water turbidity for each individual filter shall be less than or equal to 0.15 NTU in at least 95% of the measurements recorded each month.

(2) No individual filter may have a measured turbidity greater than 0.3 NTU in two consecutive measurements collected 15 minutes apart.

(3) The owner that has received treatment credit for individual filter performance and fails to meet the requirements of subdivision E 5 b (1) or E 5 b (2) of this section during any month does not receive a treatment technique violation under subdivision D 2 c of this section if the department determines the following:

(a) The failure was due to unusual and short-term circumstances that could not reasonably be prevented through optimizing water treatment plant design, operation, and maintenance.

(b) The waterworks has experienced no more than two failures in any calendar year.

6. Additional filtration toolbox components.

a. Bag and cartridge filters. The owner receives Cryptosporidium treatment credit of up to 2.0-log for individual bag or cartridge filters and up to 2.5-log for bag or cartridge filters operated in series by meeting the criteria in subdivisions E 6 a (1) through E 6 a (10) of this section. To be eligible for this credit, the owner shall report the results of challenge testing that meets the requirements of subdivisions E 6 a (2) through E 6 a (9) of this section to the department. The filters shall treat the entire water treatment plant flow taken from a surface water source, a GUDI source, or both.

(1) The Cryptosporidium treatment credit awarded to bag or cartridge filters shall be based on the removal efficiency demonstrated during challenge testing that is conducted according to the criteria in subdivisions E 6 a (2) through E 6 a (9) of this section. A factor of safety equal to 1-log for individual bag or cartridge filters and 0.5-log for bag or cartridge filters in series shall be applied to challenge testing results to determine removal credit. The owner may use the results from challenge testing conducted before January 5, 2006, if the prior testing was consistent with the criteria specified in subdivisions E 6 a (2) through E 6 a (9) of this section.

(2) Challenge testing shall be performed on full-scale bag or cartridge filters, and the associated filter housing or pressure vessel, that are identical in material and construction to the filters and housings the waterworks will use for removal of Cryptosporidium. Bag or cartridge filters shall be challenge tested in the same configuration that the waterworks will use, either as individual filters or as a series configuration of filters.

(3) Challenge testing shall be conducted using Cryptosporidium or a surrogate that is removed no more efficiently than Cryptosporidium. The microorganism or surrogate used during challenge testing is referred to as the challenge particulate. The concentration of the challenge particulate shall be determined using a method capable of discreetly quantifying the specific microorganism or surrogate used in the test; gross measurements such as turbidity shall not be used.

(4) The maximum feed water concentration that can be used during a challenge test shall be based on the detection limit of the challenge particulate in the filtrate (i.e., filtrate detection limit) and shall be calculated using the following equation:

$$\text{Maximum Feed Concentration} = 1 \times 10^4 \times (\text{Filtrate Detection Limit})$$

(5) Challenge testing shall be conducted at the maximum design flow rate for the filter as specified by the manufacturer.

(6) Each filter evaluated shall be tested for a duration sufficient to reach 100% of the terminal pressure drop that establishes the maximum pressure drop under which the filter may be used to comply with the requirements of this subdivision E 6.

(7) Removal efficiency of a filter shall be determined from the results of the challenge test and expressed in terms of log removal values using the following equation:

$$LRV = LOG_{10}(C_f) - LOG_{10}(C_p),$$

where LRV = log removal value demonstrated during challenge testing;

C_f = the feed concentration measured during the challenge test; and

C_p = the filtrate concentration measured during the challenge test.

In applying this equation, the same units shall be used for the feed and filtrate concentrations. If the challenge particulate is not detected in the filtrate, then the term C_p shall be set equal to the detection limit.

(8) Each filter tested shall be challenged with the challenge particulate during three periods over the filtration cycle: within two hours of start-up of a new filter; when the pressure drop is between 45% and 55% of the terminal pressure drop; and at the end of the cycle after the pressure drop has reached 100% of the terminal pressure drop. An LRV shall be calculated for each of these challenge periods for each filter tested. The LRV for the filter (LRV filter) shall be assigned the value of the minimum LRV observed during the three challenge periods for that filter.

(9) If fewer than 20 filters are tested, then the overall removal efficiency for the filter product line shall be set equal to the lowest LRV filter among the filters tested. If 20 or more filters are tested, then the overall removal efficiency for the filter product line shall be set equal to the 10th percentile of the set of LRV filter values for the various filters tested. The percentile is

defined by (i/(n+1)), where i is the rank of n individual data points ordered lowest to highest. If necessary, the 10th percentile may be calculated using linear interpolation.

(10) If a previously tested filter is modified in a manner that could change the removal efficiency of the filter product line, then challenge testing to demonstrate the removal efficiency of the modified filter shall be conducted and submitted to the department.

b. Membrane filtration.

(1) The owner receives Cryptosporidium treatment credit for membrane filtration that meets the criteria of this subdivision E 6 b. Membrane cartridge filters that meet the definition of membrane filtration in 12VAC5-590-10 are eligible for this credit. The level of treatment credit the owner receives is equal to the lower of the values determined as follows:

(a) The removal efficiency demonstrated during challenge testing conducted under the conditions in subdivision E 6 b (2) of this section.

(b) The maximum removal efficiency that can be verified through direct integrity testing used with the membrane filtration process under the conditions in subdivision E 6 b (3) of this section.

(2) Challenge Testing. The membrane used by the waterworks shall undergo challenge testing to evaluate removal efficiency and the owner shall report the results of the challenge testing to the department. Challenge testing shall be conducted according to the criteria in subdivisions E 6 b (2) (a) through E 6 b (2) (g) of this section. The owner may use data from challenge testing conducted before January 5, 2006, if the prior testing was consistent with the following criteria:

(a) Challenge testing shall be conducted on either a full-scale membrane module, identical in material and construction to the membrane modules used in the waterworks treatment facility, or a smaller-scale membrane module, identical in material and similar in construction to the full-scale module. A module is defined as the smallest component of a membrane unit in which a specific membrane surface area is housed in a device with a filtrate outlet structure.

(b) Challenge testing shall be conducted using Cryptosporidium or a surrogate that is removed no more efficiently than Cryptosporidium. The organism or surrogate used during challenge testing is referred to as the challenge particulate. The concentration of the challenge particulate, in both the feed and filtrate water, shall be determined using a method capable of discretely quantifying the specific challenge particulate used in the test; gross measurements such as turbidity shall not be used.

(c) The maximum feed water concentration that can be used during a challenge test is based on the detection limit of the challenge particulate in the filtrate and shall be determined according to the following equation:

$$\text{Maximum Feed Concentration} = 3.16 \times 10^6 \times (\text{Filtrate Detection Limit})$$

(d) Challenge testing shall be conducted under representative hydraulic conditions at the maximum design flux and maximum design process recovery specified by the manufacturer for the membrane module. Flux is defined as the throughput of a pressure-driven membrane process expressed as flow per unit of membrane area. Recovery is defined as the volumetric percent of feed water that is converted to filtrate over the course of an operating cycle uninterrupted by events such as chemical cleaning or a solids removal process (i.e., backwashing).

(e) Removal efficiency of a membrane module shall be calculated from the challenge test results and expressed as a log removal value according to the following equation:

$$LRV = LOG_{10}(C_f) - LOG_{10}(C_p),$$

where LRV = log removal value demonstrated during the challenge test;

C_f = the feed concentration measured during the challenge test; and

C_p = the filtrate concentration measured during the challenge test.

Equivalent units shall be used for the feed and filtrate concentrations. If the challenge particulate is not detected in the filtrate, then the term C_p is set equal to the detection limit for the purpose of calculating the LRV. An LRV shall be calculated for each membrane module evaluated during the challenge test.

(f) The removal efficiency of a membrane filtration process demonstrated during challenge testing shall be expressed as a log removal value ($LRV_{C\text{-}Test}$). If fewer than 20 modules are tested, then $LRV_{C\text{-}Test}$ is equal to the lowest of the representative LRVs among the modules tested. If 20 or more modules are tested, then $LRV_{C\text{-}Test}$ is equal to the 10th percentile of the representative LRVs among the modules tested. The percentile is defined by (i/(n+1)), where i is the rank of n individual data points ordered lowest to highest. If necessary, the 10th percentile may be calculated using linear interpolation.

(g) The challenge test shall establish a QCRV for a nondestructive performance test that demonstrates the Cryptosporidium removal capability of the membrane filtration module. This performance test shall be applied to each production membrane module used by the waterworks that was not directly challenge tested to verify Cryptosporidium removal capability. Production modules that do not meet the established QCRV are not eligible for the treatment credit demonstrated during the challenge test.

(h) If a previously tested membrane is modified in a manner that could change the removal efficiency of the membrane or the applicability of the nondestructive performance test and associated QCRV, then additional challenge testing to demonstrate the removal efficiency of, and determine a new QCRV for, the modified membrane shall be conducted and submitted to the department.

(3) Direct integrity testing. The owner shall conduct direct integrity testing in a manner that demonstrates a removal efficiency equal to or greater than the removal credit awarded to the membrane filtration process and meets the requirements described in subdivisions E 6 b (3) (a) through E 6 b (3) (f) of this section. A direct integrity test is defined as a physical test applied to a membrane unit to identify and isolate integrity breaches (i.e., one or more leaks that could result in contamination of the filtrate).

(a) The direct integrity test shall be independently applied to each membrane unit in service. A membrane unit is defined as a group of membrane modules that share common valving that allows the unit to be isolated from the rest of the waterworks for the purpose of integrity testing or other maintenance.

(b) The direct integrity method shall have a resolution of three micrometers or less, where resolution is defined as the size of the smallest integrity breach that contributes to a response from the direct integrity test.

(c) The direct integrity test shall have a sensitivity sufficient to verify the log treatment credit awarded to the membrane filtration process by the department, where sensitivity is defined as the maximum log removal value that can be reliably verified by a direct integrity test. Sensitivity shall be determined using the approach in either of the following as applicable to the type of direct integrity test the waterworks uses:

(i) For direct integrity tests that use an applied pressure or vacuum, the direct integrity test sensitivity shall be calculated according to the following equation:

$$LRV_{DIT} = LOG_{10}(Q_p / (VCF \times Q_{breach})),$$

where LRV_{DIT} = the sensitivity of the direct integrity test;

Q_p = total design filtrate flow from the membrane unit;

Q_{breach} = flow of water from an integrity breach associated with the smallest integrity test response that can be reliably measured; and

VCF = volumetric concentration factor.

The volumetric concentration factor is the ratio of the suspended solids concentration on the high-pressure side of the membrane relative to that in the feed water.

(ii) For direct integrity tests that use a particulate or molecular marker, the direct integrity test sensitivity shall be calculated according to the following equation:

$$LRV_{DIT} = LOG_{10}(C_f) - LOG_{10}(C_p),$$

where LRV_{DIT} = the sensitivity of the direct integrity test;

C_f = the typical feed concentration of the marker used in the test; and

C_p = the filtrate concentration of the marker from an integral membrane unit.

(d) The owner shall establish a control limit within the sensitivity limits of the direct integrity test that is indicative of an integral membrane unit capable of meeting the removal credit awarded by the department.

(e) If the result of a direct integrity test exceeds the control limit established under subdivision E 6 b (3) (d) of this section, then the owner shall remove the membrane unit from service. The owner shall conduct a direct integrity test to verify any repairs, and may return the membrane unit to service only if the direct integrity test is within the established control limit.

(f) The owner shall conduct direct integrity testing on each membrane unit at a frequency of not less than once each day that the membrane unit is in operation. The department may approve less frequent testing based on demonstrated process reliability, the use of multiple barriers effective for Cryptosporidium, or reliable process safeguards.

(4) Indirect integrity monitoring. The owner shall conduct continuous indirect integrity monitoring on each membrane unit according to the criteria in subdivisions E 6 b (4) (a) through E 6 b (4) (e). Indirect integrity monitoring is defined as monitoring some aspect of filtrate water quality that is indicative of the removal of particulate matter. The owner that implements continuous direct integrity testing of membrane units in accordance with the criteria in subdivisions E 6 b (3) (a) through E 6 b (3) (f) of this section is not subject to the requirements for continuous indirect integrity monitoring. The owner shall submit a monthly report to the department summarizing all continuous indirect integrity monitoring results triggering direct integrity testing and the corrective action that was taken in each case.

(a) Unless the department approves an alternative parameter, continuous indirect integrity monitoring shall include continuous filtrate turbidity monitoring.

(b) Continuous monitoring shall be conducted at a frequency of no less than once every 15 minutes.

(c) Continuous monitoring shall be separately conducted on each membrane unit.

(d) If indirect integrity monitoring includes turbidity and if the filtrate turbidity readings are above 0.15 NTU for a period greater than 15 minutes (i.e., two consecutive 15-minute readings above 0.15 NTU), direct integrity testing shall immediately be performed on the associated membrane unit as specified in subdivisions E 6 b (3) (a) through E 6 b (3) (f) of this section.

(e) If indirect integrity monitoring includes an alternative parameter approved by the department and if the alternative parameter exceeds a control limit approved by the department for a period greater than 15 minutes, then direct integrity testing shall immediately be performed on the associated membrane units as specified in subdivisions E 6 b (3) (a) through E 6 b (3) (f) of this section.

c. Second stage filtration. The owner receives 0.5-log Cryptosporidium treatment credit for a separate second stage of filtration that consists of sand, dual media, GAC, or other fine grain

media following granular media filtration if approved by the department. To be eligible for this credit, the first stage of filtration shall be preceded by a coagulation step and both filtration stages shall treat the entire water treatment treatment plant flow taken from a surface water source, a GUDI source, or both. A cap, such as GAC, on a single stage of filtration is not eligible for this credit. The department shall approve the treatment credit based on an assessment of the design characteristics of the filtration process.

d. Slow sand filtration as secondary filter. The owner is eligible to receive 2.5-log Cryptosporidium treatment credit for a slow sand filtration process that follows a separate stage of filtration if both filtration stages treat the entire water treatment plant flow taken from a surface water source, a GUDI source, or both and no residual disinfectant is present in the influent water to the slow sand filtration process. The department shall approve the treatment credit based on an assessment of the design characteristics of the filtration process. This subdivision does not apply to treatment credit awarded to slow sand filtration used as a primary filtration process.

7. Inactivation toolbox components.

a. Calculation of CT values.

(1) CT is the product of the disinfectant contact time (T, in minutes) and disinfectant concentration (C, in milligrams per liter). The owner of a waterworks with treatment credit for chlorine dioxide or ozone under subdivision E 7 b of this section shall calculate CT at least once each day, with both C and T measured during peak hourly flow in accordance with the procedure listed in 12VAC5-590-500.

(2) A waterworks with several disinfection segments in sequence may calculate CT for each segment, where a disinfection segment is defined as a treatment unit process with a measurable residual disinfectant level and a liquid volume. Under this approach, the owner shall add the Cryptosporidium CT values in each segment to determine the total CT for the treatment plant.

b. CT values for chlorine dioxide and ozone.

(1) The owner receives the Cryptosporidium treatment credit listed in Table 401.5 by meeting the corresponding chlorine dioxide CT value for the applicable water temperature, as described in subdivision E 7 a of this section.

TABLE 401.5
CT Values (mg-min/L) for Cryptosporidium Inactivation by Chlorine Dioxide[a]

	WATER TEMPERATURE, °C					
LOG CREDIT	≤0.5	1	2	3	5	7
0.25	159	153	140	128	107	90
0.5	319	305	279	256	214	180
1.0	637	610	558	511	429	360
1.5	956	915	838	767	643	539
2.0	1275	1220	1117	1023	858	719
2.5	1594	1525	1396	1278	1072	899
3.0	1912	1830	1675	1534	1286	1079

	WATER TEMPERATURE, °C					
LOG CREDIT	10	15	20	25	30	
0.25	69	45	29	19	12	
0.5	138	89	58	38	24	
1.0	277	179	116	75	49	
1.5	415	268	174	113	73	
2.0	553	357	232	150	98	
2.5	691	447	289	188	122	
3.0	830	536	347	226	147	
[a]The owner may use this equation to determine log credit between the indicated values: Log credit = $(0.001506\times(1.09116)^{Temp})\times$ CT.						

(2) The owner receives the Cryptosporidium treatment credit listed in Table 401.6 by meeting the corresponding ozone CT values for the applicable water temperature, as described in subdivision E 7 a of this section.

TABLE 401.6
CT Values (mg-min/L) for Cryptosporidium Inactivation by Ozone[a]

LOG CREDIT	WATER TEMPERATURE, °C										
	≤0.5	1	2	3	5	7	10	15	20	25	30
0.25	6.0	5.8	5.2	4.8	4.0	3.3	2.5	1.6	1.0	0.6	0.39
0.5	12	12	10	9.5	7.9	6.5	4.9	3.1	2.0	1.2	0.78
1.0	24	23	21	19	16	13	9.9	6.2	3.9	2.5	1.6
1.5	36	35	31	29	24	20	15	9.3	5.9	3.7	2.4
2.0	48	46	42	38	32	26	20	12	7.8	4.9	3.1
2.5	60	58	52	48	40	33	25	16	9.8	6.2	3.9
3.0	72	69	63	57	47	39	30	19	12	7.4	4.7
[a]The owner may use this equation to determine log credit between the indicated values: Log credit = $(0.0397\times(1.09757)^{Temp})\times$ CT.											

c. UV light. The owner receives Cryptosporidium, Giardia lamblia, and virus treatment credits for UV light reactors by achieving the corresponding UV dose values shown in subdivision E 7 c (1) of this section. The owner shall validate and monitor UV reactors as described in subdivisions E 7 c (2) and E 7 c (3) of this section to demonstrate that they are achieving a particular UV dose value for treatment credit.

(1) UV dose table. The treatment credits listed in Table 401.7 are for UV light at a wavelength of 254 nm as produced by a low-pressure mercury vapor lamp. To receive treatment credit for

other lamp types, the owner shall demonstrate an equivalent germicidal dose through reactor validation testing as described in subdivision E 7 c (2) of this section. The UV dose values listed in Table 401.7 are applicable only to post-filter applications of UV in filtered waterworks.

TABLE 401.7
UV Doses for Cryptosporidium, Giardia lamblia and Virus Inactivation Credit

LOG CREDIT	CRYPTOSPORIDIUM UV DOSE (mJ/cm2)	GIARDIA LAMBLIA UV DOSE (mJ/cm2)	VIRUS UV DOSE (mJ/cm^2)
0.5	1.6	1.5	39
1.0	2.5	2.1	58
1.5	3.9	3.0	79
2.0	5.8	5.2	100
2.5	8.5	7.7	121
3.0	12	11	143
3.5	15	15	163
4.0	22	22	186

(2) Reactor validation testing. The owner shall use UV reactors that have undergone validation testing to determine the operating conditions under which the reactor delivers the UV dose required in subdivision E 7 c (1) of this section (i.e., validated operating conditions). These operating conditions shall include flow rate, UV intensity as measured by a UV sensor, and UV lamp status.

(a) When determining validated operating conditions, the owner shall account for the following factors: (i) UV absorbance of the water; (ii) lamp fouling and aging; (iii) measurement uncertainty of online sensors; (iv) UV dose distributions arising from the velocity profiles through the reactor; (v) failure of UV lamps or other critical waterworks components; and (vi) inlet and outlet piping or channel configurations of the UV reactor.

(b) Validation testing shall include the following: full-scale testing of a reactor that conforms uniformly to the UV reactors used by the waterworks and inactivation of a test microorganism whose dose-response characteristics have been quantified with a low-pressure mercury vapor lamp.

(c) UV reactor validation testing shall be in accordance with EPA's recommended validation protocol for UV reactors, as described in EPA's "Ultraviolet Disinfection Guidance Manual for the Final Long Term 2 Enhanced Surface Water Treatment Rule," November 2006, EPA Office of Water. Alternative protocols may be considered for approval by the department on a case-by-case basis.

(d) Validation testing, whether onsite or offsite, shall be performed by a third party independent of the UV reactor manufacturer and the owner to ensure that validation testing and data analysis are conducted in a technically sound manner without bias.

(e) To receive credit for lamp types other than low-pressure types, the owner shall demonstrate an equivalent germicidal dose through reactor validation testing.

(f) A validation report shall be submitted and approved by the department to receive disinfection credit.

(3) UV reactor monitoring.

(a) The owner shall monitor the UV reactors to determine if the reactors are operating within validated conditions as determined under subdivision E 7 c (2) of this section. This monitoring shall include UV intensity as measured by a UV sensor, flow rate, lamp status, and other parameters the department designates based on UV reactor operation. The owner shall verify the calibration of UV sensors and shall recalibrate sensors in accordance with a protocol approved by the department.

(b) To receive treatment credit for UV light, the owner shall treat at least 95% of the water delivered to the public during each month by the UV reactors operating within validated conditions for the required UV dose as described in subdivisions E 7 c (1) and E 7 c (2) of this section. The owner shall demonstrate compliance with this condition by the monitoring required under subdivision E 7 c (3) (a) of this section.

F. The owner shall comply with the applicable recordkeeping and reporting requirements described in 12VAC5-590-530, 12VAC5-590-531, 12VAC5-590-550, and 12VAC5-590-570.

12VAC5-590-405. Lead and copper treatment techniques.

A. Lead and copper corrosion control techniques.

1. Corrosion control treatment requirements. The owner of a community waterworks or a NTNC shall install and operate optimum corrosion control treatment by completing the corrosion control treatment requirements described below which are applicable to these waterworks under subdivision A 2 of this section.

a. Owner's proposal regarding corrosion control treatment. Based upon the results of lead and copper tap monitoring and water quality parameter monitoring, the owner of a small or a medium waterworks exceeding the lead or copper AL shall propose installation of one or more of the corrosion control treatments listed in subdivision A 1 c (1) of this section that the owner believes constitutes optimal corrosion control for that waterworks. The department may require the owner to conduct additional water quality parameter monitoring in accordance with 12VAC5-590-375 C 2 to assist the department in evaluating the proposal.

b. Applicability of studies of corrosion control treatment (applicable to small and medium waterworks). The department may require the owner of a small or a medium waterworks that exceeds the lead or copper AL to perform corrosion control studies under subdivision A 1 c of this section to identify optimal corrosion control treatment for the waterworks.

c. Corrosion control studies.

(1) The owner of a waterworks required by the department to perform corrosion control studies shall evaluate the effectiveness of each of the following treatments, and, if appropriate, combinations of the following treatments to identify the optimal corrosion control treatment for that waterworks:

(a) Alkalinity and pH adjustment;

(b) Calcium hardness adjustment; and

(c) The addition of a phosphate-based or silicate-based corrosion inhibitor at a concentration sufficient to maintain an effective corrosion inhibitor residual concentration in all test tap samples, such that a passivating film is formed on the interior walls of the pipe.

(2) The owner shall evaluate each of the corrosion control treatments using either pipe rig or loop tests, metal coupon tests, partial-system tests, or analyses based on documented analogous treatments with other waterworks of similar size, water chemistry, and distribution system configuration.

(3) The owner shall measure the following water quality parameters in any tests conducted under subdivision A 1 c of this section before and after evaluating the corrosion control treatments listed in subdivision A 1 c (1) of this section:

(a) Lead;

(b) Copper;

(c) pH;

(d) Alkalinity;

(e) Calcium;

(f) Conductivity;

(g) Orthophosphate (when an inhibitor containing a phosphate compound is used);

(h) Silicate (when an inhibitor containing a silicate compound is used); and

(i) Water temperature.

(4) The owner shall identify all chemical or physical constraints that limit or prohibit the use of a particular corrosion control treatment and document such constraints with at least one of the following:

(a) Data and documentation showing that a particular corrosion control treatment has adversely affected other water treatment processes when used by another waterworks with comparable water quality characteristics; or

(b) Data and documentation demonstrating that the owner has previously attempted to evaluate a particular corrosion control treatment and has found that the treatment is ineffective or adversely affects other water quality treatment processes.

(5) The owner shall evaluate the effect of the chemicals used for corrosion control treatment on other water quality treatment processes.

(6) On the basis of an analysis of the data generated during each evaluation, the owner shall propose in writing to the department that the treatment option resulting from the corrosion control studies constitutes optimal corrosion control treatment for that waterworks. The owner shall provide a rationale for the recommendation along with all supporting documentation specified in subdivisions A 1 c (1) through A 1 c (5) of this section.

d. Approval of optimal corrosion control treatment.

(1) Based upon consideration of available information including, where applicable, studies performed under subdivision A 1 c of this section and the owner's proposed treatment alternative, the department shall either approve the corrosion control treatment option recommended by the owner, or designate alternative corrosion control treatment from among those listed in subdivision A 1 c (1) of this section. When approving optimal treatment, the department shall consider the effects that additional corrosion control treatment will have on water quality parameters and on other water quality treatment processes.

(2) The department shall notify the owner of the determination on optimal corrosion control treatment in writing and explain the basis for this determination. If the department requests additional information to aid an evaluation, then the owner shall provide the information.

e. Installation of optimal corrosion control. The owner shall properly install and operate throughout the waterworks the optimal corrosion control treatment approved by the department under subdivision A 1 d of this section. A construction permit is required before installation of any treatment in accordance with 12VAC5-590-200.

f. The department's evaluation of treatment and specification of the optimal water quality control parameters shall consist of the following:

(1) The department shall evaluate the results of all lead and copper tap samples and water quality parameter samples submitted by the owner and determine whether the owner has properly installed and operated the optimal corrosion control treatment approved by the department under subdivision A 1 d of this section. Upon evaluating the results of tap water and water quality parameter monitoring by the owner, both before and after the owner installs optimal corrosion control treatment, the department shall designate:

(a) A minimum value or a range of values for pH measured at each entry point to the distribution system;

(b) A minimum pH value, measured in all tap samples. The value shall be equal to or greater than 7.0, unless the department determines that meeting a pH level of 7.0 is not technologically feasible or is not necessary for the owner to optimize corrosion control;

(c) If a corrosion inhibitor is used, then a minimum concentration or a range of concentrations for the inhibitor, measured at each entry point to the distribution system and in all tap samples, that the department determines is necessary to form a passivating film on the interior walls of the pipes of the distribution system;

(d) If alkalinity is adjusted as part of the optimal corrosion control treatment, then a minimum concentration or a range of concentrations for alkalinity, measured at each entry point to the distribution system and in all tap samples; or

(e) If calcium carbonate stabilization is used as part of the corrosion control, then a minimum concentration or a range of concentrations for calcium, measured in all tap samples.

(2) The values for the applicable water quality control parameters listed in subdivision A 1 c (3) of this section shall be those that the department determines to reflect optimal corrosion control treatment for the waterworks. The department may designate values for additional water quality control parameters determined by the department to reflect optimal corrosion control for the waterworks. The department shall notify the owner in writing of these determinations and explain the basis for the decisions.

g. Continued operation and monitoring. The owner of a waterworks optimizing corrosion control shall continue to operate and maintain optimal corrosion control treatment, including maintaining water quality parameters at or above minimum values or within ranges designated by the department under subdivision A 1 f of this section as verified by all samples collected under 12VAC5-590-375 C 4,12VAC5-590-375 C 5, and 12VAC5-590-375 C 6. Compliance with the requirements of this subdivision shall be determined every six months, as specified under 12VAC5-590-375 C 4. The waterworks is out of compliance with the requirements of this subdivision for a six-month period if excursions occur for any department-specified parameter on more than nine days during the period. An excursion occurs whenever the daily value for one or more of the water quality parameters measured at a sampling location is below the minimum value or outside the range designated by the department. The department has discretion to delete results of obvious sampling errors from this calculation. Daily values shall be calculated as follows:

(1) On days when more than one measurement for the water quality parameter is collected at the sampling location, the daily value shall be the average of all results collected during the day regardless of whether they are collected through continuous monitoring, grab sampling, or a combination of both.

(2) On days when only one measurement for the water quality parameter is collected at the sampling location, the daily value shall be the result of that measurement.

(3) On days when no measurement is collected for the water quality parameter at the sampling location, the daily value shall be the daily value calculated on the most recent day on which the water quality parameter was measured at the sample site.

h. Modification of the department's treatment decisions. Upon the department's initiative or in response to a request by an owner or other interested party, the department may modify the determination of the optimal corrosion control treatment under subdivision A 1 d of this section or optimal water quality control parameters under subdivision A 1 f of this section. A request for modification by an owner or other interested party shall be in writing, explain why the modification is appropriate, and provide supporting documentation. The department may modify the determination where it is concluded that the change is necessary to ensure that the waterworks continues to optimize corrosion control treatment. A revised determination shall be made in writing, set forth the new treatment requirements, explain the basis for the department's decision, and provide an implementation schedule for completing the treatment modifications.

2. Corrosion control treatment steps.

a. The owner shall complete the applicable corrosion control treatment requirements described in subdivision A 1 of this section by the deadlines established in this subdivision.

(1) The owner of a large waterworks (serving greater than 50,000 persons) shall complete the corrosion control treatment steps specified in subdivision A 2 d of this section, unless the owner is deemed to have optimized corrosion control under subdivision A 2 b (2) or A 2 b (3) of this section.

(2) The owner of a small waterworks (serving fewer than or equal to 3300 persons) or a medium waterworks (serving greater than 3,300 and fewer than or equal to 50,000 persons) shall complete the corrosion control treatment steps specified in subdivision A 2 e of this section, unless the owner is deemed to have optimized corrosion control under subdivisions A 2 b (1) through A 2 b (3) of this section.

b. The owner is deemed to have optimized corrosion control and is not required to complete the applicable corrosion control treatment steps identified in this subdivision if the waterworks satisfies one of the criteria specified in subdivisions A 2 b (1) through A 2 b (3) of this section. The owner deemed to have optimized corrosion control under this subdivision and to have treatment in place shall continue to operate and maintain optimal corrosion control treatment and meet any requirements that the department determines appropriate to ensure optimal corrosion control treatment is maintained.

(1) The owner of a small or a medium waterworks is deemed to have optimized corrosion control if the waterworks meets the lead and copper ALs during each of two consecutive six-month monitoring periods conducted in accordance with 12VAC5-590-375.

(2) The owner may be deemed by the department to have optimized corrosion control treatment if the owner demonstrates to the satisfaction of the department that the owner has conducted activities equivalent to the corrosion control steps applicable to the waterworks under this section. If the department makes this determination, then the owner shall be provided with a written notice explaining the basis for the decision and the notice shall specify the water quality control parameters representing optimal corrosion control in accordance with subdivision A 1 f of this section. The owner deemed to have optimized corrosion control under this subdivision shall operate in compliance with the department designated optimal water quality control parameters in accordance with subdivision A 1 g and continue to conduct lead and copper tap and water quality parameter sampling in accordance with 12VAC5-590-375 B 4 c and 12VAC5-590-375 C 4, respectively. The owner shall provide the department with the following information to support a determination under this subdivision:

(a) The results of all test samples collected for each of the water quality parameters in subdivision A 1 c (3) of this section;

(b) A report explaining the test methods used by the owner to evaluate the corrosion control treatments listed in subdivision A 1 c (1) of this section, the results of all tests conducted, and the basis for the owner's selection of optimal corrosion control treatment;

(c) A report explaining how corrosion control has been installed and how it is being maintained to insure minimal lead and copper concentrations at consumers' taps; and

(d) The results of tap water samples collected in accordance with 12VAC5-590-375 B at least once every six months for one year after corrosion control treatment has been installed.

(3) A waterworks is deemed to have optimized corrosion control if the owner submits results of tap water monitoring conducted in accordance with 12VAC5-590-375 B and source water monitoring conducted in accordance with 12VAC5-590-375 D that demonstrates for two consecutive six-month monitoring periods that the difference between the 90th percentile tap water lead level, computed under 12VAC5-590-385 C, and the highest source water lead concentration is less than the PQL for lead (0.005 mg/L).

(a) The owner that submits monitoring results indicating that the highest source water lead level is below the MDL may also be deemed to have optimized corrosion control under this subdivision if the 90th percentile tap water lead level is less than or equal to the PQL for lead (0.005 mg/L) for two consecutive six-month monitoring periods.

(b) The owner deemed to have optimized corrosion control under this subdivision shall continue monitoring for lead and copper at the tap no less frequently than once every three calendar years using the reduced number of sites specified in 12VAC5-590-375 B 3 and collecting the samples at times and locations specified in 12VAC5-590-375 B 4 d (4).

(c) The owner deemed to have optimized corrosion control pursuant to this subdivision shall notify the department in writing pursuant to 12VAC5-590-532 B 3 of any upcoming long-term change in treatment or addition of a new source water as described in 12VAC5-590-532 B 3. The department shall evaluate and approve the addition of a new source water or long-term change in water treatment before it is implemented by the owner. The department may require the owner of a waterworks to conduct additional monitoring or to take other actions the department deems appropriate to ensure that minimum levels of corrosion control are being maintained in the distribution system.

(d) The owner is not deemed to have optimized corrosion control under this subdivision, and shall implement corrosion control treatment specified in subdivision A 2 b (3) (e) of this section, unless the copper AL is met.

(e) The owner of a waterworks triggered into corrosion control because the waterworks is no longer deemed to have optimized corrosion control under this subsection shall implement corrosion control treatment in accordance with the deadlines in subdivision A 2 e of this section. The owner of a large waterworks shall adhere to the schedule specified in subdivision A 2 e of this section for a medium waterworks, with the time period for completing each step being triggered by the date the owner is no longer deemed to have optimized corrosion control treatment under this subsection.

c. The owner of a small or a medium waterworks that is required to complete the corrosion control steps due to the exceedance of the lead or copper AL may cease completing the treatment steps whenever the waterworks meets both ALs during each of two consecutive six-month monitoring periods conducted pursuant to 12VAC5-590-375 B 4 a and submits the results to the department. If a waterworks thereafter exceeds the lead or copper AL during any monitoring period, the owner shall recommence completion of the applicable treatment steps, beginning with the first treatment step that was not previously completed in its entirety. The department may require the owner to repeat treatment steps previously completed where the department determines that this is necessary to properly implement the treatment requirements of this section. The department shall notify the owner in writing of the determination and

explain the basis for the decision. The requirement for the owner of a small or a medium waterworks to implement corrosion control treatment steps in accordance with subdivision A 2 e of this section (including waterworks deemed to have optimized corrosion control under subdivision A 2 b (1) of this section) is triggered whenever a small or a medium waterworks exceeds the lead or copper AL.

d. Treatment steps and deadlines for large waterworks. Except as provided in subdivisions A 2 b (2) and A 2 b (3) of this section, the owner of a large waterworks shall complete the following corrosion control treatment steps (described in the referenced portions of subdivision A 1 of this section, 12VAC5-590-375 B, and 12VAC5-590-375 C).

(1) Step 1: The owner shall conduct initial monitoring (12VAC5-590-375 B 4 a and 12VAC5-590-375 C 2) during two consecutive six-month monitoring periods by a date specified by the department.

(2) Step 2: The owner shall complete corrosion control studies (subdivision A 1 c of this section) and submit the study and recommendations to the department no later than 18 months after the date that initial monitoring is completed as specified in Step 1.

(3) Step 3: The department shall approve optimal corrosion control treatment (subdivision A 1 d of this section) no later than 12 months following receipt of the corrosion control study required in Step 2.

(4) Step 4: The owner shall install optimal corrosion control treatment (subdivision A 1 e of this section) no later than 24 months following the department's approval of optimal corrosion control treatment specified in Step 3.

(5) Step 5: The owner shall complete follow-up sampling (12VAC5-590-375 B 4 b and 12VAC5-590-375 C 3) no later than 12 months following the installation of optimal corrosion control treatment specified in Step 4.

(6) Step 6: The department shall evaluate the installation of treatment and designate optimal water quality control parameters (subdivision A 1 f of this section) no later than six months following completion of follow-up sampling specified in Step 5.

(7) Step 7: The owner shall operate the waterworks in compliance with the department-specified optimal water quality control parameters (subdivision A 1 g of this section) and continue to conduct tap sampling (12VAC5-590-375 B 4 c and 12VAC5-590-375 C 4).

e. Treatment steps and deadlines for small and medium waterworks. Except as provided in subdivision A 2 b of this section, the owner of a small or a medium waterworks shall complete the following corrosion control treatment steps (described in the referenced portions of subdivision A 1 of this section, 12VAC5-590-375 B, and 12VAC5-590-375 C):

(1) The owner shall conduct initial tap sampling (12VAC5-590-375 B 4 a and 12VAC5-590-375 C 2) until the waterworks either exceeds the lead or copper AL or becomes eligible for reduced monitoring under 12VAC5-590-375 B 4 d. The owner of a waterworks exceeding the lead or copper AL shall propose optimal corrosion control treatment (subdivision A 1 a of this section) within six months after the end of the monitoring period during which it exceeds one of the ALs.

(2) Within 12 months after the end of the monitoring period during which a waterworks exceeds the lead or copper AL, the department may require the owner to perform corrosion control studies (subdivision A 1 b of this section). If the department does not require the owner to perform these studies, the department shall specify optimal corrosion control treatment (subdivision A 1 d of this section) within the following timeframes:

(a) For a medium waterworks, within 18 months after the end of the monitoring period during which the waterworks exceeds the lead or copper AL.

(b) For a small waterworks, within 24 months after the end of the monitoring period during which the waterworks exceeds the lead or copper AL.

(3) If the department requires the owner to perform corrosion control studies under subdivision A 2 e (2) of this section, then the owner shall complete the studies (subdivision A 1 c of this section) and submit the study and recommendations to the department within 18 months after the department requires that the studies be conducted.

(4) If the owner has performed corrosion control studies under subdivision A 2 e (2) of this section, then the department shall designate optimal corrosion control treatment (subdivision A 1 d of this section) within six months after completion of the provisions of subdivision A 2 e (3) of this section.

(5) The owner shall install optimal corrosion control treatment (subdivision A 1 e of this section) within 24 months after the department designates such treatment. A construction permit is required before installation of any treatment, in accordance with 12VAC5-590-200.

(6) The owner shall complete follow-up sampling (12VAC5-590-375 B 4 b and 12VAC5-590-375 C 3) within 36 months after the department designates optimal corrosion control treatment.

(7) The department shall evaluate the owner's installation of treatment and designate optimal water quality control parameters (subdivision A 1 f of this section) within six months after completion of the provisions of subdivision A 2 e (6) of this section.

(8) The owner shall operate the waterworks in compliance with the department-designated optimal water quality control parameters (subdivision A 1 g of this section) and continue to conduct tap sampling (12VAC5-590-375 B 4 c and 12VAC5-590-375 C 4).

B. Source water treatment technique requirements for lead and copper. The owner of a waterworks exceeding the lead or copper AL shall complete the applicable source water monitoring and treatment requirements (described in the referenced portions of subdivision B 2 of this section, and in 12VAC5-590-375 B and 12VAC5-590-375 D) by the following deadlines:

1. Deadlines for completing source water treatment steps.

a. The owner of a waterworks exceeding the lead or copper AL shall complete lead and copper source water monitoring (12VAC5-590-375 D 2) and submit a treatment proposal to the department (subdivision B 2 a of this section) no later than 180 days after the end of the monitoring period during which the lead or copper AL was exceeded.

b. The department shall make a determination regarding the need for source water treatment (subdivision B 2 b of this section) within six months after submission of monitoring results under subdivision B 1 a of this section.

c. If the department requires installation of source water treatment, then the owner shall install the treatment (subdivision B 3 of this section) within 24 months after completion of subdivision B 1 b of this section.

d. The owner shall complete follow-up tap water monitoring (12VAC5-590-375 B 4 b) and source water lead and copper monitoring (12VAC5-590-375 D 3) within 36 months after completion of subdivision B 1 b.

e. The department shall evaluate the owner's installation and operation of the source water treatment and specify maximum permissible source water lead and copper levels (subdivision B 4 of this section) within six months after completion of subdivision B 1 d of this section.

f. The owner shall operate the waterworks in compliance with the department-specified maximum permissible source water lead and copper levels (subdivision B 4 of this section) and continue source water monitoring (12VAC5-590-375 D 4).

2. Description of source water treatment requirements.

a. Waterworks treatment recommendation. The owner of a waterworks that exceeds the lead or copper AL shall propose in writing to the department the installation and operation of one of the source water treatments listed in subdivision B 2 b of this section. The owner may propose that no treatment be installed based upon a demonstration that source water treatment is not necessary to minimize lead and copper levels at consumer taps.

b. Department's determination regarding source water treatment. The department shall complete an evaluation of the results of all source water samples submitted by the owner to determine whether source water treatment is necessary to minimize lead or copper levels in water delivered to consumer taps. If the department determines that treatment is needed, then the department shall either require installation and operation of the source water treatment recommended by the owner or require the installation and operation of another source water treatment from among the following: (i) ion exchange, (ii) RO, (iii) lime softening, or (iv) coagulation or filtration. If the department requests additional information to aid in the evaluation, then the owner shall provide the information by the date specified by the department in the request. The department shall notify the owner in writing of the determination and set forth the basis for the decision.

3. Installation of source water treatment. The owner shall properly install and operate the source water treatment designated by the department under subdivision B 2 b of this section.

4. The department's evaluation of source water treatment and specification of maximum permissible source water lead and copper levels. The department shall evaluate the source water samples collected by the owner both before and after the owner installs source water treatment, and determine whether the owner has properly installed and operated the source water treatment designated by the department. Based upon the evaluation, the department shall designate the maximum permissible lead and copper concentrations for finished water entering the distribution system. The levels shall reflect the contaminant removal capability of the treatment properly operated and maintained. The department shall notify the owner in writing and explain the basis for the decision.

5. Continued operation and maintenance. The waterworks shall be operated to maintain lead and copper levels below the maximum permissible concentrations designated by the department at each sampling point monitored in accordance with 12VAC5-590-375 D. The waterworks is out of compliance with this subdivision B 5 if the level of lead or copper at any sampling point is greater than the maximum permissible concentration designated by the department.

6. Modification of the department's treatment decisions. Upon the department's initiative or in response to a request by an owner or other interested party, the department may modify the determination of the source water treatment under subdivision B 2 b of this section, or may modify the maximum permissible lead and copper concentrations for finished water entering the distribution system under subdivision B 4 of this section. A request for modification by an owner or other interested party shall be in writing, explain why the modification is appropriate, and provide supporting documentation. The department may modify the determination where the conclusion is made that the change is necessary to ensure that the waterworks continues to minimize lead and copper concentrations in source waters. A revised determination shall be made in writing, set forth the new treatment requirements, explain the basis for the department's decision, and provide an implementation schedule for completing the treatment modifications.

C. Lead service line replacement treatment technique requirements:

1. The owner of a waterworks that fails to meet the lead AL in tap samples collected pursuant to 12VAC5-590-375 B 4 b, after installing corrosion control or source water treatment (whichever sampling occurs later), shall replace lead service lines in accordance with the requirements of this section. If the owner is in violation of subdivision A 2 of this section or subsection B of this section for failure to install source water or corrosion control treatment, then the department may require

the owner to commence lead service line replacement under this section after the date by which the owner was required to conduct monitoring under 12VAC5-590-375 B 4 b has passed.

2. The owner shall replace annually at least 7.0% of the initial number of lead service lines in its distribution system. The initial number of lead service lines is the number of lead lines in place at the time the replacement program begins. The owner shall identify the initial number of lead service lines in its distribution system based upon a materials evaluation, including the evaluation required under 12VAC5-590-375 B 1. The first year of lead service line replacement shall begin on the first day following the end of the monitoring period in which the lead AL was exceeded under subdivision C 1 of this section. If monitoring is required annually or less frequently, then the end of the monitoring period is September 30 of the calendar year in which the sampling occurs. If the department has established an alternate monitoring period, then the end of the monitoring period will be the last day of that period.

3. The owner of a waterworks resuming a lead service line replacement program after the cessation of the lead service line replacement program as allowed by subdivision C 7 of this section shall update the inventory of lead service lines to include those sites that were previously determined not to require replacement through the sampling provision under subdivision C 4 of this section. The owner shall then divide the updated number of remaining lead service lines by the number of remaining years in the program to determine the number of lines that must be replaced per year (7.0% lead service line replacement is based on a 15-year replacement program; so, for example, the owner resuming lead service line replacement after previously conducting two years of replacement would divide the updated inventory by 13). For the owner that has completed a 15-year lead service line replacement program, the department will determine a schedule for replacing or retesting lines that were previously tested out under the replacement program when the waterworks re-exceeds the lead AL.

4. The owner is not required to replace an individual lead service line if the lead concentration in all service line samples from that line, collected pursuant to 12VAC5-590-375 B 2 c, is less than or equal to 0.015 mg/L.

5. The owner shall replace that portion of the lead service line that is owned by the waterworks. In cases where the owner does not own the entire lead service line, the owner shall notify the building owner, or the building owner's authorized agent, that the owner will replace that portion of the service line that is owned by the waterworks and shall offer to replace the building owner's portion of the line. The owner is not required to bear the cost of replacing the building owner's portion of the service line, nor is the owner required to replace the building owner's portion where the owner chooses not to pay the cost of replacing the building owner's portion of the line, or where replacing the building owner's portion would be precluded by state, local, or common law. The owner that does not replace the entire length of the service line also shall complete the following tasks:

a. At least 45 days before commencing with the partial replacement of a lead service line, the owner shall provide notice to the resident or residents of all buildings served by the line explaining that they may experience a temporary increase of lead levels in the drinking water, along with guidance on measures consumers can take to minimize their exposure to lead. The department may allow the owner to provide notice under the previous sentence less than 45 days before commencing partial lead service line replacement where the replacement is in conjunction with emergency repairs. In addition, the owner shall inform each resident served by the lead service line that the owner will, at the owner's expense, collect a sample from each partially replaced lead service line that is representative of the water in the service line for analysis of lead content, as prescribed in 12VAC5-590-375 B 2 c, within 72 hours after the completion of the partial replacement of the lead service line. The owner shall collect the sample and report the results of the analysis to the building owner and each resident served by the service line within three business days of receiving the results. Mailed notices post-marked within three business days of receiving the results shall be considered on time.

b. The owner shall provide the information required by subdivision C 5 a of this section to the residents of individual dwellings by mail or by other methods approved by the department. In instances where multi-family dwellings are served by the service line, the owner shall have the option to post the information at a conspicuous location.

6. The department shall require the owner to replace lead service lines on a shorter schedule than that required by this subsection, taking into account the number of lead service lines in the waterworks, where a shorter replacement schedule is feasible. The department shall make this determination in writing and notify the owner of the findings within six months after the waterworks is triggered into lead service line replacement based on monitoring referenced in subdivision C 1 of this section.

7. The owner may cease replacing lead service lines whenever first-draw tap samples collected pursuant to 12VAC5-590-375 B 2 b meet the lead AL during each of two consecutive six-month monitoring periods and the owner submits the results to the department. If the first-draw tap samples collected in a waterworks thereafter exceed the lead AL, then the owner shall recommence replacing lead service lines, pursuant to subdivision C 3 of this section.

8. To demonstrate compliance with subdivisions C 1 through C 5 of this section, an owner shall report to the department the information specified in 12VAC5-590-532.

D. Lead public education requirements. The owner shall deliver a consumer notice of lead tap water monitoring results to all persons served by the waterworks at sites that are tested in accordance with subdivision D 4 of this section. The owner of a waterworks that exceeds the lead AL based on tap water samples collected in accordance with 12VAC5-590-375 B shall deliver the public education materials contained in subdivision D 1 of this section in accordance with the requirements in subdivision D 2 of this section. The owner of a waterworks that exceeds the lead AL shall sample the tap water of any customer who requests it in accordance with subdivision D 3 of this section.

1. Content of written materials. The owner shall include the following text in all of the printed materials distributed through the lead public education program:

a. Community waterworks and NTNCs. The owner of community waterworks or a NTNC shall include the following elements in printed materials (e.g., brochures and pamphlets) in the same order as listed in this subdivision D 1 a. In addition, the language specified in subdivisions D 1 a (1) and D 1 a (2) and in subdivision D 1 a (6) of this section shall be included in materials, exactly as written, except for the text in brackets for which the owner shall include system-specific information. Any additional information presented by the owner shall be consistent with the information in this subdivision D 1 a and be in plain language that can be understood by the general public. The department may require the owner to obtain approval of the content of written material before delivery.

(1) IMPORTANT INFORMATION ABOUT LEAD IN YOUR DRINKING WATER. "(Insert name of waterworks) found elevated levels of lead in drinking water in some homes or buildings. Lead can cause serious health problems, especially for pregnant women and young children. Please read this information closely to see what you can do to reduce lead in your drinking water."

(2) Health effects of lead. "Lead can cause serious health problems if too much enters your body from drinking water or other sources. It can cause damage to the brain and kidneys, and can interfere with the production of red blood cells that carry oxygen to all parts of your body. The greatest risk of lead exposure is to infants, young children, and pregnant women. Scientists have linked the effects of lead on the brain with lowered IQ in children. Adults with kidney problems and high blood pressure can be affected by low levels of lead more than healthy adults. Lead is stored in the bones, and it can be released later in life. During pregnancy, the child receives lead from the mother's bones, which may affect brain development."

(3) Sources of lead.

(a) Explain what lead is.

(b) Explain possible sources of lead in drinking water and how lead enters drinking water. Include information on home or building materials and services lines that may contain lead.

(c) Discuss other important sources of lead exposure in addition to drinking water (e.g., paint).

(4) Discuss the steps the consumer can take to reduce their exposure to lead in drinking water.

(a) Encourage running the water to flush out the lead.

(b) Explain concerns with using hot water from the tap and specifically caution against the use of hot water for preparing baby formula.

(c) Explain that boiling water does not reduce lead levels.

(d) Discuss other options consumers can take to reduce exposure to lead in drinking water, such as alternative sources or treatment of water.

(e) Suggest that parents have their child's blood tested for lead.

(5) Explain why there are elevated levels of lead in the waterworks' drinking water (if known) and what the owner is doing to reduce the lead levels in homes and buildings.

(6) "For more information call us at (Insert owner's contact phone number), or if applicable, visit our website at (Insert waterworks' website URL here). For more information on reducing lead exposure around your home or building and the health effects of lead, visit EPA's website at http://www.epa.gov/lead or contact your health care provider."

b. In addition to including the elements specified in subdivision D 1 a of this section, the owner of a community waterworks shall:

(1) Tell consumers how to get their water tested.

(2) Discuss lead in plumbing components and the difference between low lead and lead free. "Lead free" means (i) when used with respect to solders and flux refers to solders and flux containing not more than 0.2% lead, and (ii) when used with respect to pipes, pipe fittings, plumbing fittings, and plumbing fixtures refers to the weighted average of wetted surfaces of pipes, pipe fittings, plumbing fittings, and plumbing fixtures containing not more than 0.25% lead.

2. Delivery of public education materials.

a. The owner of a waterworks serving a large proportion of non-English speaking consumers, as determined by the department, shall include in all public education materials information in the appropriate languages regarding the importance of the notice or contain a telephone number or address where persons served may contact the waterworks to obtain a translated copy of the public education materials or to request assistance in the appropriate language.

b. The owner of a community waterworks that exceeds the lead AL on the basis of tap water samples collected in accordance with 12VAC5-590-375 B, and that is not already conducting public education tasks, shall conduct the public education tasks under this subdivision within 60 days after the end of the monitoring period in which the exceedance occurred. For a waterworks that is required to conduct monitoring annually or less frequently, the end of the monitoring period is September 30 of the calendar year in which the sampling occurs, or, if the department has established an alternate monitoring period, the last day of that period. These public education tasks include:

(1) Delivering printed materials meeting the content requirements of subdivision D 1 of this section to all bill paying customers.

(2) Contacting customers who are most at risk by delivering education materials that meet the content requirements of subdivision D 1 of this section to the local health department even if they are not located within the waterworks service area, along with an informational notice that

encourages distribution to all the organization's potentially affected customers or community waterworks consumers. The owner shall contact the local health department directly by phone or in person. The local health department may provide a specific list of additional community based organizations serving target populations, which may include organizations outside the service area of the waterworks. If these lists are provided, then the owner shall deliver education materials that meet the content requirements of subdivision D 1 of this section to all organizations on the provided lists.

(3) Contacting customers who are most at risk by delivering materials that meet the content requirements of subdivision D 1 of this section to the following organizations that are located within the waterworks service area, along with an informational notice that encourages distribution to all the organization's potentially affected customers or community waterworks users: (i) public and private schools or school boards; (ii) Women, Infants and Children (WIC) and Head Start programs; (iii) public and private hospitals and medical clinics; (iv) pediatricians; (v) family planning clinics; and (vi) local welfare agencies.

(4) Make a good faith effort to locate the following organizations within the service area and deliver materials that meet the content requirements of subdivision D 1 of this section to them, along with an informational notice that encourages distribution to all potentially affected customers or consumers. The good faith effort to contact at-risk customers may include requesting a specific contact list of these organizations from the local health department, even if the agencies are not located within the waterworks service area: (i) licensed childcare centers, (ii) public and private preschools, and (iii) obstetricians-gynecologists and midwives.

(5) No less often than quarterly, providing information on or in each water bill as long as the waterworks exceeds the AL for lead. The message on the water bill shall include the following statement exactly as written except for the text in brackets for which the owner shall include system-specific information: "(Insert name of waterworks) found high levels of lead in drinking water in some homes. Lead can cause serious health problems. For more information please call (insert name of waterworks) or (if applicable) visit our website at (insert waterworks website URL here)". The message or delivery mechanism can be modified in consultation with the department; specifically, the department may allow a separate mailing of public education materials to customers if the owner cannot place the information on water bills.

(6) Posting materials meeting the content requirements of subdivision D 1 of this section on the waterworks website if the waterworks serves a population greater than 100,000 persons.

(7) Submitting a press release to newspapers, television, and radio stations.

(8) In addition to the delivery requirements contained in subdivisions D 2 b (1) through D 2 b (7) of this section, the owner of a waterworks exceeding the lead AL shall implement at least three activities from one or more of the following categories: (i) public service announcements, (ii) paid advertisements, (iii) public area informational displays, (iv) emails to customers, (v) public meetings, (vi) household deliveries, (vii) targeted individual customer contact, (viii) direct material distribution to all multi-family homes and institutions, and (ix) other methods approved by the department. The educational content and selection of these activities shall be determined in consultation with the department.

(9) As long as a community waterworks exceeds the lead AL, the owner shall repeat the following public education activities:

(a) The owner of a community waterworks shall repeat the tasks contained in subdivisions D 2 b (1), D 2 b (2), D 2 b (3), and D 2 b (8) of this section every 12 months.

(b) The owner of a community waterworks shall repeat tasks contained in subdivision D 2 b (5) of this section with each billing cycle.

(c) The owner of a community waterworks serving a population greater than 100,000 shall post and retain the material on a publicly accessible website pursuant to subdivision D 2 b (6) of this section.

(d) The owner of a community waterworks shall repeat the task in subdivision D 2 b (7) of this section twice every 12 months on a schedule agreed upon with the department.

(10) The department may allow the public education activities described in subdivision D 2 b of this section to extend beyond the 60-day requirement if needed for implementation purposes on a case-by-case basis; however, this extension must be approved in writing by the department in advance of the 60-day deadline.

c. The owner of a NTNC that exceeds the lead AL on the basis of tap water samples collected in accordance with 12VAC5-590-375 B, and that is not already conducting public education tasks, shall conduct the public education tasks under this subdivision within 60 days after the end of the monitoring period in which the exceedance occurred. For a waterworks that is required to conduct monitoring annually or less frequently, the end of the monitoring period is September 30 of the calendar year in which the sampling occurs, or, if the department has established an alternate monitoring period, the last day of that period. These public education tasks include:

(1) Posting informational posters containing all of the public education elements contained in subdivision D 1 of this section in a public place or common area in each of the buildings served by the waterworks; and

(2) Distributing informational pamphlets or brochures on lead in drinking water containing all of the public education elements in subdivision D 1 of this section to each person served by the NTNC. The department may allow the owner to utilize electronic transmission instead of or combined with printed materials as long as it achieves at least the same coverage.

(3) The owner of a NTNC shall repeat the tasks contained in subdivisions D 2 c (1) and D 2 c (2) of this section at least once during each calendar year in which the waterworks exceeds the lead AL.

(4) The department may allow the public education activities described in subdivision D 2 c of this section to extend beyond the 60-day requirement if needed for implementation purposes on a case-by-case basis; however, this extension must be approved in writing by the department in advance of the 60-day deadline.

d. The owner may discontinue delivery of public education materials if the waterworks has met the lead AL during the most recent six-month monitoring period conducted pursuant to 12VAC5-590-375 B. The owner shall recommence public education in accordance with this subsection if the waterworks subsequently exceeds the lead AL during any monitoring period.

e. The owner of a community waterworks may apply to the department, in writing, (unless the department has waived the requirement for prior approval) to use only the text specified in subdivision D 1 a of this section instead of the text in subdivisions D 1 a and D 1 b of this section and to perform the tasks listed in subdivisions D 2 c (1) and D 2 c (2) of this section instead of the tasks in subdivisions D 2 b (1) through D 2 b (9) of this section if:

(1) The waterworks serves a facility, such as a prison or a hospital, where the population served is not capable of or is prevented from making improvements to plumbing or installing POU treatment devices; and

(2) The owner provides water as part of the cost of services provided and does not separately charge for water consumption.

f. The owner of a community waterworks serving 3,300 or fewer people may limit certain aspects of the public education programs as follows:

(1) With respect to the requirements of subdivision D 2 b (8) of this section, the owner of a waterworks serving 3,300 or fewer people shall implement at least one of the activities listed in that subdivision.

(2) With respect to the requirements of subdivision D 2 b (2) of this section, the owner of a waterworks serving 3,300 or fewer people may limit the distribution of the public education materials required under that subdivision to facilities and organizations served by the waterworks that are most likely to be visited regularly by pregnant women and children.

(3) With respect to the requirements of subdivision D 2 b (7) of this section, the department may waive this requirement for waterworks serving 3,300 or fewer persons as long as the owner distributes notices to every household served by the waterworks.

3. Supplemental monitoring and notification of results. The owner of a waterworks that fails to meet the lead AL on the basis of tap samples collected in accordance with 12VAC5-590-375 B shall offer to sample the tap water of any customer who requests it. The owner is not required to pay for collecting or analyzing the sample, nor is the owner required to collect and analyze the sample itself.

4. Notification of results. The owner of a community waterworks or a NTNC shall provide a notice of the individual tap results from lead tap water monitoring carried out under the requirements of 12VAC5-590-375 B to the persons served by the waterworks at the specific sampling site from which the sample was collected (e.g., the occupants of the residence or buildings where the tap was tested).

a. Timing of notification. The owner shall provide this consumer notice as soon as practical, but no later than 30 days after the owner learns of the tap monitoring results.

b. Content. The consumer notice shall include the results of lead tap water monitoring for the tap that was tested, an explanation of the health effects of lead, list steps consumers can take to reduce exposure to lead in drinking water, and contact information for the waterworks. The notice shall also provide the MCLG and the AL for lead and the definitions for these two terms from 12VAC5-590-10.

c. Delivery. The consumer notice shall be provided to persons served at the tap that was tested, either by postal mail or by another method approved by the department. For example, the owner of a NTNC may post the results on a bulletin board in the facility to allow consumers to review the information. The owner shall provide the notice to customers at sample taps tested, including consumers who do not receive water bills.

12VAC5-590-411. Disinfection byproduct precursors, disinfection byproducts, and maximum residual disinfection level treatment techniques.

A. Treatment technique for control of DBPPs.

1. Applicability.

a. The owner of a community waterworks or a NTNC shall comply with treatment techniques for the control of DBPPs.

b. A waterworks that uses a surface water source, a GUDI source, or both using conventional filtration treatment shall operate with enhanced coagulation or enhanced softening to achieve the TOC percentage removal levels specified in subdivision A 2 of this section unless the waterworks meets at least one of the alternative compliance criteria listed in subdivision A 1 c or A 1 d of this section.

c. Alternative compliance criteria for enhanced coagulation and enhanced softening waterworks. A waterworks that uses a surface water source, a GUDI source, or both provided with conventional filtration treatment may use the alternative compliance criteria in subdivisions A 1 c (1) through A 1 c (6) of this section to comply with this section instead of

complying with subdivision A 2 of this section. The owner shall comply with monitoring requirements in 12VAC5-590-374 I.

(1) The waterworks' source water TOC level is less than 2.0 mg/L, calculated quarterly as an RAA.

(2) The waterworks' treated water TOC level is less than 2.0 mg/L, calculated quarterly as an RAA.

(3) The waterworks' source water TOC level is less than 4.0 mg/L, calculated quarterly as an RAA; the source water alkalinity is greater than 60 mg/L (as $CaCO_3$), calculated quarterly as an RAA; and no TTHM and HAA5 LRAAs are greater than 0.040 mg/L and 0.030 mg/L, respectively.

(4) No TTHM and HAA5 LRAAs are greater than 0.040 mg/L and 0.030 mg/L, respectively, and the waterworks uses only chlorine for primary disinfection and maintains a residual in the distribution system.

(5) The waterworks' source water SUVA, before any treatment and measured monthly, is less than or equal to 2.0 liters per milligram-meter (L/mg-m), calculated quarterly as an RAA.

(6) The waterworks' finished water SUVA, measured monthly, is less than or equal to 2.0 L/mg-m, calculated quarterly as an RAA.

d. Additional alternative compliance criteria for softening waterworks. A waterworks practicing enhanced softening that cannot achieve the TOC removals required by subdivision A 2 b of this section may use the alternative compliance criteria in subdivisions A 1 c (1) and A 1 c (2) instead of complying with subdivision A 2 of this section. A waterworks shall comply with monitoring requirements in 12VAC5-590-374 J.

(1) Softening that results in lowering the treated water alkalinity to less than 60 mg/L (as CaCO3), measured monthly and calculated quarterly as an RAA.

(2) Softening that results in removing at least 10 mg/L of magnesium hardness (as CaCO3), measured monthly and calculated quarterly as an RAA.

2. Enhanced coagulation and enhanced softening performance requirements.

a. A waterworks shall achieve the percentage reduction of TOC specified in subdivision A 2 b of this section between the source water and the CFE, unless the department approves an owner's request for alternate minimum TOC removal (Step 2) requirements under subdivision A 2 c of this section.

Required Step 1 TOC reductions, indicated in Table 411.1, are based upon specified source water parameters. A waterworks practicing softening is required to meet the Step 1 TOC reductions in the far-right column (source water alkalinity greater than 120 mg/L) for the specified source water TOC.

b. Required Step 1 TOC reductions are indicated in Table 411.1, Required Percentage Removals of TOC.

TABLE 411.1 Required Percentage Removals of TOC[a,b]			
SOURCE WATER TOC, mg/L	SOURCE WATER ALKALINITY, mg/L as $CaCO_3$		
	0 - 60	>60 - 120	>120[c]
>2.0 - 4.0	35.0%	25.0%	15.0%
>4.0 - 8.0	45.0%	35.0%	25.0%
>8.0	50.0%	40.0%	30.0%

[a]A waterworks meeting at least one of the conditions in subdivisions A 1 c (1) through A 1 c (6) of this section is not required to operate with enhanced coagulation.

[b]A waterworks utilizing softening and meeting one of the alternative compliance criteria in subdivision A 1 d of this section is not required to operate with enhanced softening.

[c]A waterworks practicing softening shall meet the TOC removal requirements in this column.

c. A waterworks that uses a surface water source, a GUDI source, or both with conventional treatment that cannot achieve the Step 1 TOC removals required by subdivision A 2 b due to water quality parameters or operational constraints shall apply to the department within three months of failure to achieve the TOC removals required by subdivision A 2 b of this section for approval of alternative minimum TOC (Step 2) removal requirements submitted by the owner. If the department approves the alternative minimum TOC removal (Step 2) requirements, then the department may make those requirements retroactive for the purposes of determining compliance. Until the department approves the alternate minimum TOC removal (Step 2) requirements, the waterworks shall meet the Step 1 TOC removals contained in subdivision A 2 b of this section.

d. Alternate minimum TOC removal (Step 2) requirements. Applications made to the department by the owner of a waterworks using enhanced coagulation for approval of alternative minimum TOC removal (Step 2) requirements under subdivision A 2 c of this section shall include, at a minimum, results of bench-scale or pilot-scale testing conducted under subdivision A 2 d (1) of this section. The submitted bench-scale or pilot-scale testing shall be used to determine the alternate enhanced coagulation level.

(1) Alternate enhanced coagulation level is defined as coagulation at a coagulant dose and pH as determined by the method described in subdivisions A 2 d (1) through A 2 d (5) of this section so that an incremental addition of 10 mg/L of alum (or equivalent amount of ferric salt) results in a TOC removal of equal to or less than 0.3 mg/L. The percentage removal of TOC at this point on the "TOC removal versus coagulant dose" curve is then defined as the minimum TOC removal required for the waterworks. Once approved by the department, this minimum requirement supersedes the minimum TOC removal requirements listed in Table 411.1. This requirement shall be effective until the department approves a new value based on the results of a new bench-scale and pilot-scale test. Failure to achieve the alternative minimum TOC removal levels set by the department is a violation of this section.

(2) Bench-scale or pilot-scale testing of enhanced coagulation shall be conducted by using representative water samples and adding 10 mg/L increments of alum (or equivalent amounts of ferric salt) until the pH is reduced to a level less than or equal to the enhanced coagulation Step 2 target pH shown in Table 411.2.

TABLE 411.2 Enhanced Coagulation	
ALKALINITY (mg/L as CaCO3)	TARGET pH
0 - 60	5.5
>60 -120	6.3
>120 - 240	7.0
>240	7.5

(3) For source waters with alkalinities of less than 60 mg/L for which addition of small amounts of alum or equivalent addition of iron coagulant drives the pH below 5.5 before significant TOC removal occurs, the waterworks shall add necessary chemicals to maintain the pH between 5.3 and 5.7 in samples until the TOC removal of 0.3 mg/L per 10 mg/L alum added (or equivalent addition of iron coagulant) is reached.

(4) The waterworks may operate at any coagulant dose or pH necessary (consistent with other sections of this chapter) to achieve the minimum TOC percentage removal approved under subdivision A 2 c of this section.

(5) If the TOC removal is consistently less than 0.3 mg/L of TOC per 10 mg/L of incremental alum dose at all dosages of alum (or equivalent addition of iron coagulant), then the water is deemed to contain TOC not amenable to enhanced coagulation. The owner may then apply to the department for a waiver of enhanced coagulation requirements.

3. Compliance calculations.

a. A waterworks that uses a surface water source, a GUDI source, or both other than those identified in subdivision A 1 b or A 1 c of this section shall comply with requirements contained in subdivision A 2 b or A 2 c of this section. The owner shall calculate compliance quarterly, beginning after the waterworks has collected 12 months of data, by determining an annual average using the following method:

(1) Determine actual monthly TOC percentage removal, equal to:

[1-(treated water TOC/source water TOC)] X 100.

(2) Determine the required monthly TOC percentage removal (from either Table 411.1 or from subdivision A 2 c of this section).

(3) Divide the value in subdivision A 3 a (1) of this section by the value in subdivision A 3 a (2) of this section.

(4) Add together the results of subdivision A 3 a (3) of this section for the last 12 months and divide by 12.

(5) If the value calculated in subdivision A 3 a (4) of this section is less than 1.00, then the waterworks is not in compliance with the TOC percentage removal requirements.

b. The owner may use the provisions in subdivisions A 3 b (1) through A 3 b (5) of this section instead of the calculations in subdivisions A 3 a (1) through A 3 a (5) of this section to determine compliance with TOC percentage removal requirements.

(1) In any month that the waterworks' treated or source water TOC level is less than 2.0 mg/L, the waterworks may assign a monthly value of 1.0 (instead of the value calculated in subdivision A 3 a (3) of this section) when calculating compliance under the provisions of subdivision A 3 a of this section.

(2) In any month that a waterworks practicing softening removes at least 10 mg/L of magnesium hardness (as CaCO3), the waterworks may assign a monthly value of 1.0 (instead of the value calculated in subdivision A 3 a (3) of this section) when calculating compliance under the provisions of subdivision A 3 a of this section.

(3) In any month that the waterworks source water SUVA before any treatment is equal to or less than 2.0 L/mg-m, the waterworks may assign a monthly value of 1.0 (instead of the value calculated in subdivision A 3 a (3) of this section) when calculating compliance under the provisions of subdivision A 3 a of this section.

(4) In any month that the waterworks finished water SUVA is equal to or less than 2.0 L/mg-m, the waterworks may assign a monthly value of 1.0 (instead of the value calculated in subdivision A 3 a (3) of this section) when calculating compliance under the provisions of subdivision A 3 a of this section.

(5) In any month that the waterworks practicing enhanced softening lowers the alkalinity below 60 mg/L (as $CaCO_3$), the waterworks may assign a monthly value of 1.0 (instead of the value calculated in subdivision A 3 a (3) of this section) when calculating compliance under the provisions of subdivision A 3 a of this section.

c. A waterworks that uses a surface water source, a GUDI source, or both and uses conventional treatment may also comply with the requirements of this section by meeting the criteria in subdivision A 1 b or A 1 c of this section.

4. Enhanced coagulation or enhanced softening is the treatment technique required to control the level of DBP precursors in water treatment and distribution system for a waterworks using a surface water source, a GUDI source, or both and using conventional treatment.

B. The BAT, treatment techniques, or other means available for achieving compliance with the PMCLs for DBPs shown in Table 340.6 are listed in this subsection:

1. The BAT, treatment techniques, or other means available for achieving compliance with the PMCLs for bromate and chlorite:

DISINFECTION BYPRODUCT	BEST AVAILABLE TECHNOLOGY
Bromate	Control of ozone treatment process to reduce production of bromate
Chlorite	Control of treatment processes to reduce disinfectant demand and control of disinfection treatment processes to reduce disinfectant levels

2. The BAT, treatment techniques, or other means available for achieving compliance with the RAA PMCLs for TTHM and HAA5:

DISINFECTION BYPRODUCT	BEST AVAILABLE TECHNOLOGY
TTHM and HAA5	Enhanced coagulation or enhanced softening or GAC10, with chlorine as the primary and residual disinfectant

3. The BAT, treatment techniques, or other means available for achieving compliance with the LRAA PMCLs for TTHM and HAA5 for a waterworks that disinfects its source water:

DISINFECTION BYPRODUCT	BEST AVAILABLE TECHNOLOGY
TTHM and HAA5	Enhanced coagulation or enhanced softening, plus GAC10; or NF with a molecular weight cutoff fewer than or equal to 1,000 Daltons; or GAC20

4. The BAT, treatment techniques, or other means available for achieving compliance with the LRAA MCLs for TTHM and HAA5 for a a consecutive waterworks and applies only to the disinfected water that a consecutive waterworks buys or otherwise receives:

DISINFECTION BYPRODUCT	BEST AVAILABLE TECHNOLOGY
TTHM and HAA5	A waterworks serving equal to or greater than 10,000 people: Improved distribution system and storage tank management to reduce residence time, plus the use of chloramines for residual disinfectant maintenance A waterworks serving fewer than 10,000 people: Improved distribution system and storage tank management to reduce residence time

C. The BAT, treatment techniques, or other means available for achieving compliance with the MRDLs identified in Table 340.7 are the controls of treatment processes to reduce disinfectant demand and controls of disinfection treatment processes to reduce disinfectant levels.

12VAC5-590-415. Uncovered finished water storage.

A. A waterworks with uncovered finished water storage facilities shall comply with the requirements to cover the facility as described in this section.

B. The owner shall immediately notify the department of the use of each uncovered finished water storage facility.

C. All uncovered finished water storage facilities shall be covered in compliance with a schedule approved by the department.

D. Failure to comply with the requirements of this section is a violation of the treatment technique requirement.

12VAC5-590-421. Groundwater system treatment techniques.

A. The owner of a groundwater system that (i) has a confirmed E. coli contamination as described in 12VAC5-590-379 B or (ii) has been notified in writing of a significant deficiency as described in 12VAC5-590-350 D shall meet the requirements of this section. Failure to meet any requirement of this section after the applicable time period specified is a treatment technique violation.

1. The owner shall implement one or more of the following corrective actions:

a. Correct all significant deficiencies;

b. Provide an alternate source of water;

c. Eliminate the source of contamination; or

d. Provide treatment of the groundwater source that reliably achieves at least 4-log treatment of viruses before or at the first customer.

2. Unless the department directs the owner to implement a specific corrective action, the owner shall consult with the department regarding the appropriate corrective action within 30 days of receiving written notification from the department or the laboratory. This consultation may take the form of a telephone conversation, email, meeting, or other mechanism agreed to by the department.

3. Within 45 days of receiving this notification, the owner shall submit a written corrective action plan (CAP) to the department that satisfactorily addresses the deficiency. The CAP shall include a schedule for completing individual actions, and it shall include one or more of the corrective actions in subdivision A 1 of this section. Approval of the CAP by the department constitutes an approved CAP.

4. Within 120 days of receiving written notification from the department or the laboratory, the owner shall either:

a. Have completed corrective actions in accordance with the department approved CAP including department specified interim measures; or

b. Be in compliance with a department approved CAP and schedule.

(1) Any subsequent modifications to a department approved CAP and schedule shall also be approved by the department.

(2) If the department specifies interim measures for protection of the public health pending the department's approval of the CAP and schedule or pending completion of the CAP, then the owner shall comply with these interim measures as well as with any schedule specified by the department.

5. When a significant deficiency is identified at a waterworks that uses both a groundwater and a surface water or a GUDI source, the owner shall comply with this section unless the department has determined that the significant deficiency is in a portion of the distribution system that is served solely by the surface water or the GUDI source**.**

B. The owner of a groundwater system that provides at least 4-log treatment of viruses before or at the first customer shall conduct compliance monitoring to demonstrate treatment effectiveness in accordance with subsection C of this section. The owner shall also conduct source water monitoring in accordance with 12VAC5-590-379 C.

The owner shall provide engineering, operational, or other information as required by the department to complete a determination of virus treatment effectiveness.

C. The owner of a groundwater system that provides at least 4-log treatment of viruses shall monitor the effectiveness and reliability of treatment for that groundwater source before or at the first customer as follows:

1. Chemical disinfection.

a. The owner of a groundwater system that serves greater than 3,300 people shall continuously monitor and record the residual disinfectant concentration using analytical methods specified in 12VAC5-590-440 at a location approved by the department and shall record the lowest residual disinfectant concentration each day that water from the groundwater source is served to the public. The owner shall maintain at least the department-determined residual disinfectant concentration every day the groundwater system serves water from the groundwater source to the public. If there is a failure in the continuous monitoring equipment, the owner shall conduct grab sampling every four hours until the continuous monitoring equipment is returned to service. The system shall resume continuous residual disinfectant monitoring within 14 days.

b. The owner of a groundwater system that serves 3,300 or fewer people shall monitor the residual disinfectant concentration using analytical methods specified in 12VAC5-590-440 at a location approved by the department and record the residual disinfection concentration each day that water from the groundwater source is served to the public. The owner shall maintain the department-determined residual disinfectant concentration every day the groundwater

system serves water from the groundwater source to the public. The owner shall collect a daily grab sample during the hour of peak flow or at another time specified by the department. If any daily grab sample measurement falls below the department-determined residual disinfectant concentration, the owner shall collect follow-up samples every four hours until the residual disinfectant concentration is restored to the department-determined level. The owner of a groundwater system that serves 3,300 or fewer people may monitor continuously to meet the requirements of this subsection.

c. When the disinfection treatment is required based on confirmed E. coli contamination in the source water, the requirements in this section apply. When the disinfection treatment is required for any other reason or provided voluntarily by the owner, the department will determine the frequency of residual disinfectant monitoring.

d. Failure to maintain the department-specified minimum residual disinfectant concentration for a period of more than four hours is a violation of the treatment technique requirement.

2. The owner of a groundwater system that uses a department-approved alternative treatment to meet the requirements of this section by providing at least 4-log treatment of viruses before or at the first customer shall:

a. Monitor the alternative treatment in accordance with all department-specified monitoring requirements; and

b. Operate the alternative treatment in accordance with all department-specified compliance requirements necessary to achieve at least 4-log treatment of viruses.

3. Failure to meet the monitoring requirements of subsection C of this section is a violation and requires the owner to provide public notification as required in 12VAC5-590-540 A 3.

D. Discontinuing compliance monitoring or treatment.

1. The owner may discontinue compliance monitoring if the department determines and documents in writing that compliance monitoring is no longer necessary for that groundwater source. The owner of a groundwater systems that has department approval to discontinue compliance monitoring shall be subject to the triggered source water monitoring requirements of 12VAC5-590-379 B 1.

2. The owner of a groundwater system that is discontinuing compliance monitoring is still subject to the requirements of 12VAC5-590-380 G.

3. The owner that has been required by the department to provide at least 4-log treatment of viruses shall not discontinue treatment or monitoring.

12VAC5-590-430. Determination of surface water influence of groundwater sources.

A. A groundwater source utilized by a waterworks, including wells, springs, and infiltration galleries, shall be evaluated by the department and a determination of surface water influence shall be made by the department. The owner shall provide to the department all necessary information to make this determination in accordance with the three-step procedure described in subsection B of this section.

B. The groundwater source shall be evaluated and subjected to the criteria in a stepwise fashion. Once the department has made a determination with regard to surface water influence, it is not necessary to continue to the next step:

1. Step 1. Evaluation of source history, construction, and location.

a. The source is under the direct influence of surface water if it has been directly associated with a biological waterborne disease outbreak.

b. The source is under the direct influence of surface water if there are any demonstrated or known direct connections between the source to surface water via surface water bodies, sinkholes, troughs, drainage ways, or other geologic features.

c. The source is under the direct influence of surface water if a sanitary survey reveals, or there is other evidence to indicate, that surface water is directly entering the source.

d. If the department has not determined that the source is influenced by surface water based upon the criteria in subdivisions B 1 a, B 1 b, and B 1 c of this section, then the source evaluation proceeds to Step 2.

2. Step 2. Microbiological water quality.

a. The owner shall collect a series of bacteriological samples directly from the source before any treatment. The specific number of samples to be collected, the sampling frequency, and the duration of sampling shall be determined by the department.

(1) At a minimum, a series of 20 samples collected on a weekly frequency is required. Sample collection may be adjusted within the week to collect samples immediately following rainfall events, whenever possible.

(2) All bacteriological analyses shall be performed by laboratories that have received certification by EPA or DCLS as specified in 12VAC5-590-440 for drinking water samples and by a test method that will yield both total coliform concentration and E. coli concentration.

(3) The department may utilize bacteriological results from source water samples collected in accordance with 12VAC5-590-379 C if the sample results cover at least a 20-week period that includes multiple significant rainfall events for this Step 2 evaluation.

b. The total coliform concentration sample results shall be evaluated as follows:

(1) If the results of the total coliform concentration samples indicate three or more samples with total coliform greater than 100 colonies/100 ml, then the source evaluation proceeds to Step 3.

(2) If the results of the total coliform concentration samples indicate a geometric mean equal to or greater than 100 colonies/100 ml, then the requirements of 12VAC5-590-380 G 2 will apply.

c. The E. coli concentration samples shall be evaluated as follows:

(1) If the results of the E. coli concentration samples indicate greater than or equal to five E. coli per 100 ml in three or more samples, then the source evaluation proceeds to Step 3.

(2) If the results of the E. coli concentration samples indicate the presence of E. coli in five or more samples, then the source evaluation proceeds to Step 3.

3. Step 3. Additional water quality monitoring.

a. The owner shall prepare and submit a written source water monitoring plan to the department for approval detailing additional water quality samples to be collected directly from the source before any treatment and if applicable from a nearby surface water source. The monitoring plan shall include the following:

(1) The specific parameters to be monitored.

(2) The monitoring frequency for each parameter.

(3) The duration of monitoring.

b. The source water monitoring plan shall include microscopic particulate analysis (MPA).

(1) A minimum of four source water MPA tests is required, two to be conducted during a wet period and two to be conducted during a dry period. All MPA tests shall be collected at least 60 days apart.

(2) All MPA tests shall be performed by a laboratory approved by the department and shall include both Giardia lamblia and Cryptosporidium.

(3) All MPA testing and reporting of results shall be in accordance with EPA "Consensus Method for Determining Groundwaters Under the Direct Influence of Surface Water Using

Microscopic Particulate Analysis (MPA)," dated October 1992, Environmental Services Division.

c. The source water monitoring plan shall include monitoring of the physical parameters such as temperature, pH, turbidity, conductivity, and other parameters.

(1) If a surface water source is located near the groundwater source being evaluated, then monitoring of the nearby surface water source is required using the same physical parameters and frequency as the groundwater source.

(2) Records of rainfall and other climatological events shall be maintained and reported with the physical parameter results.

d. The owner shall provide the department with all of the monitoring results required in the approved monitoring plan. Results of all MPA tests shall be reported within 10 days of receipt by the owner. If any MPA result indicates the presence of Giardia lamblia or Cryptosporidium, then the owner shall notify the department within 24 hours of receipt. The results of the physical parameter monitoring shall be provided along with applicable rainfall or climatological data to the department in a summary report.

e. The additional water quality monitoring results shall be evaluated as follows:

(1) The source is under the direct influence of surface water if any single MPA test result indicates a score of equal to or greater than 20.

(2) The source is under the direct influence of surface water if any two MPA test results indicate a score of equal to or greater than 15.

(3) The source is under the direct influence of surface water if the results of physical parameter monitoring indicate a correlation between fluctuations in the groundwater source in direct response to a rainfall or other climatological event.

(4) The source is under the direct influence of surface water if the results of physical parameter monitoring indicate a direct correlation between the groundwater source being evaluated and the physical parameters of a nearby surface water source.

(5) The source is a groundwater source and is not under the direct influence of surface water if (i) all MPA test results indicate a score of equal to or less than 9, (ii) there are no fluctuations in source water monitored physical parameters in direct response to a rainfall or other climatological event, and (iii) there is no direct correlation in the monitored physical parameters between the groundwater source being evaluated and a nearby surface water source.

f. If the department has not determined that the source is under the direct influence of surface water based upon the criteria in subdivisions B 3 e (1) through B 3 e (4) of this section, and if at least one of the MPA test results indicate a score of greater than 9 but less than 15, then the department shall evaluate all available water quality monitoring data, source construction, location, geology, and any other relevant factors, and to determine that either:

(1) The source is a groundwater source and is not under the direct influence of surface water; or

(2) The source is at risk and requires continued source water monitoring as prescribed by the department.

C. If the source is subject to the requirements of subdivision B 3 of this section, then the owner shall perform the following interim measures until the department has made a final GUDI determination:

1. Provide disinfection treatment to achieve a 4-log inactivation of virus in accordance with 12VAC5-590-421 A 1 d;

2. Conduct compliance monitoring in accordance with 12VAC5-590-421 C 1;

3. If the disinfection treatment required in subdivision C 1 of this section has to be installed, then the owner shall issue a public notice in accordance with 12VAC5-590-540 A 1 advising consumers

to boil the water before using it for human consumption. The boil water notice shall remain in effect until the disinfection treatment is installed and in operation; and

4. The department may require that the owner perform additional interim measures if deemed necessary to protect public health.

D. If the total coliform concentration criteria in subdivision B 2 b of this section or the E. coli concentration criteria in subdivision B 2 c of this section are exceeded or if the department has declared the source to be GUDI, then the owner may propose mitigation measures, a plan to correct deficiencies, or both.

1. Any proposed mitigation measures or corrective actions must be detailed in a report submitted to the department for approval. The report shall be prepared by a professional engineer licensed in Virginia, a professional geologist licensed in Virginia, or other licensed professional approved by the department. The report shall include:

a. A description of the proposed mitigation or corrective action activities such as the repair of structural defects, elimination of sources of contamination in proximity to the source, implementation of source water protection measures, or other mitigation or corrective action activities.

b. Specific milestones and milestone completion dates.

c. A follow-up source water monitoring plan to be implemented upon completion of the mitigation measures or of the corrective actions.

2. If the source must remain in operation during the period of time that the mitigation or corrective action activities are implemented and evaluated, then the department may require that the owner implement the interim measures described in 12VAC5-590-395 A 3 or subdivisions C 1 through C 4 of this section.

3. A final summary report detailing the mitigation measures, the corrective actions, or both that are completed; the results of the follow-up monitoring; conclusions; recommendations; and all other supporting data shall be submitted to the department for approval.

a. The final summary report shall be prepared by a professional engineer licensed in Virginia, a professional geologist licensed in Virginia, or other licensed professional approved by the department.

b. Upon evaluation of the final report and supporting data, the department will make a GUDI determination.

E. For any source previously determined to be a groundwater source and not under the direct influence of surface water, the department may:

1. Require that the source be reevaluated in accordance with procedures contained in this section; or

2. Waive any additional reevaluation under this section.

12VAC5-590-440. Analytical methods.

A. All drinking water analyses for compliance purposes shall be performed by analytical methods that are consistent with current EPA regulations found at 40 CFR Part 141 and 40 CFR Part 143. Standards for laboratories seeking certification to perform drinking water analyses are found in the Regulation for the Certification of Laboratories Analyzing Drinking Water (1VAC30-41) and regulations for the Accreditation for Commercial Environmental Laboratories (1VAC30-46) promulgated by the Department of General Services, DCLS.

B. For the purposes of determining compliance, the department will only accept results from samples that have been collected, handled, processed, and documented in accordance with the Regulation for the Certification of Laboratories Analyzing Drinking Water (1VAC30-41) and regulations for the Accreditation for Commercial Environmental Laboratories (1VAC30-46).

C. Testing for alkalinity, calcium, conductivity, residual disinfectant, orthophosphate, pH, silica, temperature, bromide, turbidity, TOC, DOC, SUVA, and UV_{254} for compliance may be performed by any person or party acceptable to the department in accordance with methods specified in 40 CFR Part 141.

12VAC5-590-450. Facility and personnel management.

Waterworks operation comprises the constant oversight and management of the facilities and personnel. Consideration shall be given to such factors as the competency of personnel; water quality, including drinking water standards; water treatment plant maintenance and cleanliness; analytical laboratory control; and the operation and maintenance of the facilities, including water treatment plant equipment, distribution system equipment, and piping. As the complexity of the waterworks increases, so does the expertise and skill required of the operating staff.

12VAC5-590-461. Classification of waterworks, operator requirements, and operator attendance.

A. Classification of waterworks. All community and NTNC waterworks, including consecutive waterworks, fitting the classification protocol in this subsection shall be designated as classified waterworks. The department retains the discretion to assign the classification of the waterworks or treatment facility either higher or lower. Those community and NTNC waterworks failing to fall within one of the classifications listed in this subsection shall be designated an unclassified waterworks unless specified otherwise by the department. Normally, a TNC waterworks shall not be classified and shall not be required to have an operator unless the department determines that it is necessary to ensure satisfactory operation of the installed treatment. If a waterworks consists of multiple treatment facilities, then these facilities may be individually classified for the purpose of determining the operator requirements.

1. Class 1 means:

   a. A waterworks or a water treatment plant serving 50,000 or more persons, or having a water treatment plant capacity of 5.0 MGD or more and employing conventional filtration or chemical coagulation in combination with membrane filtration; or

   b. A waterworks designated by the department to be a Class 1 waterworks.

2. Class 2 means:

   a. A waterworks or a water treatment plant serving 5,000 or more persons but fewer than 50,000 persons or having a water treatment plant capacity of 0.5 MGD or more but less than 5.0 MGD, whichever range applies, and employing rapid rate conventional filtration (see 12VAC5-590-874) or chemical coagulation in combination with membrane filtration;

   b. A waterworks or a water treatment plant serving fewer than 50,000 persons or having a water treatment plant capacity of less than 5.0 MGD and employing high rate conventional filtration (see 12VAC5-590-874); or

   c. A waterworks designated by the department to be a Class 2 waterworks.

3. Class 3 means:

   a. A waterworks or a water treatment plant serving fewer than 5,000 persons or having a water treatment plant capacity less than 0.5 MGD, whichever is greater, and employing conventional filtration or chemical coagulation in combination with membrane filtration;

   b. A waterworks or a water treatment plant serving 5,000 or more persons or having a water treatment plant capacity of 0.5 MGD or more, whichever is greater, and employing one or more of the following: disinfection other than with hypochlorination, caustic soda feed, iron and manganese removal, ion exchange, slow sand filtration, aeration, rechlorination other than with hypochlorination, activated carbon contactors, membrane or other filtration technologies without chemical coagulation, and fluoridation with a saturator or acid feed;

   c. A waterworks or a water treatment plant employing fluoridation with other than a saturator not considered a Class 1 or Class 2 waterworks; or

   d. A waterworks designated by the department to be a Class 3 waterworks.

4. Class 4 means:

a. A waterworks or a water treatment plant serving fewer than 5,000 persons or having a water treatment plant capacity of less than 0.5 MGD and employing one or more of the following: disinfection other than with hypochlorination, caustic soda feed, iron and manganese removal, ion exchange, slow sand filtration, aeration, rechlorination other than with hypochlorination, activated carbon contactors, membrane or other filtration technologies without chemical coagulation, and fluoridation with a saturator; or

b. A waterworks designated by the department to be a Class 4 waterworks.

5. Class 5 means:

a. A waterworks serving 400 or more persons that:

(1) Provides no treatment; or

(2) Employs one or more of the following treatment processes:

(a) Hypochlorination for disinfection;

(b) Corrosion control with calcite or magnesium oxide contactors or solution feed except with caustic soda; or

(c) Sequestration by solution feed.

b. A waterworks designated by the department to be a Class 5 waterworks.

6. Class 6 means:

a. A waterworks serving fewer than 400 persons that:

(1) Provides no treatment; or

(2) Employs one or more of the following treatment processes:

(a) Hypochlorination for disinfection;

(b) Corrosion control with calcite or magnesium oxide contactors or solution feed except with caustic soda; or

(c) Sequestration by solution feed.

b. A waterworks is designated by the department to be a Class 6 waterworks.

B. Operator requirements. The operation of all waterworks must rest in the hands of qualified staff. The number and qualifications of persons constituting the operating staff at a waterworks depend principally upon the capacity of the waterworks, the number of persons served by the waterworks, and the complexity of the treatment process or processes. If a classified waterworks or water treatment plant is without a required operator, then the owner shall notify the department as soon as practical but no later than 24 hours of such an occurrence.

1. The operator attendance requirements specified in subsection C of this section are a minimum to protect the health of the consumer and safety of the operating staff. The department may increase the required operating attendance when appropriate to protect human health.

2. A classified waterworks shall be operated by an operator having a valid license issued by the Commonwealth of Virginia (18VAC160-30-90) with a classification equal to or higher than the classification of the waterworks or water treatment plant being operated. (See definition of operator in 12VAC5-590-10).

3. Operators are not required at unclassified waterworks.

C. Minimum operator attendance at classified waterworks. For the purpose of this section and 12VAC5-590-570, all classified waterworks or individual water treatment plants shall maintain the minimum operator attendance as follows:

1. Class 1. The waterworks shall have a minimum of two operating staff in attendance whenever the water treatment plant is in operation; at least one of the operating staff must be an operator.

2. Class 2. The waterworks shall have a minimum of one operator in attendance whenever the water treatment plant is in operation.

3. Class 3. The waterworks employing conventional filtration or chemical coagulation in combination with membrane filtration shall have a minimum of one operator in attendance whenever the water treatment plant is in operation. All other treatment facilities may have operator attendance similar to a Class 4 waterworks.

4. Class 4. The waterworks shall be attended by an operator at least three days per week, except that water treatment plants employing membrane filters treating surface water sources or GUDI sources shall be attended by an operator daily. The attendance shall be for sufficient time to perform the necessary operations, monitoring, and maintenance.

5. Class 5 and Class 6.

a. Where no treatment is provided, the waterworks shall be attended by an operator at least twice a month.

b. When treatment is provided, the waterworks shall be attended by an operator at least once per week.

c. The attendance shall be for sufficient time to perform the necessary operations, monitoring, and maintenance.

D. Operator attendance alternatives.

1. Increased staffing attendance may be required by the department on a case-by-case basis to protect public health.

2. Reduced operator attendance for Class 3 through Class 6 waterworks may be considered by the department on a case-by-case basis.

3. When requiring increased operator attendance or considering reduced operator attendance the department will consider the following criteria, including:

a. Operational history;

b. Type of treatment;

c. Facility capacity and hours of operation;

d. Population served;

e. Type and reliability of remote monitoring controls, alarms, and communications;

f. Reliable staff communications; and

g. Emergency response plans and procedures.

12VAC5-590-470. Waterworks condition.

The waterworks shall be maintained in a clean and orderly condition.

12VAC5-590-475. Removal of wells from service.

A. Temporary inactivation.

1. A water well temporarily inactivated shall be sealed with a watertight cap or wellhead seal.

2. The well shall be maintained so that it will not be a source or channel for contamination during temporary inactivation.

3. The wellhead shall be visually inspected and observations documented to verify adequate sanitary integrity on a quarterly basis.

4. The well lot shall be maintained.

B. Permanent abandonment.

1. Well abandonment shall be supervised by a certified water well systems provider.

2. All well abandonments shall be documented on a Uniform Water Well Completion Report, Form GW-2, and submitted to the department within 30 days of completing the physical abandonment.

3. Groundwater wells that are abandoned shall be sealed by methods that will restore to the fullest extent possible the controlling geological conditions that existed before the wells were constructed.

4. Casing and screen materials may be salvaged.

5. The well shall be checked from land surface to the entire depth of the well before it is sealed to ascertain freedom from obstructions that may interfere with sealing operations. Effort shall be made to remove or clear any obstacles that may prohibit sealing by grouting the complete well depth.

6. The well shall be thoroughly chlorinated before sealing.

7. Bored wells and uncased wells shall be backfilled with clean fill to the water level. A two-foot-thick bentonite grout plug shall be placed immediately above the water level. Clean fill shall be placed on top of the bentonite grout plug and brought up to at least five feet from the ground surface. The top five feet of the well casing, if present, shall be removed from the bore hole. If an open annular space is present around the well casing, then the annular space shall be filled with bentonite grout to the maximum depth possible, but less than or equal to 20 feet. A one-foot-thick cement or bentonite grout plug that completely fills the bore void space shall be placed a minimum of five feet from the ground surface. As an alternative, bored wells and uncased wells may be completely filled with concrete, sand-cement, bentonite-cement, or neat cement grout to within a minimum of five feet from the ground surface by introduction through a pipe initially extending to the bottom of the well. The pipe shall be raised but remain submerged in grout or concrete as the well is filled. The remaining space shall be filled with clean fill that is mounded a minimum of one foot above the surrounding ground surface.

8. Non-bored wells constructed in unconsolidated formations shall be completely filled with concrete, sand-cement, bentonite-cement, or neat cement grout to within a minimum of five feet from the ground surface by introduction through a pipe initially extending to the bottom of the well. The pipe shall be raised but remain submerged in grout or concrete as the well is filled. The remaining space shall be filled with clean fill that is mounded a minimum of one foot above the surrounding ground surface.

9. Wells constructed in consolidated rock formations or that penetrate zones of consolidated rock may be filled with sand or gravel opposite the zones of consolidated rock. The top of the sand or gravel fill shall be at least five feet below the top of the consolidated rock and at least 20 feet below land surface. The remainder of the well shall be filled with concrete, sand-cement, bentonite-cement, or neat cement grout to within a minimum of five feet from the ground surface by introduction through a pipe initially extending to the bottom of the well. The pipe shall be raised but remain submerged in grout or concrete as the well is filled. The remaining space shall be filled with clean fill that is mounded a minimum of one foot above the surrounding ground surface.

10. The location of the well shall be permanently documented for future reference.

12VAC5-590-476. Reactivation of wells.

A. The owner shall notify the department of the intent to reactivate a well.

B. Before bringing the well into service, the well shall be pumped to waste (purged) for a minimum of five well volumes but for not less than 30 minutes. The purged well water shall be discharged in a manner so that it will not return to the well, directly or indirectly, during the pumping period.

C. After the well is pumped, water quality samples shall be collected. If the well has been inactive for less than one year, then two samples shall be collected at least 30 minutes apart and tested for the presence of E. coli. If the well has been inactive for one or more years, then it shall be tested for total coliform density (MPN), nitrate, and, if determined by the department, inorganics, VOCs, SOCs, and radionuclides. Satisfactory test results shall be obtained before placing the well in service.

D. A well yield and drawdown test may be required by the department before bringing the well into service. The test shall be performed in accordance with 12VAC5-590-840 H, as applicable.

E. A well may be activated for emergency use before receipt of satisfactory monitoring results, even if public health and safety are unknowns and may be at risk, as determined by the department. However, in these circumstances, a special water advisory shall be approved by the department and issued by the waterworks at the same time the well is activated.

12VAC5-590-480. Operational control testing and monitoring.

A. Water analyses and tests performed at waterworks are conducted for four main purposes: (i) to ensure compliance; (ii) to control water treatment plant operation; (iii) to record water treatment plant performance; and (iv) to provide information for improving water treatment plant performance. Tests designed to control operation shall present evidence that:

1. Each key process, such as mixing, coagulation, sedimentation, filtration, softening, iron and manganese removal, disinfection, and taste and odor control, is effective; and

2. The finished product is clean, is free from objectionable taste and odor, is free from undesirable chemical characteristics, and is safe for human consumption.

B. Testing for regulatory compliance purposes shall use an EPA-approved analytical method found in 40 CFR Parts 141 and 143. Instruments used for operational control purposes must be calibrated in accordance with manufacturer instructions. Calibrations shall be documented in a manner acceptable to the department.

C. Ample laboratory space shall be provided for all required laboratory analyses as specified in 12VAC5-590-760.

D. Required waterworks onsite laboratory analyses. The analyses listed in this subsection are the minimum required. Additional testing may be required by the department.

1. The owner of a waterworks employing chemical coagulation or lime softening in combination with any filtration treatment for turbidity removal or TOC reduction shall provide equipment for the analysis of pH, alkalinity, hardness, turbidity, water temperature, and coagulant dosage. A calibrated electric pH meter must be provided; however, a color comparator may be used as a backup unit. Turbidities must be determined by the use of a calibrated turbidimeter.

2. The owner of a waterworks employing membrane filtration without chemical coagulation or lime softening shall provide equipment for the analysis of turbidity and temperature. Turbidities shall be determined by the use of a calibrated turbidimeter.

3. The owner of a waterworks employing softening only and utilizing chemical precipitation shall provide equipment for the analysis of pH utilizing a calibrated electric pH meter, alkalinity, hardness, water temperature, and chemical dosage for precipitation utilizing a multiple jar stirring machine.

4. The owner of a waterworks employing iron and manganese removal by chemical precipitation shall provide equipment for the analysis of pH, alkalinity, iron, manganese, and water temperature.

5. The owner of a waterworks employing fluoridation shall provide equipment for the analysis of the fluoride ion concentration and water temperature.

6. The owner of a waterworks employing chlorination, rechlorination, chloramination, or rechloramination shall provide equipment for the analysis of the appropriate chlorine residual measurement and temperature.

7. The owner of a waterworks employing iron and manganese removal by ion exchange or softening by ion exchange shall provide equipment for the analysis of iron and manganese.

E. Process control instruments, monitors, gauges, and controllers, including reading, recording, and alarm features, required in Part III, Manual of Practice (12VAC5-590-640 et seq.), shall be maintained fully operational and calibrated in accordance with the manufacturer instructions.

1. The owner of a waterworks employing UV for inactivation credit shall perform UV sensor calibration checks. Calibrations and instrument checks shall be documented in a manner acceptable to the department. All UV sensors shall be calibrated with a reference UV sensor at least monthly. It is also recommended that offline and standby sensors be calibrated at the same time. At least one reference sensor for calibration of online sensors shall be provided. The reference UV sensor shall be calibrated at least yearly at a qualified facility, usually the manufacturer. Ultraviolet transmittance (UVT) analyzer calibration is required when used as a control instrument. The UVT analyzer shall be calibrated at least weekly by comparing online measurements to a benchtop spectrophotometer that is calibrated in accordance with manufacturer instructions. Instead of an online UVT analyzer, a benchtop spectrophotometer may be utilized to determine UV transmittance at least every four hours.

2. The owner of a waterworks employing ozone for inactivation credit shall perform calibration checks on continuous, online ozone residual monitors at least weekly. Inactivation credits for a multiple chamber contactor shall be based on only the chambers that have a measured ozone residual greater than 0.02 mg/L or higher, depending on residual analysis instrumentation.

12VAC5-590-490. Adequate treatment.

A. Adequate treatment is any one or any combination of the controlled processes of coagulation, sedimentation, absorption, filtration, disinfection, or other processes that produce water consistently meeting the requirements of this chapter. The concept of adequate treatment also includes processes that are appropriate to (i) the source water; (ii) waterworks that are of adequate capacity to meet maximum demands without creating health hazards and that are located, designed, and constructed to eliminate or prevent cross-connections; and (iii) the conscientious operation by well-trained and competent personnel whose qualifications are commensurate with the responsibilities of the position and acceptable to the department.

B. A waterworks shall provide adequate treatment when required and in accordance with 12VAC5-590-680 to ensure the production of potable water.

12VAC5-590-500. Disinfection criteria, determination of CT, disinfection profiles, and disinfection benchmarks for Giardia and virus inactivation.

A. A waterworks utilizing surface water sources or GUDI sources, in whole or in part, shall be disinfected in accordance with subsection C of this section and 12VAC5-590-1000.

B. The owner of a groundwater system subject to the requirements of 12VAC5-590-421 A 1 d shall provide primary disinfection treatment by means of one of the following:

1. A residual disinfectant concentration (C) and contact time (T) to achieve a 4-log removal or inactivation of viruses. CT shall be calculated in accordance with subsections C and D of this section, which contain information on calculation methods and contact tank baffling factors.

2. UV treatment to achieve a 4-log removal or inactivation of viruses. Log inactivation shall be determined in accordance with 12VAC5-590-401 E 7 c. A secondary disinfection residual in the distribution system may be required by the department.

C. Disinfection criteria.

1. An owner of a waterworks utilizing surface water sources, in whole or in part, or GUDI sources shall provide a minimum 3-log (99.9%) removal of Giardia cysts and a 4-log (99.99%) removal of viruses, respectively.

2. Additional inactivation levels that must be achieved by disinfection shall be in accordance with Table 500.1 for waterworks employing the filtration processes listed.

TABLE 500.1 Maximum Log Removal Credits for Various Filtration Technologies and the Resulting Minimum Required Logs of Inactivation by Disinfection				
FILTRATION PROCESS[a]	MAXIMUM LOG REMOVAL CREDITS FOR FILTRATION		ADDITIONAL LOG INACTIVATION REQUIRED BY DISINFECTION	
	Giardia lamblia	Viruses	Giardia lamblia	Viruses
Conventional	2.5	2.0	0.5	2.0
Direct	2.0	1.0	1.0	3.0
Pre-engineered package	2.5	Zero	0.5	4.0
Diatomaceous Earth	2.0	1.0	1.0	3.0
Slow Sand	2.0	2.0	1.0	2.0
Membrane (MF or UF)	3.0	Zero	0.5	4.0
Bag or Cartridge	2.0	Zero	1.0	4.0
[a]Refer to Part III of this chapter for further description of the filtration processes.				

D. A disinfection profile shall be developed in accordance with the procedures in subdivisions D 1, D 2, and D 3.

1. The owner shall monitor at least weekly for a period of 12 consecutive months to determine the total log inactivation for Giardia lamblia and viruses. If an owner monitors more frequently, then the monitoring frequency shall be evenly spaced. An owner of a waterworks that operates for fewer than 12 months per year shall monitor weekly during the period of operation.

2. The owner of a waterworks with a single point of disinfectant application before the entrance to the distribution system or with more than one point of disinfectant application shall conduct the monitoring in subdivisions D 2 a through D 2 e of this section.

a. For a waterworks using a disinfectant other than UV, the temperature of the disinfected water shall be measured at each residual disinfectant concentration sampling point during peak hourly flow or at an alternative location approved by the department.

b. For a waterworks using chlorine, the pH of the disinfected water shall be measured at each chlorine residual disinfectant concentration sampling point during peak hourly flow or at an alternative location approved by the department.

c. The residual disinfectant concentration (C) of the water before or at the first customer and before each additional point of disinfectant application shall be measured at peak hourly flow.

d. The disinfectant contact times (T) of the water before or at the first customer and before each additional point of disinfectant application shall be determined during peak hourly flow. The disinfectant contact time to be used for calculating CT is T_{10}, which is the detention time at which 90% of the water passing through a unit is retained within that unit. T_{10} shall be determined either by calculations that involve the theoretical hydraulic detention time and baffling factors that account for the degree of short-circuiting that might be expected through

any given unit or by tracer studies. The baffling factors listed in Table 500.15 shall be used in determining contact time if tracer studies are not performed.

e. Inactivation credits for ozone contactors will be based on only the chambers that have a measured ozone residual. A minimum of two dedicated online monitors per ozone contactor shall be installed at locations suited to the CT calculation method used. Ozone residual levels shall be monitored continuously and recorded. Methods for computing log inactivation of Giardia lamblia and virus shall be approved by the department. Tracer studies shall be required to verify T_{10} values before receiving inactivation credit.

3. Instead of conducting new monitoring under subdivision D 2 of this section, an owner may elect to meet the requirements of subdivision D 3 a or D 3 b of this section.

a. The owner who has at least one year of existing data that are substantially equivalent to data collected under the provisions of subdivision D 3 of this section shall use these data to develop disinfection profiles if the owner has neither made a significant change to the treatment practice nor changed sources since the data were collected. The owner may develop a disinfection profile using up to three years of existing data.

b. The owner may use a disinfection profile developed previously in accordance with the procedures in subdivisions D 1, D 2, and D 3 of this section, if the owner has neither made a change to the treatment practice nor changed sources since the profile was developed. An owner that has not developed a virus profile shall develop a virus disinfection profile using the same monitoring data on which the Giardia lamblia profile is based.

E. The owner shall calculate the total inactivation ratio for Giardia lamblia and viruses as specified in subdivisions E 1 through E 4 of this subsection based on $CT_{99.9}$ (3-log) values using the appropriate values in Tables 500.2 through 500.14. Note that the 3-log values in the tables for Giardia lamblia also indicate that a 4-log virus inactivation can be achieved. pH and temperature values between the indicated values in Tables 500.2 through 500.14 shall be determined by linear interpolation, or the CT value at the lower temperature and at the higher pH shall be used. All parameters necessary to determine the total inactivation ratio shall be monitored during peak hourly flow.

1. The owner using only one point of disinfectant application shall determine the total inactivation ratio for the disinfection segment based on either of the following methods:

a. Determine one inactivation ratio ($CT_{calc}/CT_{99.9}$) before or at the first customer during peak hourly flow.

b. Determine successive $CT_{calc}/CT_{99.9}$ values, representing sequential inactivation ratios, between the point of disinfectant application and a point before or at the first customer during peak hourly flow. The owner shall calculate the total inactivation ratio by determining ($CT_{calc}/CT_{99.9}$) for each sequence and then adding the ($CT_{calc}/CT_{99.9}$) values together to determine total inactivation ($\sum (CT_{calc}/CT_{99.9})$).

2. The owner using more than one point of disinfectant application before the first customer shall determine the CT value of each disinfection segment immediately before the next point of disinfectant application, or for the final segment before or at the first customer, during peak hourly flow. The ($CT_{calc}/CT_{99.9}$) value of each segment and ($\sum (CT_{calc}/CT_{99.9})$) shall be calculated using the method in subdivision E 1 a or E 1 b of this subsection.

3. The owner shall determine the total logs of inactivation of Giardia lamblia by multiplying the value calculated in subdivision E 1 a or E 1 b of this subsection by 3.0.

4. The owner shall determine the total logs of inactivation of viruses by multiplying the value calculated in subdivision E 1 a or E 1 b of this subsection by 4.0.

F. A disinfection benchmark shall be calculated following the procedures in subdivisions F 1, F 2, and F 3 of this subsection.

1. For each year of profiling data collected and calculated, an owner shall determine the lowest mean monthly level of both Giardia lamblia and virus inactivation. The owner shall determine the mean Giardia lamblia and virus inactivation for each calendar month for each year of profiling data by dividing the sum of daily or weekly Giardia lamblia and virus log inactivation by the number of values calculated for that month.

2. The disinfection benchmark is the lowest monthly mean value (for waterworks with one year of profiling data) or the mean of the lowest monthly mean values (for waterworks with more than one year of profiling data) of Giardia lamblia and virus log inactivation in each year of profiling data.

3. The owner of a waterworks using chloramines, ozone, or chlorine dioxide for primary disinfection shall calculate the disinfection benchmark for viruses from the data collected in the same manner used to calculate the Giardia lamblia disinfection benchmark.

G. The owner shall retain the disinfection profile in graphic form, as a spreadsheet or in some other format acceptable to the department for evaluation as part of sanitary surveys conducted by the department.

H. Before making a significant change to the waterworks disinfection practice, the owner shall review the disinfection benchmark and consult with the department.

1. Significant changes to disinfection practice are (i) changes to the point of disinfectant application, (ii) changes to the disinfectants used in the treatment plant, (iii) changes to the disinfection process, and (iv) any other modification identified by the department.

2. The owner shall submit the following information to the department as part of the consultation process: (i) a description of the proposed change; (ii) the disinfection profile and benchmarks established for Giardia lamblia and, if necessary, viruses; (iii) an analysis of how the proposed change will affect the current levels of disinfection; and (iv) any additional information to justify the change.

TABLE 500.2 CT Values for 3-Log Inactivation of Giardia lamblia by Free Chlorine at Less than 0.5ºC							
FREE RESIDUAL (mg/L)	pH						
	≤ 6.0	6.5	7.0	7.5	8.0	8.5	≤ 9.0
≤ 0.4	137	163	195	237	277	329	390
0.6	141	168	200	239	286	342	407
0.8	145	172	205	246	295	354	422
1.0	148	176	210	253	304	365	437
1.2	152	180	215	259	313	376	451
1.4	155	184	221	266	321	387	464
1.6	157	189	226	273	329	397	477
1.8	162	193	231	279	338	407	489
2.0	165	197	236	286	346	417	500
2.2	169	201	242	297	353	426	511
2.4	172	205	247	298	361	435	522
2.6	175	209	252	304	368	444	533
2.8	178	213	257	310	375	452	543
3.0	181	217	261	316	382	460	552

TABLE 500.3 CT Values for 3-Log Inactivation of Giardia lamblia by Free Chlorine at 5ºC							
FREE RESIDUAL (mg/L)	pH						
	≤ 6.0	6.5	7.0	7.5	8.0	8.5	≤ 9.0
≤ 0.4	97	117	139	166	198	236	279
0.6	100	120	143	171	204	244	291
0.8	103	122	146	175	210	252	301
1.0	105	125	149	179	216	260	312
1.2	107	127	152	183	221	267	320
1.4	109	130	155	187	227	274	329
1.6	111	132	158	192	232	281	337
1.8	114	135	162	196	238	287	345
2.0	116	138	165	200	243	294	353
2.2	118	140	169	204	248	300	361
2.4	120	143	172	209	253	306	368
2.6	122	146	175	213	258	312	375
2.8	124	148	178	217	263	318	382
3.0	126	151	182	221	268	324	389

TABLE 500.4 CT Values for 3-Log Inactivation of Giardia lamblia by Free Chlorine at 10°C							
FREE RESIDUAL (mg/L)	pH						
	≤ 6.0	6.5	7.0	7.5	8.0	8.5	≤ 9.0
≤ 0.4	73	88	104	125	149	177	209
0.6	75	90	107	128	153	183	218
0.8	78	92	110	131	158	189	226
1.0	79	94	112	134	162	195	234
1.2	80	95	114	137	166	200	240
1.4	82	98	116	140	170	206	247
1.6	83	99	119	144	174	211	253
1.8	86	101	122	147	179	215	259
2.0	87	104	124	150	182	221	265
2.2	89	105	127	153	186	225	271
2.4	90	107	129	157	190	230	276
2.6	92	110	131	160	194	234	281
2.8	93	111	134	163	197	239	287
3.0	95	113	137	166	201	243	292

TABLE 500.5 CT Values for 3-Log Inactivation of Giardia lamblia by Free Chlorine at 15°C							
FREE RESIDUAL (mg/L)	pH						
	≤ 6.0	6.5	7.0	7.5	8.0	8.5	≤ 9.0
≤ 0.4	49	59	70	83	99	118	140
0.6	50	60	72	86	102	122	146
0.8	52	61	73	88	105	126	151
1.0	53	63	75	90	108	130	156
1.2	54	64	76	92	111	134	160
1.4	55	65	78	94	114	137	165
1.6	56	66	79	96	116	141	169
1.8	57	68	81	98	119	144	173
2.0	58	69	83	100	122	147	177
2.2	59	70	85	102	124	150	181
2.4	60	72	86	105	127	153	184
2.6	61	73	88	107	129	156	188
2.8	62	74	89	109	132	159	191
3.0	63	76	91	111	134	162	195

TABLE 500.6 CT Values for 3-Log Inactivation of Giardia lamblia by Free Chlorine at 20ºC							
FREE RESIDUAL (mg/L)	pH						
	≤ 6.0	6.5	7.0	7.5	8.0	8.5	≤ 9.0
≤ 0.4	36	44	52	62	74	89	105
0.6	38	45	54	64	77	92	109
0.8	39	46	55	66	79	95	113
1.0	39	47	56	67	81	98	117
1.2	40	48	57	69	83	100	120
1.4	41	49	58	70	85	103	123
1.6	42	50	59	72	87	105	126
1.8	43	51	61	74	89	108	129
2.0	44	52	62	75	91	110	132
2.2	44	53	63	77	93	113	135
2.4	45	54	65	78	95	115	138
2.6	46	55	66	80	97	117	141
2.8	47	56	67	81	99	119	143
3.0	47	57	68	83	101	122	146

TABLE 500.7 CT Values for 3-Log Inactivation of Giardia lamblia by Free Chlorine at 25oC and Higher							
FREE RESIDUAL (mg/L)	pH						
	≤ 6.0	6.5	7.0	7.5	8.0	8.5	≤ 9.0
≤ 0.4	24	29	35	42	50	59	70
0.6	25	30	36	43	51	61	73
0.8	26	31	37	44	53	63	75
1.0	26	31	37	45	54	65	78
1.2	27	32	38	46	55	67	80
1.4	27	33	39	47	57	69	82
1.6	28	33	40	48	58	70	84
1.8	29	34	41	49	60	72	86
2.0	29	35	41	50	61	74	88
2.2	30	35	42	51	62	75	90
2.4	30	36	43	52	63	77	92
2.6	31	37	44	53	65	78	94
2.8	31	37	45	54	66	80	96
3.0	32	38	46	55	67	81	97

TABLE 500.8 CT Values for Inactivation of Viruses by Free Chlorine, pH 6.0-9.0									
LOG INACTIVATION CREDIT	WATER TEMPERATURE (°C)								
	0.5	1	2	3	4	5	6	7	8
2	6.0	5.8	5.3	4.9	4.4	4.0	3.8	3.6	3.4
3	9.0	8.7	8.0	7.3	6.7	6.0	5.6	5.2	4.8
4	12.0	11.6	10.7	9.8	8.9	8.0	7.6	7.2	6.8
LOG INACTIVATION CREDIT	WATER TEMPERATURE (°C)								
	9	10	11	12	13	14	15	16	17
2	3.2	3.0	2.8	2.6	2.4	2.2	2.0	1.8	1.6
3	4.4	4.0	3.8	3.6	3.4	3.2	3.0	2.8	2.6
4	6.4	6.0	5.6	5.2	4.8	4.4	4.0	3.8	3.6
LOG INACTIVATION CREDIT	WATER TEMPERATURE (°C)								
	18	19	20	21	22	23	24	25	
2	1.4	1.2	1.0	1.0	1.0	1.0	1.0	1.0	
3	2.4	2.2	2.0	1.8	1.6	1.4	1.2	1.0	
4	3.4	3.2	3.0	2.8	2.6	2.4	2.2	2.0	

TABLE 500.9 CT Values for Inactivation of Giardia lamblia by Chlorine Dioxide, pH 6.0-9.0									
LOG INACTIVATION CREDIT	WATER TEMPERATURE (°C)								
	1	2	3	4	5	6	7	8	9
0.5	10.0	8.6	7.2	5.7	4.3	4.2	4.2	4.1	4.1
1	21.0	17.9	14.9	11.8	8.7	8.5	8.3	8.1	7.9
1.5	32.0	27.3	22.5	17.8	13.0	12.8	12.6	12.4	12.2
2	42.0	35.8	29.5	23.3	17.0	16.6	16.2	15.8	15.4
2.5	52.0	44.5	37.0	29.5	22.0	21.4	20.8	20.2	19.6
3	63.0	53.8	44.5	35.3	26.0	25.4	24.8	24.2	23.6
LOG INACTIVATION CREDIT	WATER TEMPERATURE (°C)								
	10	11	12	13	14	15	16	17	18
0.5	4.0	3.8	3.7	3.5	3.4	3.2	3.1	2.9	2.8
1	7.7	7.4	7.1	6.9	6.6	6.3	6.0	5.8	5.5
1.5	12.0	11.6	11.2	10.8	10.4	10.0	9.5	9.0	8.5
2	15.0	14.6	14.2	13.8	13.4	13.0	12.4	11.8	11.2
2.5	19.0	3.8	3.7	3.5	3.4	3.2	3.1	2.9	2.8
3	23.0	7.4	7.1	6.9	6.6	6.3	6.0	5.8	5.5
LOG INACTIVATION CREDIT	WATER TEMPERATURE (°C)								
	19	20	21	22	23	24	25		
0.5	2.6	2.5	2.4	2.3	2.2	2.1	2.0		
1	5.3	5.0	4.7	4.5	4.2	4.0	3.7		
1.5	8.0	7.5	7.1	6.7	6.3	5.9	5.5		
2	10.6	10.0	9.5	8.9	8.4	7.8	7.3		
2.5	2.6	2.5	12.2	11.4	10.6	9.8	9.0		
3	5.3	5.0	14.2	13.4	12.6	11.8	11.0		

TABLE 500.10 CT Values for Inactivation of Virus by Chlorine Dioxide, pH 6.0-9.0									
LOG INACTIVATION CREDIT	WATER TEMPERATURE (°C)								
	1	2	3	4	5	6	7	8	9
2	8.4	7.7	7.0	6.3	5.6	5.3	5.0	4.8	4.5
3	25.6	23.5	21.4	19.2	17.1	16.2	15.4	14.5	13.7
4	50.1	45.9	41.8	37.6	33.4	31.7	30.1	28.4	26.8
LOG INACTIVATION CREDIT	WATER TEMPERATURE (°C)								
	10	11	12	13	14	15	16	17	18
2	4.2	3.9	3.6	3.4	3.1	2.8	2.7	2.5	2.4
3	12.8	12.0	11.1	10.3	9.4	8.6	8.2	7.7	7.3
4	25.1	23.4	21.7	20.1	18.4	16.7	15.9	15.0	14.2
LOG INACTIVATION CREDIT	WATER TEMPERATURE (°C)								
	19	20	21	22	23	24	25		
2	2.2	2.1	2.0	1.8	1.7	1.5	1.4		
3	6.8	6.4	6.0	5.6	5.1	4.7	4.3		
4	13.3	12.5	11.7	10.9	10.0	9.2	8.4		

TABLE 500.11
CT Values for Inactivation of Giardia lamblia by Chloramines, pH 6.0-9.0

LOG INACTIVATION CREDIT	WATER TEMPERATURE (°C)								
	1	2	3	4	5	6	7	8	9
0.5	635	568	500	433	365	354	343	332	321
1	1,270	1,136	1,003	869	735	711	687	663	639
1.5	1,900	1,700	1,500	1,300	1,100	1,066	1,032	998	964
2	2,535	2,269	2,003	1,736	1,470	1,422	1,374	1,326	1,278
2.5	3,170	2,835	2,500	2,165	1,830	1,772	1,714	1,656	1,598
3	3,800	3,400	3,000	2,600	2,200	2,130	2,060	1,990	1,920
LOG INACTIVATION CREDIT	WATER TEMPERATURE (°C)								
	10	11	12	13	14	15	16	17	18
0.5	310	298	286	274	262	250	237	224	211
1	615	592	569	546	523	500	474	448	422
1.5	930	894	858	822	786	750	710	670	630
2	1,230	1,184	1,138	1,092	1,046	1,000	947	894	841
2.5	1,540	1,482	1,424	1,366	1,308	1,250	1,183	1,116	1,049
3	1,850	1,780	1,710	1,640	1,570	1,500	1,420	1,340	1,260
LOG INACTIVATION CREDIT	WATER TEMPERATURE (°C)								
	19	20	21	22	23	24	25		
0.5	198	185	173	161	149	137	125		
1	396	370	346	322	298	274	250		
1.5	590	550	515	480	445	410	375		
2	788	735	688	641	594	547	500		
2.5	982	915	857	799	741	683	625		
3	1,180	1,100	1,030	960	890	820	750		

TABLE 500.12 CT Values for Inactivation of Virus by Chloramines, pH 6.0-9.0									
LOG INACTIVATION CREDIT	WATER TEMPERATURE (°C)								
	1	2	3	4	5	6	7	8	9
2	1,243	1,147	1,050	954	857	814	771	729	686
3	2,063	1,903	1,743	1,583	1,423	1,352	1,281	1,209	1,138
4	2,883	2,659	2,436	2,212	1,988	1,889	1,789	1,690	1,590
LOG INACTIVATION CREDIT	WATER TEMPERATURE (°C)								
	10	11	12	13	14	15	16	17	18
2	643	600	557	514	471	428	407	385	364
3	1,067	996	925	854	783	712	676	641	605
4	1,491	1392	1292	1193	1,093	994	944	895	845
LOG INACTIVATION CREDIT	WATER TEMPERATURE (°C)								
	19	20	21	22	23	24	25		
2	342	321	300	278	257	235	214		
3	570	534	498	463	427	392	356		
4	796	746	696	646	597	547	497		

TABLE 500.13 CT Values for Inactivation of Giardia lamblia by Ozone									
LOG INACTIVATION CREDIT	WATER TEMPERATURE (°C)								
	1	2	3	4	5	6	7	8	9
0.5	0.48	0.44	0.40	0.36	0.32	0.30	0.28	0.27	0.25
1	0.97	0.89	0.80	0.72	0.63	0.60	0.57	0.54	0.51
1.5	1.50	1.36	1.23	1.09	0.95	0.90	0.86	0.81	0.77
2	1.90	1.75	1.60	1.45	1.30	1.23	1.16	1.09	1.02
2.5	2.40	2.20	2.00	1.80	1.60	1.52	1.44	1.36	1.28
3	2.90	2.65	2.40	2.15	1.90	1.81	1.71	1.62	1.52
LOG INACTIVATION CREDIT	WATER TEMPERATURE (°C)								
	10	11	12	13	14	15	16	17	18
0.5	0.23	0.22	0.20	0.19	0.17	0.16	0.15	0.14	0.14
1	0.48	0.45	0.42	0.38	0.35	0.32	0.30	0.29	0.27
1.5	0.72	0.67	0.62	0.58	0.53	0.48	0.46	0.43	0.41
2	0.95	0.89	0.82	0.76	0.69	0.63	0.60	0.57	0.54
2.5	1.20	1.12	1.04	0.95	0.87	0.79	0.75	0.71	0.68
3	1.43	1.33	1.24	1.14	1.05	0.95	0.90	0.86	0.81
LOG INACTIVATION CREDIT	WATER TEMPERATURE (°C)								
	19	20	21	22	23	24	25		
0.5	0.13	0.12	0.11	0.10	0.10	0.09	0.08		
1	0.26	0.24	0.22	0.21	0.19	0.18	0.16		
1.5	0.38	0.36	0.34	0.31	0.29	0.26	0.24		
2	0.51	0.48	0.45	0.42	0.38	0.35	0.32		
2.5	0.64	0.60	0.56	0.52	0.48	0.44	0.40		
3	0.13	0.12	0.11	0.10	0.10	0.09	0.08		

TABLE 500.14 CT Values for Inactivation of Virus by Ozone									
LOG INACTIVATION CREDIT	WATER TEMPERATURE (°C)								
	1	2	3	4	5	6	7	8	9
2	0.90	0.83	0.75	0.68	0.60	0.58	0.56	0.54	0.52
3	1.40	1.28	1.15	1.03	0.90	0.88	0.86	0.84	0.82
4	1.80	1.65	1.50	1.35	1.20	1.16	1.12	1.08	1.04
LOG INACTIVATION CREDIT	WATER TEMPERATURE (°C)								
	10	11	12	13	14	15	16	17	18
2	0.50	0.46	0.42	0.38	0.34	0.30	0.29	0.28	0.27
3	0.80	0.74	0.68	0.62	0.56	0.50	0.48	0.46	0.44
4	1.00	0.92	0.84	0.76	0.68	0.60	0.58	0.56	0.54
LOG INACTIVATION CREDIT	WATER TEMPERATURE (°C)								
	19	20	21	22	23	24	25		
2	0.26	0.25	0.23	0.21	0.19	0.17	0.15		
3	0.42	0.40	0.37	0.34	0.31	0.28	0.25		
4	0.52	0.50	0.46	0.42	0.38	0.34	0.30		

TABLE 500.15 Baffling Classifications		
BAFFLING CONDITION	T_{10}/T	BAFFLING DESCRIPTION
Unbaffled (mixed flow)	0.1	None, agitated basin, very low length-to-width ratio, high inlet and outlet flow velocities
Poor	0.3	Single or multiple unbaffled inlets and outlets, no intra-basin baffles
Average	0.5	Baffled inlet or outlet with some intra-basin baffles
Superior	0.7	Perforated inlet baffle, serpentine or perforated intra-basin baffles, outlet weir or perforated launders

12VAC5-590-505. Emergency management plan for extended power outages.

A. The owner of a community waterworks (including consecutive waterworks) shall develop and maintain an emergency management plan for extended power outages.

B. The plan shall be kept current and shall be retained at a location that is readily accessible to the owner in the event of an extended power outage.

C. The owner of a community waterworks shall certify in writing to the department that the plan has been completed.

D. The plan shall address the following where applicable:

1. Identification of the criteria (events, duration of power outage, etc.) that will initiate activation of the plan.

2. How the owner will respond to an extended power outage lasting a minimum of five days.

3. Procedures for obtaining and distributing potable water in the event that the primary sources become unavailable.

4. Notification procedures and example notices to the public and media (local radio stations, television stations, local newspapers, etc.) including conservation notices and boil water advisories.

5. Emergency disinfection procedures for the distribution system and storage tank.

6. The point of contact for the department.

7. The points of contact for the waterworks personnel who should be notified.

8. The point of contact for the Local Emergency Coordinator designated by the Virginia Department of Emergency Management.

9. The points of contact for the electric power, natural gas, and propane distributors, or other energy supplier to the waterworks.

12VAC5-590-510. Acceptable operating practices.

A. This section is not intended to be all inclusive but reflects the concern for the public health significance of certain practices related to waterworks operation.

B. Filter operation.

1. Gravity flow granular media filters designed for pathogen and turbidity removal shall not be operated without adequate chemical coagulation as determined by the department.

2. A waterworks utilizing gravity flow granular media filtration shall not vary the rate of filtration through any single filter above its design capacity unless approved by the department.

3. Gravity flow granular media filters equipped with filter-to-waste facilities shall not be returned to service after backwashing until a thorough rinsing period has occurred so that the filter-to-waste water has a turbidity less than or equal to 0.3 NTU.

4. All MF and UF technologies employed for pathogen removal shall demonstrate removal efficiency equal to the removal (log inactivation) credit given in Table 500.1. A direct integrity test acceptable to the department shall be conducted and include the following:

a. The direct integrity test capability shall be provided for each filter unit; and

b. The direct integrity test shall be conducted at least daily for each day the filtration unit is in operation.

C. All waterworks shall provide a minimum working pressure of 20 psigauge (psig) at all service connections.

D. The board recommends that all community waterworks in the Commonwealth deliver the optimum fluoride ion concentration as determined by the U.S. Department of Health and Human Services.

E. A waterworks owner shall provide the commissioner at least 90 days prior written notice of the intent to initiate or discontinue a program to provide the optimum fluoride ion concentration.

12VAC5-590-515. Use of chemicals.

A. All chemicals used in water treatment shall be compliant with NSF/ANSI/CAN Standard 60-2020. These chemicals shall include the following:

1. Corrosion and scale inhibitors;

2. Coagulants and flocculants;

3. Disinfectants and oxidants;

4. pH adjustment chemicals;

5. Regenerating agents; and

6. Membrane cleaning compounds.

B. Chemical containers shall bear the proper certification mark and identification consistent with the Safety Data Sheet for the chemical used.

C. The owner shall maintain documentation verifying that all chemicals meet NSF/ANSI/CAN Standard 60-2020 certification requirements.

12VAC5-590-520. Waterworks capacity.

A. When the water production of a community waterworks reaches 80% of the permitted capacity for any consecutive three-month period, the owner shall prepare and submit a written plan within 30 days of notification by the department to address capacity needs. This plan shall be evaluated by the department and corrective actions shall be approved by the department.

B. The department may require the owner to reevaluate the source water capacity of a well by conducting a yield and drawdown test in accordance with 12VAC5-590-840 H when the well has demonstrated declining yield.

12VAC5-590-530. Reporting.

A. The results of all required monitoring activity shall be reported by the owner or the owner's authorized agent to the department no later than (i) the 10th day of the month following the month during which the test results were received, or (ii) the 10th day following the end of the monitoring period, whichever is shorter, unless stipulated otherwise by the department. The results of any required monitoring activity shall be reported by the owner or the owner's authorized agent in a format and method prescribed by the department. For routine compliance samples analyzed for contaminants listed in Tables 340.1 through 340.7, the owner shall request that the certified analytical laboratory performing the analyses provide the data electronically to the department as per the requirements of this section.

B. It shall be the duty and responsibility of an owner to report to the department in the most expeditious manner for circumstances identified in subsections C through J of this section. The owner shall contact the department for the acceptable notification method. The official laboratory data report shall be sent to the department as soon as practical.

C. Bacteriological examination reporting.

1. When a bacteriological examination shows that samples are required (see 12VAC5-590-380 D), the owner shall collect the repeat samples within 24 hours of being notified of the positive result and shall report the repeat sample results to the department.

2. Microbial contamination, as evidenced by one or more routine distribution system water samples indicating the presence of E. coli or waterborne pathogens, shall be reported by the owner to the department by the end of the day when the owner was notified of the test result, unless the department is closed, in which case the department shall be notified before the end of the next business day.

3. An E. coli PMCL violation shall be reported by the owner to the department by the end of the day when the owner was notified of the test result, unless the department is closed, in which case the department shall be notified before the end of the next business day.

4. The owner who has failed to comply with the monitoring requirements of 12VAC5-590-370 shall report the monitoring violation to the department in writing within 10 days after the owner discovers the violation and shall notify the public in accordance with 12VAC5-590-540 A 3.

D. Turbidity reporting. For a waterworks required to filter for pathogen and turbidity removal, a report shall be made within 24 hours to the department if the filtered water turbidity measurement exceeds the following concentrations based on the filtration treatment type:

1. Conventional filtration -- one NTU.

2. Diatomaceous earth filtration -- five NTU.

3. Slow sand filtration -- five NTU.

4. Membrane, bag and cartridge filtration -- one NTU.

E. PMCL exceedance.

1. When a PMCL of an inorganic or organic chemical is exceeded for a single sample the owner shall report the exceedance within seven days. If a sample result would cause the compliance average to be exceeded, then the owner shall report the sample result, in context with the compliance average, to the department within 48 hours.

2. When the average value of the samples collected pursuant to 12VAC5-590-382 and 12VAC5-590-383 exceeds the PMCL of an inorganic or organic chemical, the owner shall report the exceedance to the department within 48 hours.

3. When the PMCL for a radionuclide has been exceeded as determined by Table 340.4, the results shall be reported to the department within 48 hours.

F. The owner shall report to the department within 48 hours of the failure to comply with the monitoring and sanitary survey requirements of this chapter.

G. The owner shall report to the department within 48 hours of the failure to comply with the requirements of the schedule prescribed pursuant to a variance or exemption.

H. The owner shall report a Tier 1 violation or situation, as described in 12VAC5-590-540 A 1, to the department as soon as practical, but no later than 24 hours after the owner learns of the Tier 1 violation or situation. At the same time the report is made, the owner shall consult with the department to determine the need for any additional actions to address the violation or situation.

I. Reporting requirements for coliform treatment technique violations.

1. The owner that has violated the treatment technique required in 12VAC5-590-392 B shall report the violation to the department no later than the end of the next business day after learning of the violation and shall notify the public in accordance with 12VAC5-590-540 A 2.

2. The owner that is required to conduct an assessment under 12VAC5-590-392 C shall submit the assessment report within 30 days to the department.

3. The owner shall notify the department in writing after each scheduled corrective action is completed for corrections that were not completed by the time of submission of the assessment form under the requirements of 12VAC5-590-392 C.

J. The owner of a seasonal waterworks shall submit the certification of completion of the approved start-up procedure on a form approved by the department before serving water.

K. Reporting requirements for groundwater systems. The owner shall report the following information in accordance with subsection A of this section:

1. The owner conducting compliance monitoring as required by 12VAC5-590-421 C shall notify the department as soon as practical, but no later than the next business day, whenever the groundwater system fails to meet the department-specified minimum residual disinfectant concentration for more than four hours.

2. The owner required to conduct corrective action as described in 12VAC5-590-421 A shall notify the department within 30 days of completion of corrective action.

3. The owner subject to the source water monitoring requirements of 12VAC5-590-379 that do not conduct this monitoring under the provision of 12VAC5-590-380 E shall provide documentation to the department within 30 days of the collection that the sample met the criteria defined in 12VAC5-590-380 E.

12VAC5-590-531. Reporting requirements for filtration treatment and disinfection treatment.

A. The owner of a waterworks using a surface water source, a GUDI source, or both shall report monthly to the department the following specified information.

1. Turbidity measurements as required by 12VAC5-590-376 B shall be reported within 10 days after the end of each month the waterworks serves water to the public. Information that shall be reported includes:

a. The total number of filtered water turbidity measurements collected during the month.

b. The number and percentage of filtered water turbidity measurements collected during the month that are less than or equal to the turbidity limits specified in 12VAC5-590-395 A 2 b for the filtration technology being used.

c. The owner of a waterworks that uses lime softening may apply to the department for alternative exceedance levels for the levels specified in subdivision A 1 b of this section if the owner can demonstrate that higher turbidity levels in individual filters are due to lime carryover only and not due to degraded filter performance.

2. The owner of a waterworks with combined distribution systems serving at least 10,000 persons using a surface water source, a GUDI source, or both that provides conventional filtration treatment or direct filtration shall report monthly to the department the information specified in subdivisions A 2 a and A 2 b of this section. Also, the owner of a waterworks that provides filtration approved under 12VAC5-590-395 A 2 b shall report monthly to the department the information specified in subdivisions A 2 a and A 2 b of this section.

a. Turbidity measurements collected to meet 12VAC5-590-395 A 2 b shall be reported within 10 days after the end of each month the waterworks serves water to the public. Information that shall be reported includes:

(1) The total number of filtered water turbidity measurements collected during the month.

(2) The number and percentage of filtered water turbidity measurements collected during the month that are less than or equal to the turbidity limits specified in 12VAC5-590-395 A 2 b.

(3) The date and value of any turbidity measurements collected during the month that exceed 1.0 NTU for waterworks using conventional filtration treatment or direct filtration or that exceed the maximum level set by the department under 12VAC5-590-395 A 2 b.

b. The owner shall maintain the results of individual filter monitoring collected under 12VAC5-590-376 B for at least three years. The owner shall report the completion of individual filter turbidity monitoring under 12VAC5-590-376 B within 10 days after the end of each month the waterworks serves water to the public. The owner shall report individual filter turbidity measurement results collected under 12VAC5-590-376 B within 10 days after the end of each month the waterworks serves water to the public only if measurements demonstrate one or more of the conditions in 12VAC5-590-395 A 2 b. The owner of a waterworks that uses lime softening may apply to the department for alternative exceedance levels for the levels specified in 12VAC5-590-395 A 2 b if the owner can demonstrate that higher turbidity levels in individual filters are due to lime carryover only and not due to degraded filter performance.

3. For a waterworks with combined distribution systems serving 10,000 or more persons.

a. For an individual filter that has a measured turbidity level of greater than 1.0 NTU in two consecutive measurements collected 15 minutes apart, the owner shall report the filter number, the turbidity measurement, and the dates on which the exceedances occurred. In addition, the owner shall either produce a filter profile for the filter within seven days of the exceedance if the owner is not able to identify an obvious reason for the abnormal filter performance and report that the profile has been produced or report the obvious reason for the exceedance.

b. For an individual filter that has a measured turbidity level of greater than 0.5 NTU in two consecutive measurements collected 15 minutes apart at the end of the first four hours of continuous filter operation after the filter has been backwashed or otherwise taken offline, the owner shall report the filter number, the turbidity, and the dates on which the exceedances occurred. In addition, the owner shall either produce a filter profile for the filter within seven days of the exceedance if the owner is not able to identify an obvious reason for the abnormal filter performance and report that the profile has been produced or report the obvious reason for the exceedance.

c. For an individual filter that has a measured turbidity level of greater than 1.0 NTU in two consecutive measurements collected 15 minutes apart at any time in each of three consecutive months, the owner shall report the filter number, the turbidity measurement, and the dates on which the exceedances occurred. In addition, the waterworks shall conduct a self-assessment of the filter within 14 days of the exceedances and report that the self-assessment was conducted. The self-assessment shall consist of at least the following components: assessment of filter performance, development of a filter profile, identification and prioritization of factors limiting filter performance, assessment of the applicability of corrections, and preparation of a filter self-assessment report.

d. For an individual filter that has a measured turbidity level of greater than 2.0 NTU in two consecutive measurements collected 15 minutes apart at any time in each of two consecutive months, the owner shall report the filter number, the turbidity measurement, and the dates on which the exceedances occurred. In addition, the owner shall arrange for the conduct of a comprehensive performance evaluation (CPE) by the department or a third party approved by the department no later than 30 days following the exceedance and have the evaluation completed and submitted to the department no later than 90 days following the exceedance. A CPE means a thorough evaluation and analysis of a water treatment plant's performance-based capabilities and associated administrative, operational, and maintenance practices. A CPE is conducted to identify factors that may be adversely impacting a water treatment plant's capability to achieve compliance and emphasizes approaches that can be implemented without significant capital improvements.

4. For a waterworks with combined distribution systems serving fewer than 10,000 persons.

a. For an individual filter or the turbidity of CFE for waterworks with two filters that monitor CFE instead of individual filters that has a measured turbidity level of greater than 1.0 NTU in

two consecutive measurements collected 15 minutes apart, the owner shall report the filter numbers, the turbidity measurements, and the dates on which the exceedances occurred and the cause (if known) for the exceedances.

b. For an individual filter or the turbidity of CFE for a waterworks with two filters that monitor CFE instead of individual filters that has a measured turbidity level of greater than 1.0 NTU in two consecutive measurements collected 15 minutes apart at any time in each of three consecutive months, the owner shall conduct a self-assessment of the filters within 14 days of the day the filter exceeded 1.0 NTU unless a CPE as specified in subdivision A 4 c of this section was required. A waterworks with two filters that monitor the CFE instead of individual filters shall conduct a self-assessment on both filters. The self-assessment shall be reported to the department and consist of at least the following components: (i) date the self-assessment was triggered, (ii) date the self-assessment was completed, (iii) an assessment of filter performance, (iv) development of a filter profile, (v) identification and prioritization of factors limiting filter performance, (vi) assessment of the applicability of corrections, and (vii) preparation of a filter self-assessment report. The self-assessment shall be submitted within 10 days after the end of the month or 14 days after the self-assessment was triggered only if it was triggered during the last four days of the month.

c. For an individual filter or the turbidity of CFE for a waterworks with two filters that monitor CFE instead of individual filters that has a measured turbidity level of greater than 2.0 NTU in two consecutive measurements collected 15 minutes apart at any time in each of two consecutive months, the owner shall arrange for a CPE, as defined in subdivision A 3 d of this section, by the department or a third party approved by the department no later than 60 days following the day the filter exceeded 2.0 NTU in two consecutive months. The owner shall report within 10 days after the end of the month that a CPE is required and the date that it was triggered. If a CPE has been completed by the department or a third party approved by the department within the 12 prior months or the owner and the department are jointly participating in an ongoing comprehensive technical assistance project at the waterworks, then a new CPE is not required. If conducted, a CPE shall be completed and submitted to the department no later than 120 days following the day the filter exceeded 2.0 NTU in two consecutive measurements for the second straight month.

5. Reporting Cryptosporidium monitoring results.

a. The owner shall report results from the source water monitoring required in 12VAC5-590-401 B no later than 10 days after the end of the first month following the month when the sample is collected.

b. The owner shall report the following data elements for each Cryptosporidium analysis:

(1) Public water system (PWS) identification number;

(2) Facility identification number;

(3) Sample collection date;

(4) Sample type (field or matrix spike);

(5) Sample volume filtered (L), to nearest 1/4 L;

(6) Was 100% of filtered volume examined; and

(7) Number of oocysts counted.

c. Quality control for Cryptosporidium analysis:

(1) For matrix spike samples, the owner shall also report the sample volume spiked and the estimated number of oocysts spiked. These data are not required for field samples.

(2) For samples in which less than 10 L is filtered or less than 100% of the sample volume is examined, the owner shall also report the number of filters used and the packed pellet volume.

(3) For samples in which less than 100% of the sample volume is examined, the owner shall also report the volume of re-suspended concentrate and volume of this re-suspension processed through immunomagnetic separation.

d. The owner shall report the following data elements for each E. coli analysis:

(1) PWS identification number;

(2) Facility identification number;

(3) Sample collection date;

(4) Analytical method number;

(5) Method type;

(6) Source water type (flowing stream, lake or reservoir, GUDI source);

(7) E. coli/100 mL; and

(8) Turbidity.

e. The owner of a waterworks serving fewer than 10,000 persons and not required to monitor for turbidity under 12VAC5-590-401 B is not required to report turbidity with their E. coli results.

B. Reporting of requirements for enhanced treatment for Cryptosporidium.

1. The owner shall report sampling schedules under 12VAC5-590-401 B and source water monitoring results under 12VAC5-590-531 A 5, unless the owner notifies the department that the owner will not conduct source water monitoring due to meeting the criteria of 12VAC5-590-401 B 4.

2. The owner shall report the use of uncovered finished water storage facilities to the department as described in 12VAC5-590-415.

3. The owner of a waterworks that provide filtration shall report their Cryptosporidium bin classification as described in 12VAC5-590-401 D.

4. The owner shall report disinfection profiles and benchmarks to the department as described in 12VAC5-590-401 C 1 and C 2 before making a significant change in disinfection practice.

5. The owner shall report to the department in accordance with Table 531.1 for any microbial toolbox options used to comply with treatment requirements under 12VAC5-590-401 D 2. Alternatively, the department may approve a waterworks to certify operation within required parameters for treatment credit rather than reporting monthly operational data for toolbox options.

TABLE 531.1 Microbial Toolbox Reporting Requirements		
TOOLBOX OPTION	OWNERS SHALL SUBMIT THE FOLLOWING INFORMATION:	ON THE FOLLOWING SCHEDULE:
Alternative source or intake management	Verification that the waterworks has relocated the intake or adopted the intake withdrawal procedure reflected in monitoring results.	No later than the applicable treatment compliance date in 12VAC5-590-401 D 3.
Presedimentation	Monthly verification of the following: (i) Continuous basin operation; (ii) Treatment of 100% of the flow; (iii) Continuous addition of a coagulant; and (iv) At least 0.5-log mean reduction of influent turbidity or compliance with alternative performance criteria approved by the department.	Monthly reporting within 10 days following the month in which the monitoring was conducted, beginning on the applicable treatment compliance date in 12VAC5-590-401 D 3.
Two-stage lime softening	Monthly verification of the following: (i) Chemical addition and hardness precipitation occurred in two separate and sequential softening stages before filtration; and (ii) Both stages treated 100% of the water treatment plant flow.	Monthly reporting within 10 days following the month in which the monitoring was conducted, beginning on the applicable treatment compliance date in 12VAC5-590-401 D 3.
Bank filtration	Initial demonstration of the following: (i) Unconsolidated, predominantly sandy aquifer; and (ii) Setback distance of at least 25 ft. (0.5-log credit) or 50 ft. (1.0-log credit).	No later than the applicable treatment compliance date in 12VAC5-590-401 D 3.
	If monthly average of daily maximum turbidity is greater than 1.0 NTU then the waterworks shall report the result and submit an assessment of the cause.	Report within 30 days following the month in which the monitoring was conducted, beginning on the applicable treatment compliance date in 12VAC5-590-401 D 3.

TABLE 531.1 Microbial Toolbox Reporting Requirements (*continued*)		
TOOLBOX OPTION	OWNERS SHALL SUBMIT THE FOLLOWING INFORMATION:	ON THE FOLLOWING SCHEDULE:
Combined filter performance	Monthly verification of CFE turbidity levels less than or equal to 0.15 NTU in at least 95% of the four-hour CFE measurements collected each month.	Monthly reporting within 10 days following the month in which the monitoring was conducted, beginning on the applicable treatment compliance date in 12VAC5-590-401 D 3.
Individual filter performance	Monthly verification of the following: (i) Individual filter effluent turbidity levels less than or equal to 0.15 NTU in at least 95% of samples each month in each filter; and (ii) No individual filter greater than 0.3 NTU in two consecutive readings 15 minutes apart.	Monthly reporting within 10 days following the month in which the monitoring was conducted, beginning on the applicable treatment compliance date in 12VAC5-590-401 D 3.
Demonstration of performance	Results from testing following a protocol approved by the department.	No later than the applicable treatment compliance date in 12VAC5-590-401 D 3.
	As required by the department, monthly verification of operation within conditions of the department's approval for demonstration of performance credit.	Within 10 days following the month in which monitoring was conducted, beginning on the applicable treatment compliance date in 12VAC5-590-401 D 3.
Bag filters and cartridge filters	Demonstration that the following criteria are met: (i) Process meets the definition of bag or cartridge filtration; and (ii) Removal efficiency established through challenge testing that meets criteria in 12VAC5-590-401 E 6 a.	No later than the applicable treatment compliance date in 12VAC5-590-401 D 3.
	Monthly verification that 100% of the water treatment plant flow was filtered.	Within 10 days following the month in which monitoring was conducted, beginning on the applicable treatment compliance date in 12VAC5-590-401 D 3.

TABLE 531.1 Microbial Toolbox Reporting Requirements (*continued*)		
TOOLBOX OPTION	OWNERS SHALL SUBMIT THE FOLLOWING INFORMATION:	ON THE FOLLOWING SCHEDULE:
Membrane filtration	Results of verification testing demonstrating the following: (i) Removal efficiency established through challenge testing that meets criteria in subdivision B 5 of this section; and (ii) Integrity test method and parameters, including resolution, sensitivity, test frequency, control limits, and associated baseline.	No later than the applicable treatment compliance date in 12VAC5-590-401 D 3.
	Monthly report summarizing the following: (i) All direct integrity tests above the control limit; and (ii) If applicable, any turbidity or alternative indirect integrity monitoring approved by the department that results in triggering direct integrity testing and the corrective action that was taken.	Within 10 days following the month in which monitoring was conducted, beginning on the applicable treatment compliance date in 12VAC5-590-401 D 3.
Second stage filtration	Monthly verification that 100% of flow was filtered through both stages and the first stage was preceded by a coagulation step.	Within 10 days following the month in which monitoring was conducted, beginning on the applicable treatment compliance date in 12VAC5-590-401 D 3.
Slow sand filtration (as secondary filter)	Monthly verification that both a slow sand filter and a preceding separate stage of filtration treated 100% of flow from surface water or GUDI.	Within 10 days following the month in which monitoring was conducted, beginning on the applicable treatment compliance date in 12VAC5-590-401 D 3.
Chlorine dioxide	Summary of CT values for each day as described in 12VAC5-590-401 E 7 b (1).	Within 10 days following the month in which monitoring was conducted, beginning on the applicable treatment compliance date in 12VAC5-590-401 D 3.
Ozone	Summary of CT values for each day as described in 12VAC5-590-401 E 7 b (2).	Within 10 days following the month in which monitoring was conducted, beginning on the applicable treatment compliance date in 12VAC5-590-401D 3.

TABLE 531.1 Microbial Toolbox Reporting Requirements (*continued*)		
TOOLBOX OPTION	OWNERS SHALL SUBMIT THE FOLLOWING INFORMATION:	ON THE FOLLOWING SCHEDULE:
UV	Validation test results demonstrating operating conditions that achieve required UV dose.	No later than the applicable treatment compliance date in 12VAC5-590-401 D 3.
	Monthly report summarizing the percentage of water entering the distribution system that was not treated by UV reactors operating within validated conditions for the required dose as specified in 12VAC5-590-401 E 7 c (1).	Within 10 days following the month in which monitoring was conducted, beginning on the applicable treatment compliance date in 12VAC5-590-401 D 3.

C. Disinfection information specified in this subsection shall be reported to the department within 10 days after the end of each month the waterworks serves water to the public. Information that shall be reported includes:

1. For each day, the lowest measurement of residual disinfectant concentration in mg/L in water entering the distribution system.

2. The date and duration of each period when the residual disinfectant concentration in water entering the distribution system fell below 0.2 mg/L and when the department was notified of the occurrence.

3. The following information on the samples collected in the distribution system in conjunction with total coliform monitoring pursuant to 12VAC5-590-395 A 2.

a. Number of instances where the residual disinfectant concentration is measured;

b. Number of instances where the residual disinfectant concentration is not measured but HPC is measured;

c. Number of instances where the residual disinfectant concentration is measured but not detected and no HPC is measured;

d. Number of instances where no residual disinfectant concentration is detected and where HPC is greater than 500/mL;

e. Number of instances where the residual disinfectant concentration is not measured and HPC is greater than 500/mL; and

f. For the current and previous month the waterworks serves water to the public, the value of "V," in percent, in the following formula:

$$V = \left[\frac{(c+d+e)}{(a+b)}\right] * 100$$

a = the value in subdivision C 3 a of this section.

b = the value in subdivision C 3 b of this section.

c = the value in subdivision C 3 c of this section.

d = the value in subdivision C 3 d of this section.

e = the value in subdivision C 3 e of this section.

g. The department may determine that based on site-specific considerations if an owner has no means for having a sample transported and analyzed for HPC by a certified laboratory under the requisite time and temperature conditions and the waterworks is providing adequate disinfection in the distribution system, the HPC compliance requirements of subdivisions C 3 a through C 3 f of this section do not apply.

4. The owner need not report the data listed in subdivision C 1 of this section if all data listed in subdivisions C 1, C 2, and C 3 of this section remain on file at the waterworks and the department determines that the owner has submitted all of the information required by subdivisions C 1, C 2, and C 3 of this section for the last 12 months.

5. A waterworks using disinfection oxidants other than free chlorine after filtration shall continue to record disinfection profile measurements and incorporate log inactivation computations into their monthly operation reports, as described in 12VAC5-590-570.

D. Reporting requirements for DBPs. The owner shall report the following information to the department in accordance with 12VAC5-590-530. The department may choose to perform calculations and determine whether the PMCL was violated, instead of having the owner report that information.

1. Locational running annual average (LRAA) reporting:

a. The owner shall report the following information for each monitoring location to the department:

(1) Number of samples collected during the last quarter.

(2) Date and results of each sample collected during the last quarter.

(3) Arithmetic average of quarterly results for the last four quarters for each LRAA, beginning at the end of the fourth calendar quarter that follows the compliance date and at the end of each subsequent quarter. If the LRAA calculated based on fewer than four quarters of data would cause the PMCL to be exceeded regardless of the monitoring results of subsequent quarters, the owner shall report this information to the department as part of the first report due following the compliance date or anytime thereafter that this determination is made. If the owner is required to conduct monitoring at a frequency that is less than quarterly, then the owner shall make compliance calculations beginning with the first compliance sample collected after the compliance date, unless the owner is required to conduct increased monitoring under 12VAC5-590-374 F 5.

(4) Whether, based on 12VAC5-590-384 B 1, the PMCL was violated at any monitoring location.

(5) Any operational evaluation levels under 12VAC5-590-384 B 1 d that were exceeded during the quarter, and if so, the location and date and the calculated TTHM and HAA5 levels.

b. The owner of a waterworks using a surface water source, a GUDI source, or both seeking to qualify for or remain on reduced TTHM and HAA5 monitoring shall report the following source water TOC information for each water treatment plant that treats surface water or groundwater under the direct influence of surface water to the department within 10 days of the end of any quarter in which monitoring is required:

(1) The number of source water TOC samples collected each month during last quarter.

(2) The date and result of each sample collected during last quarter.

(3) The quarterly average of monthly samples collected during last quarter or the result of the quarterly sample.

(4) The RAA of quarterly averages from the past four quarters.

(5) Whether the RAA exceeded 4.0 mg/L.

2. The owner of a waterworks monitoring for chlorite under the requirements of 12VAC5-590-374 G shall report:

a. The number of entry point samples collected each month for the last three months.

b. The location, date, and result of each sample (both entry point and distribution system) collected during the last quarter.

c. For each month in the reporting period, the arithmetic average of all samples collected in each three sample set collected in the distribution system.

d. Whether, based on 12VAC5-590-384 B 3, the PMCL was violated, in which month, and how many times it was violated each month.

3. The owner of a waterworks monitoring for bromate under the requirements of 12VAC5-590-374 H shall report:

a. The number of samples collected during the last quarter.

b. The location, date, and result of each sample collected during the last quarter.

c. The arithmetic average of the monthly arithmetic averages of all samples collected in the last year.

d. Whether, based on 12VAC5-590-384 B 2, the PMCL was violated.

E. Reporting requirements for disinfectants. The owner shall report the information specified in this subsection to the department in accordance with 12VAC5-590-530. The department may choose to perform calculations and determine whether the MRDL was violated, instead of having the owner report that information:

1. The owner of a waterworks monitoring for chlorine or chloramines under the requirements of 12VAC5-590-374 I 1 shall report:

a. The number of samples collected during each month of the last quarter.

b. The monthly arithmetic average of all samples collected in each month for the last 12 months.

c. The arithmetic average of all monthly averages for the last 12 months.

d. Whether, based on 12VAC5-590-384 C 1, the MRDL was violated.

2. The owner of a waterworks monitoring for chlorine dioxide under the requirements of 12VAC5-590-374 I 2 shall report:

a. The dates, results, and locations of samples collected during the last quarter.

b. Whether, based on 12VAC5-590-384 C 2, the MRDL was violated.

c. Whether the MRDL was exceeded in any two consecutive daily samples and whether the resulting violation was acute or nonacute.

F. Reporting requirements for DBPPs and enhanced coagulation or enhanced softening. The owner shall report the following information to the department in accordance with 12VAC5-590-530. The department may choose to perform calculations and determine whether the treatment technique was met, instead of having the owner report that information:

1. The owner of a waterworks monitoring monthly or quarterly for TOC under the requirements of 12VAC5-590-374 J and required to meet the enhanced coagulation or enhanced softening requirements in 12VAC5-590-411 A 2 shall report:

a. The number of paired (source water and treated water) samples collected during the last quarter.

b. The location, date, and results of each paired sample and associated alkalinity collected during the last quarter.

c. For each month in the reporting period that paired samples were collected, the arithmetic average of the percent reduction of TOC for each paired sample and the required TOC percent removal.

d. Calculations for determining compliance with the TOC percentage removal requirements, as provided in 12VAC5-590-411 A 3.

e. Whether the waterworks is in compliance with the enhanced coagulation or enhanced softening percent removal requirements in 12VAC5-590-411 A 2 for the last four quarters.

2. The owner of a waterworks monitoring monthly or quarterly for TOC under the requirements of 12VAC5-590-374 J and meeting one or more of the alternative compliance criteria in 12VAC5-590-411 A 1 c or A 1 d shall report:

a. The alternative compliance criterion that the waterworks is using.

b. The number of paired samples collected during the last quarter.

c. The location, date, and result of each paired sample and associated alkalinity collected during the last quarter.

d. The running annual arithmetic average based on monthly averages (or quarterly samples) of source water TOC for a waterworks meeting a criterion in 12VAC5-590-411 A 1 c (1) or A 1 c (3) or of treated water TOC for waterworks meeting the criterion in 12VAC5-590-411 A 1 c (2).

e. The running annual arithmetic average based on monthly averages (or quarterly samples) of source water SUVA for a waterworks meeting the criterion in 12VAC5-590-411 A 1 c (5) or of treated water SUVA for a waterworks meeting the criterion in 12VAC5-590-411 A 1 c (6).

f. The RAA of source water alkalinity for a waterworks meeting the criterion in 12VAC5-590-411 A 1 c (3) and of treated water alkalinity for a waterworks meeting the criterion in 12VAC5-590-411 A 1 d (1).

g. The RAA for both TTHM and HAA5 for a waterworks meeting the criterion in 12VAC5-590-411 A 1 c (3) or A 1 c (4).

h. The RAA of the amount of magnesium hardness removal (as $CaCO_3$, in mg/L) for a waterworks meeting the criterion in 12VAC5-590-411) A 1 d (2).

i. Whether the waterworks is in compliance with the particular alternative compliance criterion in 12VAC5-590-411 A 1 c or A 1 d.

G. Additional reporting requirements. The owner shall report the following incidents within 24 hours to the department:

1. A waterborne disease outbreak that is potentially attributable to that waterworks.

2. Chlorine residual of below 0.2 mg/L in the water entering the distribution system. The owner also shall notify the department by the end of the next business day whether or not the residual was restored to at least 0.2 mg/L within four hours.

12VAC5-590-532. Reporting requirements for lead and copper.

A. The owner shall report all of the information in this section to the department in accordance with this section.

B. Reporting requirements for tap water monitoring for lead and copper and for water quality parameter monitoring.

1. Except as provided in subdivision B 1 g of this section, the owner shall report the information specified in this subsection for all tap water samples specified in 12VAC5-590-375 B and for all water quality parameter samples specified in 12VAC5-590-375 C within the first 10 days following the end of each applicable monitoring period specified in 12VAC5-590-375 B and C (i.e., every six months, annually, every three years, or every nine years). For monitoring periods with a duration

less than six months, the end of the monitoring period is the last date samples can be collected during the period as specified in 12VAC5-590-375 B and C.

a. The results of all tap samples for lead and copper including location or a location site code and the criteria under 12VAC5-590-375 B 1 c through B 1 f or 12VAC5-590-375 C under which the site was selected for the waterworks sampling pool.

b. Documentation for each tap water lead or copper sample for which the owner requests invalidation pursuant to 12VAC5-590-375 B 6.

c. The 90th percentile lead and copper concentrations measured from among all lead and copper tap water samples collected during each monitoring period (calculated in accordance with 12VAC5-590-385 C) unless the department calculates the 90th percentile lead and copper levels under subsection I of this section.

d. With the exception of initial tap sampling conducted pursuant to 12VAC5-590-375 B 4 a, the owner shall designate any site that was not sampled during previous monitoring periods and include an explanation of why sampling sites have changed.

e. The results of all tap samples for pH, and where applicable, alkalinity, calcium, conductivity, temperature, and orthophosphate or silica collected under 12VAC5-590-375 C 2 through C 5.

f. The results of all samples collected at the entry point to the distribution system for applicable water quality parameters under 12VAC5-590-375 C 2 through C 5.

g. The owner shall report the results of all water quality parameter samples collected under 12VAC5-590-375 C 3 through 12VAC5-590-375 C 6 during each six month monitoring period specified in 12VAC5-590-375 C 4 within the first 10 days following the end of the monitoring period unless the department has specified a more frequent reporting requirement.

2. The owner of a NTNC, or a community waterworks meeting the criteria of 12VAC5-590-405 D 2 e, that does not have enough taps that can provide first-draw samples must either:

a. Provide written documentation to the department identifying standing times and locations for enough non-first-draw samples to make up the sampling pool under 12VAC5-590-375 B 2 e by the start of the first applicable monitoring period under 12VAC5-590-375 B 4, unless the department has waived prior approval of non-first-draw sample sites selected by the owner pursuant to 12VAC5-590-375 B 2 e; or

b. If the department has waived prior approval of non-first-draw sample sites selected by the owner, then the owner shall identify in writing each site that did not meet the six-hour minimum standing time and the length of standing time for that particular substitute sample collected pursuant to 12VAC5-590-375 B 2 e and include this information with the lead and copper sample results required to be submitted pursuant to subsection B of this section.

3. At a time specified by the department, or if no specific time is designated by the department, then as early as practical before the addition of a new source or any long-term change in water treatment, an owner (i) deemed to have optimized corrosion control under 12VAC5-590-405 A 2 b (3), (ii) subject to reduced monitoring pursuant to 12VAC5-590-375 B 4 d, or (iii) subject to a monitoring waiver pursuant to 12VAC5-590-375 B 7 shall submit written documentation to the department describing the change or addition. The department must approve the addition of a new source or a long-term change in treatment before it is implemented by the owner. Examples of long-term treatment changes include the addition of a new treatment process or modification of an existing treatment process. Examples of modification include switching secondary disinfectants, switching coagulants (e.g., alum to ferric chloride), or switching corrosion inhibitor products (e.g., orthophosphate to blended phosphate). Long-term changes can include dose changes to existing chemicals if the waterworks is planning long-term changes to its finished water pH or residual inhibitor concentration. Long-term treatment changes would not include chemical dose fluctuations associated with daily source water quality changes.

4. The owner of a small waterworks applying for a monitoring waiver under 12VAC5-590-375 B 7 or subject to a waiver granted pursuant to 12VAC5-590-375 B 7 c shall provide the following information to the department in writing by the specified deadline:

a. By the start of the first applicable monitoring period in 12VAC5-590-375 B 4, the owner of a small waterworks applying for a monitoring waiver shall provide the documentation required to demonstrate that the waiver criteria of 12VAC5-590-375 B 7 a and 12VAC5-590-375 B 7 b have been met.

b. No later than nine years after the monitoring previously conducted pursuant to 12VAC5-590-375 B 7 b or 12VAC5-590-375 B 7 d (1), the owner of a small waterworks desiring to maintain its monitoring waiver shall provide the information required by 12VAC5-590-375 B 7 d (1) and 12VAC5-590-375 B 7 d (2).

c. No later than 60 days after becoming aware that it is no longer free of lead-containing or copper-containing material, the owner of a small waterworks with a monitoring waiver shall provide written notification to the department setting forth the circumstances resulting in the lead-containing or copper-containing materials being introduced into the waterworks and what corrective action, if any, the owner plans to take to remove these materials.

5. The owner of a groundwater system that limits water quality parameter monitoring to a subset of entry points under 12VAC5-590-375 C 3 c shall provide by the commencement of the monitoring written correspondence to the department that identifies the selected entry points and includes information sufficient to demonstrate that the sites are representative of water quality and treatment conditions throughout the waterworks.

C. Source water monitoring reporting requirements.

1. The owner shall report the sampling results for all source water samples collected in accordance with 12VAC5-590-375 D within the first 10 days following the end of each source water monitoring period (i.e., annually, per compliance period, per compliance cycle) specified in 12VAC5-590-375 D.

2. With the exception of the first round of source water sampling conducted pursuant to 12VAC5-590-375 D 2, the owner shall specify any site that was not sampled during previous monitoring periods and include an explanation of why the sampling point has changed.

D. Corrosion control treatment reporting requirements. By the applicable dates under 12VAC5-590-405 A 2 a, an owner shall report the following information:

1. For the owner demonstrating that corrosion control has already been optimized, information required in 12VAC5-590-405 A 2 b (2) or 12VAC5-590-405 A 2 b (3).

2. For the owner required to optimize corrosion control, the owner's recommendation regarding optimal corrosion control treatment under 12VAC5-590-405 A 1 a.

3. For the owner required to evaluate the effectiveness of corrosion control treatments, the information required under 12VAC5-590-405 A 1 c.

4. For the owner required to install optimal corrosion control designated by the department under 12VAC5-590-405 A 1 d, a letter certifying that the owner has completed installing that treatment.

E. Source water treatment reporting requirements. By the applicable dates in 12VAC5-590-405 B, an owner shall provide the following information to the department:

1. If required under 12VAC5-590-405 B 2 a, the owner's recommendation regarding source water treatment; or

2. For an owner required to install source water treatment under 12VAC5-590-405 B 2 b, a letter certifying that the owner has completed installing the treatment designated by the department within 24 months after the department designated the treatment.

F. Lead service line replacement reporting requirements. The owner shall report the following information to the department to demonstrate compliance with the requirements of 12VAC5-590-405 C:

1. No later than 12 months after the end of a monitoring period in which a waterworks exceeds the lead AL in sampling referred to in 12VAC5-590-405 C 1, the owner shall submit written documentation to the department of the materials evaluation conducted as required in 12VAC5-590-375 B 1, to identify the initial number of lead service lines in the distribution system at the time the waterworks exceeds the lead AL, and provide the owner's schedule for annually replacing at least 7.0% of the initial number of lead service lines in its distribution system.

2. No later than 12 months after the end of a monitoring period in which a waterworks exceeds the lead AL in sampling referred to in 12VAC5-590-405 C 1, and every 12 months thereafter, the owner shall demonstrate to the department in writing that the owner has either:

a. Replaced in the previous 12 months at least 7.0% of the initial lead service lines or a greater number of lines specified by the department under 12VAC5-590-405 C 6 in the distribution system; or

b. Conducted sampling that demonstrates that the lead concentration in all service line samples from an individual line collected pursuant to 12VAC5-590-375 B 2 c is less than or equal to 0.015 mg/L. In these cases, the total number of lines replaced that meet the criteria in 12VAC5-590-405 C 4 shall equal at least 7.0% of the initial number of lead service lines identified under subdivision F 1 of this section or the percentage specified by the department under 12VAC5-590-405 C 6.

3. The annual letter submitted to the department under subdivision F 2 of this section shall contain the following information:

a. The number of lead service lines scheduled to be replaced during the previous year of the waterworks replacement schedule;

b. The number and location of each lead service line replaced during the previous year of the waterworks replacement schedule; and

c. If measured, the water lead concentration and location of each lead service line sampled, the sampling method, and the date of sampling.

4. The owner of a waterworks that collects lead service line samples following partial lead service line replacement required by 12VAC5-590-405 C shall report the results to the department within the first 10 days of the month following the month in which the owner receives the laboratory results or as specified by the department. The owner shall also report any additional information as specified by the department in a time and manner prescribed by the department to verify that all partial lead service line replacement activities have taken place.

G. Public education program reporting requirements. The owner shall report the following information to the department to demonstrate compliance with the requirements of 12VAC5-590-405 D.

1. The owner of a waterworks that is subject to the public education requirements in 12VAC5-590-405 D shall within 10 days after the end of each period in which the owner is required to perform public education tasks in accordance with 12VAC5-590-405 D 2 send written notice to the department that contains:

a. A demonstration that the owner has delivered the public education materials that meet the content requirements of 12VAC5-590-405 D 1 and the delivery requirements of 12VAC5-590-405 D 2; and

b. A list of all the newspapers, radio stations, television stations, and facilities and organizations to which the owner delivered public education materials during the period in which the owner was required to perform public education tasks.

2. Unless required by the department, an owner that previously has submitted the information required by subdivision G 1 b of this section need not resubmit the information required by subdivision G 1 b of this section, as long as there has been no changes in the distribution list and the owner certifies that the public education materials were distributed to the same list submitted previously.

3. No later than three months following the end of the monitoring period, the owner shall mail a sample copy of the consumer notification of tap results to the department along with a certification that the notification has been distributed in a manner consistent with the requirements of 12VAC5-590-405 D 4.

H. Reporting of additional monitoring data. The owner of a waterworks that collects sampling data in addition to that required by 12VAC5-590-375 shall report the results to the department within the first 10 days following the end of the applicable monitoring period under 12VAC5-590-375 B, 12VAC5-590-375 C, and 12VAC5-590-375 D during which the samples are collected.

I. Reporting of the 90th percentile lead and copper concentrations where the department calculates a waterworks' 90th percentile concentrations. The owner is not required to report the 90th percentile lead and copper concentrations measured from among all lead and copper tap samples collected during each monitoring period, as required by subdivision B 1 d of this section if:

1. The department has previously notified the owner that the department will calculate the waterworks' 90th percentile lead and copper concentrations based on the lead and copper tap results submitted pursuant to subdivision I 2 a of this section and has specified a date before the end of the applicable monitoring period by which the owner shall provide the results of the lead and copper tap water samples; and

2. The owner has provided the following information to the department by the date specified in subdivision I 1 of this section:

a. The results of all tap samples for lead and copper including the location of each site and the criteria under 12VAC5-590-375 B 1 c through 12VAC5-590-375 B 1 f or 12VAC5-590-375 B 1 g under which the site was selected for the waterworks sampling pool, pursuant to subdivision B 1 a of this section;

b. An identification of sampling sites utilized during the current monitoring period that were not sampled during the previous monitoring periods and an explanation why sampling sites have changed; and

c. The department has provided the results of the 90th percentile lead and copper calculations in writing to the owner before the end of the monitoring period.

12VAC5-590-540. Public notices.

A. The owner shall give public notice to (i) persons served by the waterworks and (ii) the owner of any consecutive waterworks to which it sells or otherwise provides water under the following circumstances.

1. Tier 1.

a. When E. coli are present in the distribution system, or when the waterworks fails to test for E. coli when any repeat sample tests positive for total coliform;

b. Violation of the PMCL for E. coli;

c. Violation of the PMCL for nitrate, nitrite, or total nitrate and nitrite;

d. Failure to collect a confirmation sample within 24 hours of the waterworks receipt of the first sample showing an exceedance of the nitrate or nitrite PMCL;

e. Exceedance of the nitrate PMCL by a noncommunity waterworks, where permitted to exceed the PMCL by the department;

f. Violation of the MRDL for chlorine dioxide when one or more samples collected in the distribution system the day following an exceedance of the MRDL at the entry point to the distribution system exceed the MRDL;

g. Failure to monitor chlorine dioxide residuals in the distribution system the day following an exceedance of the chlorine dioxide MRDL at the entrance to the distribution system;

h. Violation of the treatment technique requirements for filtration and disinfection resulting from a single exceedance of the maximum allowable turbidity limit, where the department determines after consultation that a Tier 1 notice is required;

i. Failure to consult with the department within 24 hours after the owner learns of the violation of the treatment technique requirements for filtration and disinfection resulting from a single exceedance of the maximum allowable turbidity limit;

j. Occurrence of a waterborne disease outbreak or other waterborne emergency (such as a failure or significant interruption in key water treatment processes, a natural disaster that disrupts the water supply or distribution system, or a chemical spill or unexpected loading of possible pathogens into the source water that significantly increases the potential for drinking water contamination);

k. Detection of E. coli in groundwater source samples; or

l. Other violations or situations with significant potential to have serious adverse effects on human health as a result of short-term exposure, as determined by the commissioner or department on a case-by-case basis.

2. Tier 2.

a. All violations of the PMCL, MRDL, and treatment technique requirements, except where a Tier 1 public notice is required or where the department determines that a Tier 1 notice is required instead per subdivision A 1 l of this section;

b. Violations of the monitoring and testing procedure requirements, where the department determines that a Tier 2 rather than a Tier 3 public notice is required instead, taking into account potential health impacts and persistence of the violation;

c. Failure to comply with the terms and conditions of any variance or exemption in place; or

d. Failure to take corrective action or failure to maintain at least 4-log treatment of viruses (using inactivation, removal, or an approved combination of 4-log virus inactivation and removal) before or at the first customer under the treatment technique requirements for waterworks with groundwater sources.

3. Tier 3.

a. Monitoring violations, except where a Tier 1 public notice is required per subdivisions A 1 d and A 1 g of this section, or where the department determines that a Tier 2 public notice is required instead per subdivision A 2 b of this section;

b. Failure to comply with a testing procedure, except where a Tier 1 notice is required per subdivision A 1 b of this section or where the department determines that a Tier 2 notice is required instead per subdivision A 2 b of this section;

c. Operation under a variance or an exemption to a PMCL or treatment technique requirement;

d. Availability of UC monitoring results; or

e. Exceedance of the fluoride SMCL.

4. The department may require public notice for violations or other situations not listed in this section or may require a higher tier of public notice for specific violations and situations listed in this section.

a. The content and extent of distribution of these public notices shall be determined by the department.

b. The owner shall provide the public notice certification required in subsection N of this section.

c. At least 90 days before initiating or discontinuing a program to provide the optimum fluoride ion concentration, a waterworks owner shall deliver written notice to the waterworks' consumers. Notice to consumers shall be consistent with 12VAC5-590-540 C 2 d.

B. If a waterworks has a violation, failure, exceedance, or situation in a portion of the distribution system that is physically or hydraulically isolated from other parts of the distribution system, the department may allow the owner to limit distribution of the public notice to only those persons served by the portion of the waterworks that is out of compliance. The decision granting limited distribution of the public notice shall be issued in writing.

C. Public notice distribution requirements.

1. For Tier 1 violations, exceedances, or situations, the owner shall:

a. Provide a public notice as soon as practical but no later than 24 hours after the owner learns of the violation, exceedance, or situation;

b. Initiate consultation with the department as soon as practical, but no later than 24 hours after the owner learns of the violation, exceedance, or situation, to determine additional public notice requirements;

c. Comply with any additional public notice requirements, including any repeat notices or direction on the duration of the posted notices that are established as a result of the consultation with the department. These requirements may include the timing, form, manner, frequency, and content of repeat notices (if any) and other actions designed to reach all persons served; and

d. Provide the public notice in a form and manner reasonably calculated to reach all persons served. The form and manner shall fit the specific situation, and shall be designed to reach residential, transient, and nontransient users of the waterworks. To reach all persons served, owners shall use, at a minimum, one or more of the following forms of delivery:

(1) Appropriate broadcast media (such as radio and television);

(2) Posting of the public notice in conspicuous locations throughout the area served by the waterworks;

(3) Hand delivery of the public notice to persons served by the waterworks; or

(4) Another delivery method approved in writing by the department.

2. For Tier 2 violations, exceedances, or situations, the owner shall:

a. Provide the public notice as soon as practical, but no later than 30 days after the owner learns of the violation, exceedance, or situation. The department may allow, on a case-by-case determination, additional time for the initial notice of up to three months from the date the owner learns of the violation, exceedance, or situation; however, the department shall not grant an extension to the 30-day deadline for any unresolved violation, exceedance, or situation.

b. Repeat the public notice every three months as long as the violation, exceedance, or situation persists, unless the department determines that appropriate circumstances warrant a different repeat notice frequency. In no circumstance shall the repeat notice be given less frequently than once per year. Repeat notice frequency less than every three months shall not be allowed for (i) a violation as specified in 12VAC5-590-380 B and 12VAC5-590-392 F; (ii) a treatment technique violation for filtration and disinfection; and (iii) other ongoing violations, exceedances, or situations.

c. Consult with the department as soon as practical but no later than 24 hours after the owner learns of a violation of the treatment technique requirements for filtration and disinfection resulting from a single exceedance of the maximum allowable turbidity limit to determine whether a Tier 1 public notice is required to protect public health. If consultation does not take place within the 24-hour period, then the owner shall distribute a Tier 1 public notice of the violation within the next 24 hours (i.e., no later than 48 hours after the owner learns of the violation).

d. Provide the initial public notice and any repeat notices in a form and manner that is reasonably calculated to reach persons served in the required time period.

(1) For a community waterworks, the owner shall:

(a) Mail or otherwise directly deliver the public notice to each customer receiving a bill and to other service connections to which water is delivered by the waterworks; and

(b) Use any other distribution method reasonably calculated to reach other persons regularly served by the waterworks, if they would not normally be reached by the notice required in subdivision C 2 d (1) (a) of this section. These persons may include those who do not pay water bills or do not have service connection addresses (e.g., house renters, apartment dwellers, university students, nursing home patients, prison inmates, etc.). Other methods may include (i) publication in a local newspaper; (ii) delivery of multiple copies for distribution by customers that provide their drinking water to others (e.g., apartment building owners or large private employers); (iii) posting in public places served by the waterworks or on the Internet; or (iv) delivery to community organizations.

(2) For a noncommunity waterworks, the owner shall:

(a) Post the public notice in conspicuous locations throughout the distribution system frequented by persons served by the waterworks, or by mail or direct delivery to each customer and service connection (where known); and

(b) Use any other method reasonably calculated to reach other persons served by the system if they would not normally be reached by the notice required in subdivision C 2 d (2) (a) of this section. These persons may include those served who may not see a posted notice because the posted notice is not in a location they routinely pass by. Other methods may include (i) publication in a local newspaper or newsletter distributed to customers; (ii) use of email to notify employees or students; or (iii) delivery of multiple copies in central locations (e.g., community centers).

e. Maintain a posted public notice in place for as long as the violation, exceedance, or situation persists, but in no case for less than seven days, even if the violation, exceedance, or situation is resolved.

3. For Tier 3 violations, exceedances, or situations the owner shall:

a. Provide the public notice not later than one year after the owner learns of the violation, exceedance, or situation or begins operating under a variance or exemption.

b. Repeat the public notice annually for as long as the violation, exceedance, variance, exemption, or other situation persists.

c. Maintain a posted public notice in place for as long as the violation, exceedance, variance, exemption, or other situation persists, but in no case less than seven days even if the violation, exceedance, or situation is resolved.

d. Instead of individual Tier 3 public notices, the owner may use an annual report detailing all violations, exceedances, and situations that occurred during the previous 12 months, as long as the timing requirements of subdivision C 3 a of this section are met. For a community waterworks, the CCR may be used as a vehicle for the initial Tier 3 public notice and all required repeat notices, provided that:

(1) The CCR is provided to persons served by the waterworks no later than 12 months after the owner learns of the violation, exceedance, or other situation.

(2) The Tier 3 public notice contained in the CCR meets the content requirements in subsection D of this section.

(3) The CCR is distributed in a manner meeting the delivery requirements in subdivision C 3 e (1) of this section.

e. For a community waterworks, the owner shall:

(1) Mail or otherwise directly deliver the public notice to each customer receiving a bill and to other service connections to which water is delivered by the waterworks; and

(2) Use any other method reasonably calculated to reach other persons regularly served by the waterworks if they would not normally be reached by the notice required in subdivision C 3 e (1) of this section. These persons may include those who do not pay water bills or do not have service connection addresses (e.g., house renters, apartment dwellers, university students, nursing home patients, prison inmates, etc.). Other methods may include (i) publication in a local newspaper, (ii) delivery of multiple copies for distribution by customers that provide their drinking water to others (e.g., apartment building owners or large private employers), (iii) posting in public places or on the Internet, or (iv) delivery to community organizations.

f. For a noncommunity waterworks the owner shall:

(1) Post the public notice in conspicuous locations throughout the distribution system frequented by persons served by the waterworks, or by mail or direct delivery to each customer and service connection (where known); and

(2) Use any other method reasonably calculated to reach other persons served by the waterworks, if they would not normally be reached by the notice required in subdivision C 3 f (1) of this section. These persons may include those who may not see a posted notice because the notice is not in a location they routinely pass by. Other methods may include (i) publication in a local newspaper or newsletter distributed to customers, (ii) use of email to notify employees or students, or (iii) delivery of multiple copies in central locations (e.g., community centers).

D. Public notice contents.

1. Each public notice for PMCL, MRDL, and TT violations and other situations requiring a public notice shall include the following elements:

a. A description of the violation, exceedance, or situation, including the contaminants of concern, and (as applicable) the contaminant levels;

b. When the violation, exceedance, or situation occurred;

c. Any potential adverse health effects from the violation, exceedance, or situation, including the standard language under subdivision 5 a or 5 b of this subsection, whichever is applicable;

d. The population at risk, including subpopulations particularly vulnerable if exposed to the contaminant in their drinking water;

e. Whether alternative water supplies should be used;

f. What actions consumers should take, including when they should seek medical help, if known;

g. What the owner is doing to correct the violation, exceedance, or situation;

h. When the owner expects the waterworks to return to compliance or resolve the situation;

i. The name, business address, and phone number of the owner, operator, or designee as a source of additional information concerning the notice; and

j. A statement to encourage the notice recipient to distribute the public notice to other persons served, using the standard language under subdivision 5 c of this subsection, where applicable.

2. Each public notice for a waterworks that has been granted a variance or exemption shall include the following elements:

a. An explanation of the reasons for the variance or exemption;

b. The date on which the variance or exemption was issued;

c. A brief status report on the steps the owner is taking to install treatment, find alternative sources of source water, or otherwise comply with the terms and schedules of the variance or exemption; and

d. A notice of any opportunity for public input in the evaluation of the variance or exemption.

3. Each public notice for a waterworks that violates the conditions of a variance or an exemption shall contain the 10 elements listed in subdivision D 1 of this section.

4. Each public notice shall:

a. Be displayed in a conspicuous way when printed or posted;

b. Not contain overly technical language or very small print;

c. Not be formatted in a way that defeats the purpose of the notice;

d. Not contain language that nullifies the purpose of the notice; and

e. Contain information in the appropriate languages, for waterworks serving a large proportion of non-English-speaking consumers, regarding the importance of the notice or contain a telephone number or address where persons served may contact the owner to obtain a translated copy of the notice or to request assistance in the appropriate language.

5. The public notice shall include the following standard language:

a. For PMCL or MRDL violations, treatment technique violations, and violations of the condition of a variance or an exemption, use standard health effects language as specified in 12VAC5-590-546 corresponding to each PMCL, MRDL, and treatment technique violation and for each violation of a condition of a variance or an exemption. For violation of the treatment technique requirement, the public notice shall also include one or both of the following statements, as appropriate:

(1) "We failed to conduct the required assessment."

(2) "We failed to correct all sanitary defects that were identified during the assessment."

b. For monitoring and testing procedure violations including failure to monitor for total coliform bacteria or E. coli before serving water from a seasonal waterworks, use standard language as specified below, including the language necessary to fill in the blanks:

"We are required to monitor your drinking water for specific contaminants on a regular basis. Results of regular monitoring are an indicator of whether or not your drinking water meets health standards. During (compliance period), we (did not monitor or test or did not complete all monitoring or testing) for (contaminants) and therefore cannot be sure of the quality of your drinking water during that time."

c. For all public notices, use standard language (where applicable), as specified in this subdivision c:

"Please share this information with all the other people who drink this water, especially those who may not have received this notice directly (e.g., people in apartments, nursing homes, schools, and businesses). You can do this by posting this notice in a public place or distributing copies by hand or mail."

d. For total coliform bacteria treatment technique violations the public notice shall include the following statement: "We found coliforms indicating the need to look for potential problems in our waterworks. When this occurs, we are required to conduct assessments to identify problems and correct any problems that are found." The public notice shall also include the following statements, as appropriate:

(1) "We failed to conduct the required assessment."

(2) "We failed to correct all sanitary defects that were identified during the assessment."

e. For E. coli treatment technique violations the public notice shall include the following statement: "We violated the standard for E. coli, indicating the need to look for potential problems in our waterworks. When this occurs, we are required to conduct a detailed assessment to identify problems and to correct any problems that are found." The public notice shall also include the following statements, as appropriate:

(1) "We failed to conduct the required assessment."

(2) "We failed to correct all sanitary defects that were identified during the assessment."

E. Public notice to new billing units or customers.

1. For a community waterworks, the owner shall give a copy of the most recent public notice for any continuing violation, exceedance, variance, exemption, or other ongoing situation requiring a public notice to all new billing units or new customers before or at the time service begins.

2. For a noncommunity waterworks, the owner shall continuously post the public notice in conspicuous locations to inform new consumers of any continuing violation, exceedance, variance, exemption, or other situation requiring a public notice for as long as the violation, exceedance, variance, exemption, or other situation persists.

F. Special notice of the availability of UC monitoring results.

1. The owner of a community waterworks or a NTNC shall notify persons served by the waterworks of the availability of the results of the sampling no later than 12 months after the monitoring results are known.

2. The special notice shall meet the requirements of a Tier 3 public notice and shall identify a person and telephone number to contact for information on the monitoring results.

G. Special notice for exceedance of the SMCL for fluoride.

1. A community waterworks that exceeds the SMCL of 2 mg/L but does not exceed the PMCL of 4 mg/L for fluoride shall provide public notice to persons served as soon as practical but no later than 12 months from the day the owner learns of the exceedance.

2. A copy of the notice shall be sent to all new billing units and new customers at the time service begins and to the department.

3. The owner shall repeat the notice at least annually for as long as the SMCL is exceeded.

4. If the public notice is posted, then the notice shall remain in place for as long as the SMCL is exceeded, but in no case less than seven days even if the exceedance is eliminated.

5. On a case-by-case basis, the department may require an initial notice sooner than 12 months and repeat notices more frequently than annually.

6. The form and manner of the public notice (including repeat notices) shall meet the requirements of a Tier 3 public notice.

7. The public notice shall contain the following language, including the language necessary to fill in the blanks:

"This is an alert about your drinking water and a cosmetic dental problem that might affect children under nine years of age. At low levels, fluoride can help prevent cavities, but children drinking water containing more than 2 milligrams per liter (mg/L) of fluoride may develop cosmetic

discoloration of their permanent teeth (dental fluorosis). The drinking water provided by your community waterworks (name) has a fluoride concentration of (insert value) mg/L. Dental fluorosis, in its moderate or severe forms, may result in a brown staining and/or pitting of the permanent teeth. This problem occurs only in developing teeth, before they erupt from the gums. Children under nine should be provided with alternative sources of drinking water or water that has been treated to remove the excess fluoride to avoid the possibility of staining and pitting of their permanent teeth. You may also want to contact your dentist about proper use by young children of fluoride-containing products by young children. Older children and adults may safely drink the water. Drinking water containing more than 4 mg/L of fluoride (the U.S. Environmental Protection Agency's drinking water standard) can increase your risk of developing bone disease. Your drinking water does not contain more than 4 mg/L of fluoride, but we are required to notify you when we discover that the fluoride levels in your drinking water exceed 2 mg/L because of this cosmetic dental problem. For more information, please call (name of water system contact) of (name of community waterworks) at (phone number). Some home water treatment units are also available to remove fluoride from drinking water. To learn more about available home water treatment units, you may call NSF International at 1-877-867-3435 or email info@nsf.org."

H. Special notice for nitrate exceedances above PMCL by a noncommunity waterworks.

1. The owner of a noncommunity waterworks granted permission by the department to exceed the nitrate PMCL shall provide public notice to persons served meeting the requirements of a Tier 1 notice.

2. The public notice shall be posted continuously and shall indicate the fact that nitrate levels exceed 10 mg/L and the potential health effects of exposure, meeting the requirements of Tier 1 public notice delivery and content.

I. Special notice for repeated failure to conduct sampling of the source water for Cryptosporidium.

1. The owner who is required to sample source water shall provide public notice to persons served when the owner has failed to collect any three months of required samples. The form and manner of the public notice shall satisfy the requirements of a Tier 2 notice, and the notice shall be repeated in accordance with the requirements of a Tier 2 notice.

2. The notice shall contain the following language, including the language to fill in the blanks:

"We are required to monitor the source of your drinking water for Cryptosporidium. Results of the monitoring are to be used to determine whether water treatment at the (blank – fill in treatment plant name) is sufficient to adequately remove Cryptosporidium from your drinking water. We are required to complete this monitoring and make this determination by (blank – fill in required bin determination date) We "did not monitor" or "did not complete all monitoring or testing" on schedule and, therefore, we may not be able to determine by the required date what treatment modifications, if any, shall be made to ensure adequate Cryptosporidium removal. Missing this deadline may, in turn, jeopardize our ability to have the required treatment modifications, if any, completed by the deadline required, (blank – fill in date).

For more information, please call (blank – fill in name of waterworks contact) of (blank – fill in name of waterworks) at (blank – fill in phone number)."

3. The notice shall contain a description of what the owner is doing to correct the violation and when the owner expects the waterworks to return to compliance or resolve the situation.

J. Special notice for failure to determine bin classification or mean Cryptosporidium level.

1. The owner that is required to determine a bin classification or to determine mean Cryptosporidium level shall provide public notice to persons served when the determination has not been made as required. The form and manner of the public notice shall satisfy the requirements of a Tier 2 notice, and the notice shall be repeated in accordance with the requirements of a Tier 2

notice. However, a public notice is not required if the owner is complying with a schedule to address the violation approved by the department.

2. The notice shall contain the following language, including the language to fill in the blanks:

"We are required to monitor the source of your drinking water for Cryptosporidium in order to determine by [blank – fill in date] whether water treatment at the (blank – fill in treatment plant name) is sufficient to adequately remove Cryptosporidium from you drinking water. We have not made this determination by the required date. Our failure to do this may jeopardize our ability to have the required treatment modifications, if any, completed by the required deadline of (blank – fill in date). For more information, please call (blank – fill in name of waterworks contact) of (blank – fill in name of waterworks) at (blank – fill in telephone number)."

3. The notice shall contain a description of what the owner is doing to correct the violation and when the owner expects the waterworks to return to compliance or resolve the situation.

K. Special notice for significant deficiencies by a noncommunity groundwater system.

1. An owner of a noncommunity groundwater system that has not corrected a significant deficiency within one year of being notified by the department shall provide public notice to the consumers.

2. The form and manner of the public notice shall satisfy the requirements of a Tier 2 notice.

3. The owner shall continue to notify the public annually until the requirements of 12VAC5-590-421 have been satisfied. The notice shall include:

a. The nature of the significant deficiency and the date it was identified by the department; and

b. The department approved plan and schedule for correcting the significant deficiency including interim measures, progress to date, and which of the interim measures have been completed.

4. For a noncommunity groundwater system with a large proportion of non-English-speaking consumers, the notice shall contain information in the appropriate languages regarding the importance of the notice or contain a telephone number or address where the consumers may contact the owner to obtain a translated copy of the notice or assistance with the appropriate language.

5. If directed by the department, the owner of a noncommunity groundwater system with significant deficiencies that have been corrected shall inform the consumers of the significant deficiencies, how the deficiencies were corrected, and the date of correction.

L. The department may give notice to the public required by this section on behalf of the owner as long as the notice complies with the requirements of this section. However, the owner remains legally responsible for ensuring that the requirements of this section are met.

M. The department may require an owner to provide public notice for significant changes in water quality.

N. Within 10 days of completion of each initial and repeat public notice, the owner shall provide the department with the following:

1. A certification that the owner has fully complied with the public notice requirements; and

2. A representative copy of each type of notice that was distributed, published, posted, and made available to the persons served by the waterworks and to the media.

O. The owner shall maintain copies of each public notice and certification for at least three years after issuance.

12VAC5-590-545. Consumer confidence reports.

A. Purpose and applicability.

1. The owner of a community waterworks shall deliver to the owner's customers an annual report that contains information on the quality of the water delivered by the waterworks and characterizes the risks, if any, from exposure to contaminants detected in the drinking water.

2. For the purpose of this section, customers are defined as billing units or service connections to which water is delivered by a community waterworks.

3. For the purpose of this section, a contaminant is detected when the laboratory reports the contaminant level as a measured level and not as "non-detect," "not detected," "ND," or less than a certain level. These express that an analyte in a test sample cannot be reliably detected with the test equipment or laboratory instrumentation and the method used.

B. Effective dates.

1. The owner of an existing community waterworks shall deliver the report by July 1 annually.

2. The owner of a new community waterworks shall deliver the first report by July 1 of the year after its first full calendar year in operation and annually thereafter.

3. The owner of a community waterworks that sells water to a consecutive waterworks shall deliver the applicable information necessary to comply with the requirements contained in this section to the consecutive waterworks by April 1 annually, or on a date mutually agreed upon by the seller and the purchaser and specifically included in a contract between the parties.

C. Content.

1. The owner of a community waterworks shall provide the owner's customers an annual report that contains the information on the source of the water delivered as follows:

a. The report shall identify the source of the water delivered by the community waterworks by providing information on:

(1) The type of the source water (e.g., surface water, ground water); and

(2) The commonly used name, if any, and location of the body of the source water.

b. Where a source water assessment has been completed, the report shall:

(1) Notify consumers of the availability of the assessment;

(2) Describe the means to obtain the assessment; and

(3) Include a brief summary of the waterworks' susceptibility to potential sources of contamination.

c. The owner is encouraged to highlight in the report significant sources of contamination in the source water area if the information is readily available.

2. For the purpose of compliance with this section, the report shall include the following definitions:

a. "Maximum contaminant level goal" or "MCLG" means the level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.

b. "Maximum contaminant level" or "MCL" means the highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.

c. The report for a community waterworks operating under a variance or an exemption issued by the commissioner under 12VAC5-590-140 and 12VAC5-590-150 shall include the following definition: "Variances and exemptions" means state or EPA permission not to meet an MCL or a treatment technique under certain conditions.

d. The report that contains data on contaminants that EPA regulates using any of the following terms shall include the applicable definitions:

(1) "Treatment technique" means a required process intended to reduce the level of a contaminant in drinking water.

(2) "Action level" means the concentration of a contaminant that, if exceeded, triggers treatment or other requirements that an owner shall follow.

(3) "Maximum residual disinfectant level goal" or "MRDLG" means the level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.

(4) "Maximum residual disinfectant level" or "MRDL" means the highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for the control of microbial contaminants.

(5) "Level 1 assessment" means a study of the waterworks to identify potential problems and determine, if possible, why total coliform bacteria have been found in waterworks.

(6) "Level 2 assessment" means a very detailed study of the waterworks to identify potential problems and determine, if possible, why an E. coli PMCL violation has occurred and why total coliform bacteria have been found in waterworks on multiple occasions.

3. Information on detected contaminants.

a. This section specifies the requirements for information to be included in the report for contaminants subject to a PMCL, AL, MRDL, or treatment technique as specified in 12VAC5-590-340.

b. The data relating to these contaminants shall be displayed in one table or in several adjacent tables. Any additional monitoring results that an owner of a community waterworks chooses to include in the report shall be displayed separately.

c. The data shall be derived from data collected to comply with EPA and state monitoring and analytical requirements during the calendar year preceding the year the report is due, except that where an owner is allowed to monitor for contaminants specified in subdivision C 3 a of this section less often than once a year, the table shall include the date and results of the most recent sampling, and the report shall include a brief statement indicating that the data presented in the report are from the most recent testing done in accordance with this chapter. No data older than five years need be included.

d. For detected contaminants subject to a PMCL, AL, MRDL, or treatment technique as listed in Tables 340.1 through 340.7, the tables shall contain:

(1) The PMCL for that contaminant expressed as a number equal to or greater than 1.0 as provided in 12VAC5-590-546;

(2) The MCLG for that contaminant expressed in the same units as the PMCL as provided in 12VAC5-590-546;

(3) If there is no PMCL for a detected contaminant, then the tables shall indicate that there is a treatment technique, or specify the AL, applicable to that contaminant, and the report shall include the definitions for treatment technique, AL, or both, as appropriate, specified in subdivision C 3 d of this section;

(4) For contaminants subject to a PMCL, except turbidity and E. coli, the highest contaminant level used to determine compliance and the range of detected levels is as follows:

(a) When compliance with the PMCL is determined annually or less frequently, the highest detected level at any sampling point and the range of detected levels expressed in the same units as the PMCL.

(b) When compliance with the PMCL is determined by calculating an RAA of all samples collected at a sampling point, the highest average of any of the sampling points and the range of all sampling points expressed in the same units as the PMCL. For the PMCLs for TTHM and HAA5, the owner shall include the highest LRAA and the range of individual sample results for all sampling points expressed in the same units as the PMCL. If more than one

location exceeds the TTHM or HAA5 PMCL, then the owner shall include the LRAAs for all locations that exceed the PMCL.

(c) When compliance with the PMCL is determined on a system-wide basis by calculating an RAA of all samples at all sampling points, the average and range of detection expressed in the same units as the PMCL. The range of detection for TTHM and HAA5 shall include the individual sample results for the purpose of establishing the monitoring locations for EPA's "Stage 2 Disinfectants and Disinfection Byproducts Rule" initial distribution system evaluation.

(5) For turbidity, the highest single measurement and the lowest monthly percentage of combined filter samples meeting the turbidity limits specified in 12VAC5-590-395 A 2 b for the filtration technology being used. The report should include an explanation of the reasons for measuring turbidity;

(6) For lead and copper, the 90th percentile value of the most recent round of sampling and the number of sampling sites exceeding the AL;

(7) For E. coli, the total number of positive samples; and

(8) The likely source or sources of the detected contaminants. Specific information regarding contaminants may be available in sanitary surveys and source water assessments, and should be used when available to the owner. If the owner lacks specific information on the likely source, then the report shall include one or more of the typical sources for that contaminant listed in 12VAC5-590-546 that are most applicable to the system.

e. If the owner of a community waterworks distributes water to the owner's customers from multiple hydraulically independent distribution systems that are fed by different source waters, then:

(1) The table shall contain a separate column for each service area and the report shall identify each separate distribution system; or

(2) The owner shall produce a separate report tailored to include data for each service area.

f. The table shall clearly identify any data indicating violations of PMCLs, MRDLs, or treatment techniques and the report shall contain a clear and readily understandable explanation of the violation including:

(1) The length of the violation;

(2) The potential adverse health effects using the relevant language of 12VAC5-590-546; and

(3) Actions taken by the owner to address the violation.

4. Information on Cryptosporidium, radon, and other contaminants:

a. If the owner has performed any monitoring for Cryptosporidium, which indicates that Cryptosporidium may be present in the source water or the finished water, then the report shall include:

(1) A summary of the results of the monitoring; and

(2) An explanation of the significance of the results.

b. If the owner has performed any monitoring for radon, which indicates that radon may be present in the finished water, then the report shall include:

(1) The results of the monitoring; and

(2) An explanation of the significance of the results.

c. If the owner has performed additional monitoring that indicates the presence of other contaminants in the finished water, then the report should include any results that may indicate a health concern, as determined by the commissioner or department. Detections above a

proposed MCL or health advisory level may indicate possible health concerns. For these contaminants, the report should include:

(1) The results of the monitoring; and

(2) An explanation of the significance of the results noting the existence of a health advisory or a proposed regulation.

5. Compliance with other regulations. In addition to the requirements of subdivision C 3 f of this section, the report shall note any violation that occurred during the year covered by the report of a requirement listed in this subdivision 5:

a. Monitoring and reporting of compliance data;

b. Filtration and disinfection prescribed by 12VAC5-590-395. For an owner who has failed to install adequate filtration or disinfection equipment or processes or has had a failure of such equipment or processes that constitutes a violation, the report shall include the following language as part of the explanation of potential adverse health effects: "Inadequately treated water may contain disease-causing organisms. These organisms include bacteria, viruses, and parasites, which can cause symptoms such as nausea, cramps, diarrhea, and associated headaches";

c. Lead and copper control requirements prescribed by 12VAC5-590-375. For that fails to take one or more of the prescribed actions, the report shall include the applicable language of 12VAC5-590-546 for lead, copper, or both;

d. Treatment techniques for acrylamide and epichlorohydrin prescribed by 12VAC5-590-395 B. For an owner who violates the requirements of that section, the report shall include the relevant language from 12VAC5-590-546;

e. Recordkeeping of compliance data;

f. Special monitoring requirements for sodium; and

g. Violation of the terms of a variance, an exemption, or an administrative or judicial order.

6. Variances and exemptions. If a waterworks is operating under the terms of a variance or an exemption issued by the commissioner under 12VAC5-590-140 and 12VAC5-590-150, then the report shall contain:

a. An explanation of the reasons for the variance or exemption;

b. The date on which the variance or exemption was issued;

c. A brief status report on the steps the owner is taking to install treatment, find alternative sources of source water, or otherwise comply with the terms and schedules of the variance or exemption; and

d. A notice of any opportunity for public input in the evaluation or renewal of the variance or exemption.

7. Additional information.

a. The report shall contain a brief explanation regarding contaminants, which may reasonably be expected to be found in drinking water including bottled water. This explanation shall include the exact language of subdivisions 7 a (1), 7 a (2), and 7 a (3) of this subsection or the owner shall use comparable language following approval by the department. The report also shall include the exact language of subdivision 7 a (4) of this subsection.

(1) The sources of drinking water (both tap water and bottled water) include rivers, lakes or reservoirs, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity.

(2) Contaminants that may be present in source water include: (i) microbial contaminants, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife; (ii) inorganic contaminants, such as salts and metals, which can be naturally occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming; (iii) pesticides and herbicides, which may come from a variety of sources such as agriculture, urban stormwater runoff, and residential uses; (iv) organic chemical contaminants, including SOCs and VOCs, which are byproducts of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, and septic systems; and (v) radioactive contaminants, which can be naturally occurring or be the result of oil and gas production and mining activities.

(3) To ensure that tap water is safe to drink, EPA prescribes regulations that limit the amount of certain contaminants in the water provided by waterworks. The U.S. Food and Drug Administration (FDA) regulations establish limits for contaminants in bottled water which must provide the same protection for public health.

(4) Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling EPA's Safe Drinking Water Hotline (800-426-4791).

b. The report shall include the telephone number of the owner, operator, or designee of the community waterworks as a source of additional information concerning the report.

c. In communities with a large proportion of non-English-speaking residents, as determined by the department, the report shall contain information in the appropriate languages regarding the importance of the report or contain a telephone number or address where the residents may contact the waterworks to obtain a translated copy of the report or assistance in the appropriate language.

d. The report shall include the following information about opportunities for public participation in decisions that may affect the quality of the drinking water. The owner should consider including the following additional relevant information:

(1) The time and place of regularly scheduled board meetings of the governing body that has authority over the waterworks; and

(2) If regularly scheduled board meetings are not held, then the name and telephone number of a waterworks representative who has operational or managerial authority over the waterworks.

e. The owner may include additional information as deemed necessary for public education consistent with, and not detracting from, the purpose of the report.

f. For a community groundwater system:

(1) Where there is a significant deficiency that is uncorrected at the time of the report or an E. coli-positive source water sample that is not invalidated in accordance with 12VAC5-590-380 at the time of the report, the owner shall report the following:

(a) The nature of the significant deficiency or the source water, if known, of the E. coli contamination;

(b) The date the significant deficiency was identified by the department or the date or dates of the E. coli-positive source water samples;

(c) Whether the E. coli contamination has been addressed in accordance with 12VAC5-590-421 and the date of the action;

(d) The department-approved plan and schedule, including interim measures, progress to date, and which interim measures have been completed for correcting the significant deficiency or E. coli contamination; and

(e) The potential health effects language in 12VAC5-590-546 for an E. coli-positive source water sample that is not invalidated in accordance with 12VAC5-590-380.

(2) If directed by the department, where there are significant deficiencies that have been corrected at the time of the report, then the owner shall report the significant deficiencies, how the deficiencies were corrected, and the date or dates of correction.

D. Additional health information.

1. All reports shall prominently display the following language: Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer who are undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA and Centers for Disease Control and Prevention guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the Safe Drinking Water Hotline (800-426-4791).

2. The owner that detects arsenic at levels above 0.005 mg/L, but equal to or below the PMCL of 0.010 mg/L, shall include in the report the following informational statement about arsenic: "While your drinking water meets EPA's standard for arsenic, it does contain low levels of arsenic. EPA's standard balances the current understanding of arsenic's possible health effects against the cost of removing arsenic from drinking water. EPA continues to research the health effects of low levels of arsenic, which is a mineral known to cause cancer in humans at high concentrations and is linked to other health effects such as skin damage and circulatory problems."

Instead of the statement required in this subdivision, the owner may include the owner's educational statement after receiving approval from the department.

3. The owner that detects nitrate at levels above 5 mg/L, but below the PMCL, shall include in the report the following informational statement about the impacts of nitrate on children: "Nitrate in drinking water at levels above 10 ppm is a health risk for infants of less than six months of age. High nitrate levels in drinking water can cause blue baby syndrome. Nitrate levels may rise quickly for short periods of time because of rainfall or agricultural activity. If you are caring for an infant, then you should ask advice from your health care provider."

Instead of the statement required in this subdivision, the owner may include the owner's own educational statement after receiving approval from the department.

4. All reports shall prominently display the following language: "If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. (Name of Utility) is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to two minutes before using water for drinking or cooking. If you are concerned about lead in your water, then you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline (800-426-4791)."

Instead of the statement required in this subdivision, the owner may include the owner's educational statement after receiving approval from the department.

E. The owner of a community waterworks required to complete a Level 1 or a Level 2 assessment that is not due to an E. coli PMCL violation shall include in the report the text specified in subdivisions E 1, E

2, and E 3 of this section as appropriate, filling in the blanks accordingly, and shall include in the report the text specified in subdivision E 4 of this section, if appropriate.

1. "Coliforms are bacteria that are naturally present in the environment and are used as an indicator that other, potentially harmful, waterborne pathogens may be present or that a potential pathway exists through which contamination may enter the drinking water distribution system. We found coliforms indicating the need to look for potential problems in water treatment or distribution. When this occurs, we are required to conduct assessments to identify problems and to correct any problems that are found."

2. "During the past year, we were required to conduct (insert the number of Level 1 assessments) Level 1 assessments. (insert the number of Level 1 assessments) Level 1 assessments were completed. In addition, we were required to take t (insert the number of corrective actions) corrective actions and we completed (insert the number of corrective actions) of these actions."

3. "During the past year (insert the number of Level 2 assessments) Level 2 assessments were required to be completed for our waterworks. (insert the number of Level 2 assessments) Level 2 assessments were completed. In addition, we were required to take (insert the number of corrective actions) corrective actions and we completed (insert the number of corrective actions) of these actions."

4. An owner that failed to complete all of the required assessments or correct all identified sanitary defects shall also include one or both of the following statements, as appropriate:

a. "During the past year, we failed to conduct all of the required assessments."

b. "During the past year, we failed to correct all identified sanitary defects that were found during the assessments."

F. The owner of a community waterworks required to conduct Level 2 assessments due to an E. coli PMCL violation shall include in the report the text specified in subdivisions F 1 and F 2 of this section, filling in the blanks accordingly, and shall include in the report the text specified in subdivision F 3 of this section, if appropriate.

1. "E. coli are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Human pathogens in these wastes can cause short-term effects, such as diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a greater health risk for infants, young children, the elderly, and people with severely compromised immune systems. We found E. coli, indicating the need to look for potential problems in water treatment or distribution. When this occurs, we are required to conduct assessments to identify problems and to correct any problems that are found."

2. "We were required to complete a Level 2 assessment because we found E. coli in our waterworks. In addition, we were required to take (insert number of corrective actions) corrective actions and we completed (insert number of corrective actions) of these actions."

3. Any owner that has failed to complete the required assessment or correct all identified sanitary defects shall also include one or both of the following statements, as appropriate:

a. "We failed to conduct the required assessment."

b. "We failed to correct all sanitary defects that were identified during the assessment that we conducted."

4. If E. coli is detected in a waterworks and the E. coli PMCL is violated, in addition to completing the table as specified in subdivision C 3 d of this section, the owner shall include one or more of the following statements to describe any noncompliance, as applicable:

a. "We had an E. coli-positive repeat sample following a total coliform-positive routine sample."

b. "We had a total coliform-positive repeat sample following an E. coli-positive routine sample."

c. "We failed to collect all the required repeat samples following an E. coli-positive routine sample."

d. "We failed to test for E. coli when any repeat sample tested positive for total coliform."

5. If E. coli is detected in a waterworks and the E. coli PMCL is not violated, in addition to completing the table as specified in subdivision C 3 d of this section, the owner may include a statement that explains that although E. coli was detected, the owner is not in violation of the E. coli PMCL.

G. Report delivery and recordkeeping.

1. The owner of a community waterworks shall mail or otherwise directly deliver one copy of the report to each customer, except as follows:

a. The owner serving fewer than 10,000 persons shall have the option to either mail (or otherwise directly deliver) a copy of the report to each customer or publish the report in a local newspaper or newspapers of general circulation serving the area in which the waterworks is located by July 1 of each year; and

b. If the owner chooses to publish the report, then the owner shall inform customers, either in the newspaper in which the report is to be published or by other means approved by the department, that a copy of the report will not be mailed to them and that a copy of the report will be made available to the public upon request.

2. The owner of a community waterworks shall make a good faith effort to deliver the report to the consumers who are served by the waterworks but are not bill-paying customers, such as renters or workers. This good faith effort shall include at least one, and preferably two or more, of the following methods appropriate to the particular waterworks:

a. Posting the reports on the Internet;

b. Mailing to postal patrons in metropolitan areas;

c. Advertising the availability of the report in the news media;

d. Publishing in a local newspaper;

e. Posting in public places such as libraries, community centers, and public buildings;

f. Delivering multiple copies for distribution by single-biller customers such as apartment buildings or large private employers;

g. Delivering to community organizations; or

h. Other methods as approved by the department.

3. No later than July 1 of each year, the owner of a community waterworks shall deliver a copy of the report to the department, followed within three months by a certification that the report has been distributed to customers and that the information in the report is correct and consistent with the compliance monitoring data previously submitted to the department.

4. No later than July 1 of each year, the owner of a community waterworks shall deliver the report to any other agency or clearinghouse specified by the department.

5. The owner of a community waterworks shall make the report available to the public upon request.

6. The owner of a community waterworks serving 100,000 or more persons shall post the current year's report to a publicly accessible site on the Internet.

7. The owner of a community waterworks shall retain copies of the report for no less than three years.

12VAC5-590-546. Regulated contaminants for the consumer confidence reports and public notification.

A. Public notices and CCRs shall contain the appropriate mandatory language and information listed, as required by 12VAC5-590-540 and 12VAC5-590-545.

B. Information on regulated contaminants is presented in Table 546.1.

TABLE 546.1
Content Requirements of Consumer Confidence Reports and Public Notices

CONTAMINANT (UNITS)	TRADITIONAL PMCL IN mg/l	TO CONVERT FOR CCR, MULTIPLY BY	PMCL IN CCR UNITS	MCLG	MAJOR SOURCES IN DRINKING WATER	HEALTH EFFECTS LANGUAGE
Microbiological Contaminants						
(1) Total Coliform Bacteria	TT			n/a	Naturally present in the environment	Coliforms are bacteria that are naturally present in the environment and are used as an indicator that other, potentially-harmful, waterborne pathogens may be present or that a potential pathway exists through which contamination may enter the waterworks.
(2) E. coli	PMCL: In compliance unless (i) the waterworks has an E. coli-positive repeat sample following a total coliform-positive routine sample; (ii) the waterworks has a total coliform-positive repeat sample following an E. coli-positive routine sample; (iii) the waterworks owner fails to collect all required repeat samples following an E. coli positive routine sample; or (iv) the waterworks owner fails to test for E. coli when any repeat sample tests positive for total coliform.			0	Human and animal fecal waste	E. coli are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Human pathogens in these wastes can cause short-term effects, such as diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a greater health risk for infants, young children, the elderly, and people with severely-compromised immune systems.

TABLE 546.1 Content Requirements of Consumer Confidence Reports and Public Notices (*continued*)						
(3) E. coli	TT			n/a	Human and animal fecal waste	E. coli are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Human pathogens in these wastes can cause short-term health effects, such as diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a greater health risk for infants, young children, the elderly, and people with severely compromised immune system.
(4) Source water fecal indicator (E. coli)	TT		TT	0 for E. coli		Fecal indicators are microbes whose presence indicates that the water may be contaminated with human or animal wastes. Microbes in these wastes can cause short term health effects, such as diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a special health risk for infants, young children, some of the elderly, and people with severely compromised immune system.

TABLE 546.1 Content Requirements of Consumer Confidence Reports and Public Notices (*continued*)						
(5) Groundwater rule TT violations other than source water fecal indicator E. coli above[a]	TT			TT		Inadequately treated or inadequately protected water may contain disease-causing organisms. These organisms can cause symptoms such as diarrhea, nausea, cramps, and associated headaches.
(6)Turbidity	TT		TT	n/a	Soil runoff	Turbidity has no health effects. However, turbidity can interfere with disinfection and provide a medium for microbial growth. Turbidity may indicate the presence of disease-causing organisms. These organisms include bacteria, viruses, and parasites that can cause symptoms such as nausea, cramps, diarrhea, and associated headaches.
(7) Giardia lamblia, viruses, Hetrotropic plate count, Legionella, Cryptosporidium[a]	TT[c]		n/a	0	n/a	Inadequately treated water may contain disease-causing organisms. These organisms include bacteria, viruses, and parasites that can cause symptoms such as nausea, cramps, diarrhea, and associated headaches.

TABLE 546.1 Content Requirements of Consumer Confidence Reports and Public Notices (*continued*)						
Radioactive Contaminants						
(8) Beta/photon emitters (mrem/yr)	4 mrem/yr		4	0	Decay of natural and man-made deposits	Certain minerals are radioactive and may emit forms of radiation known as photons and beta radiation. Some people who drink water containing beta and photon emitters in excess of the PMCL over many years may have an increased risk of getting cancer.
(9) Alpha emitters (pCi/L)	15 pCi/L		15	0	Erosion of natural deposits	Certain minerals are radioactive and may emit a form of radiation known as alpha radiation. Some people who drink water containing alpha emitters in excess of the PMCL over many years may have an increased risk of getting cancer.
(10) Combined radium (pCi/L)	5 pCi/L		5	0	Erosion of natural deposits	Some people who drink water containing radium-226 or radium-228 in excess of the PMCL over many years may have an increased risk of getting cancer.
(11) Uranium (ppb)	30 µg/L		30	0	Erosion of natural deposits	Some people who drink water containing uranium in excess of the PMCL over many years may have an increased risk of getting cancer and kidney toxicity.

TABLE 546.1 Content Requirements of Consumer Confidence Reports and Public Notices (*continued*)						
Inorganic Contaminants						
(12) Antimony (ppb)	0.006	1000	6	6	Discharge from petroleum refineries; fire retardants; ceramics; electronics; solder	Some people who drink water containing antimony well in excess of the PMCL over many years could experience increases in blood cholesterol and decreases in blood sugar.
(13) Arsenic (ppb)	0.010	1000	10.	0	Erosion of natural deposits; runoff from orchards; runoff from glass and electronics production wastes	Some people who drink water containing arsenic in excess of the PMCL over many years could experience skin damage or problems with their circulatory system, and may have an increased risk of getting cancer.
(14) Asbestos (MFL)	7 MFL		7	7	Decay of asbestos cement water mains; erosion of natural deposits	Some people who drink water containing asbestos in excess of the PMCL over many years may have an increased risk of developing benign intestinal polyps.
(15) Barium (ppm)	2		2	2	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits	Some people who drink water containing barium in excess of the PMCL over many years could experience an increase in their blood pressure.

TABLE 546.1 Content Requirements of Consumer Confidence Reports and Public Notices (*continued*)						
(16) Beryllium (ppb)	0.004	1000	4	4	Discharge from metal refineries and coal-burning factories; discharge from electrical, aerospace, and defense industries	Some people who drink water containing beryllium well in excess of the PMCL over many years could develop intestinal lesions.
(17) Cadmium (ppb)	0.005	1000	5	5	Corrosion of galvanized pipes; erosion of natural deposits; discharge from metal refineries; runoff from waste batteries and paints	Some people who drink water containing cadmium in excess of the PMCL over many years could experience kidney damage.
(18) Chromium (ppb)	0.1	1000	100	100	Discharge from steel and pulp mills; erosion of natural deposits	Some people who drink water containing chromium well in excess of the PMCL over many years could experience allergic dermatitis.

TABLE 546.1 Content Requirements of Consumer Confidence Reports and Public Notices (*continued*)						
(19) Copper (ppm)	AL=1.3		AL=1.3	1.3	Corrosion of household plumbing systems; erosion of natural deposits	Copper is an essential nutrient, but some people who drink water containing copper in excess of the AL over a relatively short amount of time could experience gastrointestinal distress. Some people who drink water containing copper in excess of the action level over many years could suffer liver or kidney damage. People with Wilson's Disease should consult their personal doctor.
(20) Cyanide (ppb)	0.2	1000	200	200	Discharge from steel or metal factories; discharge from plastic and fertilizer factories	Some people who drink water containing cyanide well in excess of the PMCL over many years could experience nerve damage or problems with their thyroid.

TABLE 546.1 Content Requirements of Consumer Confidence Reports and Public Notices (*continued*)						
(21) Fluoride (ppm)	4		4	4	Erosion of natural deposits; water additive that promotes strong teeth; discharge from fertilizer and aluminum factories	Some people who drink water containing fluoride in excess of the PMCL over many years could get bone disease, including pain and tenderness of the bones. Fluoride in drinking water at half the PMCL or more may cause mottling of children's teeth, usually in children less than nine years old. Mottling, also known as dental fluorosis, may include brown staining or pitting of the teeth, and occurs only in developing teeth before they erupt from the gums.
(22) Lead (ppb)	AL=0.015	1000	AL=15	0	Corrosion of household plumbing systems; erosion of natural deposits	Infants and children who drink water containing lead in excess of the AL could experience delays in their physical or mental development. Children could show slight deficits in attention span and learning abilities. Adults who drink this water over many years could develop kidney problems or high blood pressure.

TABLE 546.1 Content Requirements of Consumer Confidence Reports and Public Notices (*continued*)						
(23) Mercury [inorganic] (ppb)	0.002	1000	2	2	Erosion of natural deposits; discharge from refineries and factories; runoff from landfills; runoff from cropland	Some people who drink water containing inorganic mercury well in excess of the PMCL over many years could experience kidney damage.
(24) Nitrate (ppm)	10		10	10	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits	Infants younger than the age of six months who drink water containing nitrate in excess of the PMCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue baby syndrome.
(25) Nitrite (ppm)	1		1	1	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits	Infants younger than the age of six months who drink water containing nitrite in excess of the PMCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue baby syndrome.
(26) Total Nitrate and Nitrite	10		n/a	10	n/a	Infants younger than the age of six months who drink water containing nitrate and nitrite in excess of the PMCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue baby syndrome.

TABLE 546.1 Content Requirements of Consumer Confidence Reports and Public Notices (*continued*)						
(27) Selenium (ppb)	0.05	1000	50	50	Discharge from petroleum and metal refineries; erosion of natural deposits; discharge from mines	Selenium is an essential nutrient. However, some people who drink water containing selenium in excess of the PMCL over many years could experience hair or fingernail losses, numbness in fingers or toes, or problems with their circulation.
(28) Thallium (ppb)	0.002	1000	2	0.5	Leaching from ore-processing sites; discharge from electronics, glass, and drug factories	Some people who drink water containing thallium in excess of the PMCL over many years could experience hair loss, changes in their blood, or problems with their kidneys, intestines, or liver.
Synthetic Organic Chemicals including Pesticides and Herbicides						
(29) 2,4-D (ppb)	0.07	1000	70	70	Runoff from herbicides used on row crops	Some people who drink water containing the weed killer 2,4-D well in excess of the PMCL over many years could experience problems with their kidneys, liver, or adrenal glands.
(30) 2,4,5-TP [Silvex] (ppb)	0.05	1000	50	50	Residue of banned herbicide	Some people who drink water containing silvex in excess of the PMCL over many years could experience liver problems.

TABLE 546.1 Content Requirements of Consumer Confidence Reports and Public Notices (*continued*)						
(31) Acrylamide	TT		TT	0	Added to water during sewage or wastewater treatment	Some people who drink water containing high levels of acrylamide over a long period of time could have problems with their nervous system or blood and may have an increased risk of getting cancer.
(32) Alachlor (ppb)	0.002	1000	2	0	Runoff from herbicide used on row crops	Some people who drink water containing alachlor in excess of the PMCL over many years could have problems with their eyes, liver, kidneys, or spleen, or experience anemia and may have an increased risk of getting cancer.
(33) Atrazine (ppb)	0.003	1000	3	3	Runoff from herbicide used on row crops	Some people who drink water containing atrazine well in excess of the PMCL over many years could experience problems with their cardiovascular system or reproductive difficulties.
(34) Benzo(a)pyrene [PAH]	0.0002	1,000,000	200	0	Leaching from linings of water storage tanks and distribution lines	Some people who drink water containing benzo(a)pyrene in excess of the PMCL over many years could experience reproductive difficulties and may have an increased risk of getting cancer.

TABLE 546.1 Content Requirements of Consumer Confidence Reports and Public Notices (*continued*)						
(35) Carbofuran (ppb)	0.04	1000	40	40	Leaching of soil fumigant used on rice and alfalfa	Some people who drink water containing carbofuran in excess of the PMCL over many years could experience problems with their blood, or nervous or reproductive systems.
(36) Chlordane (ppb)	0.002	1000	2	0	Residue of banned termiticide	Some people who drink water containing chlordane in excess of the PMCL over many years could experience problems with their liver or nervous system, and may have an increased risk of getting cancer.
(37) Dalapon (ppb)	0.2	1000	200	200	Runoff from herbicide used on rights of way	Some people who drink water containing dalapon well in excess of the PMCL over many years could experience minor kidney changes.
(38) Di(2-ethylhexyl) adipate (ppb)	0.4	1000	400	400	Discharge from chemical factories	Some people who drink water containing di(2-ethyhexyl)adipate well in excess of the PMCL over many years could experience toxic effects, such as weight loss, liver enlargement or possible reproductive difficulties.

TABLE 546.1 Content Requirements of Consumer Confidence Reports and Public Notices (*continued*)						
(39) Di(2-ethylhexyl)phthalate (ppb)	0.006	1000	6	0	Discharge from rubber and chemical factories	Some people who drink water containing di(2-ethylhexyl)phthalate in excess of the PMCL over many years may have problems with their liver, or experience reproductive difficulties, and may have an increased risk of getting cancer.
(40) Dibromochloro-propane (DBCP) (ppt)	0.0002	1,000,000	200	0	Runoff or leaching from soil fumigant used on soybeans, cotton, pineapples, and orchards	Some people who drink water containing DBCP well in excess of the PMCL over many years could experience reproductive problems and may have an increased risk of getting cancer.
(41) Dinoseb (ppb)	0.007	1000	7	7	Runoff from herbicide used on soybeans and vegetables	Some people who drink water containing dinoseb well in excess of the PMCL over many years could experience reproductive difficulties.
(42) Diquat (ppb)	0.02	1000	20	20	Runoff from herbicide use	Some people who drink water containing diquat in excess of the PMCL over many years could get cataracts.

TABLE 546.1 Content Requirements of Consumer Confidence Reports and Public Notices (*continued*)						
(43) Dioxin [2,3,7,8-TCDD] (ppq)	0.00000003	1,000,000,000	30	0	Emissions from waste incineration and other combustion; discharge from chemical factories	Some people who drink water containing dioxin in excess of the PMCL over many years could experience reproductive difficulties and may have an increased risk of getting cancer.
(44) Endothall (ppb)	0.1	1000	100	100	Runoff from herbicide use	Some people who drink water containing endothall in excess of the PMCL over many years could experience problems with their stomach or intestines.
(45) Endrin (ppb)	0.002	1000	2	2	Runoff of banned insecticide	Some people who drink water containing endrin in excess of the PMCL over many years could experience liver problems.
(46) Epichlorohydrin	TT		TT	0	Discharge from industrial chemical factories; an impurity of some water treatment chemicals	Some people who drink water containing high levels of epichlorohydrin over a long period of time could experience stomach problems and may have an increased risk of getting cancer.

TABLE 546.1 Content Requirements of Consumer Confidence Reports and Public Notices (*continued*)						
(47) Ethylene dibromide (ppt)	0.00005	1,000,000	50	0	Discharge from petroleum refineries	Some people who drink water containing ethylene dibromide in excess of the PMCL over many years could experience problems with their liver, stomach, reproductive system, or kidneys, and may have an increased risk of getting cancer.
(48) Glyphosate (ppb)	0.7	1000	700	700	Runoff from herbicide use	Some people who drink water containing glyphosate in excess of the PMCL over many years could experience problems with their kidneys or reproductive difficulties.
(49) Heptachlor (ppt)	0.0004	1,000,000	400	0	Residue of banned pesticide	Some people who drink water containing heptachlor in excess of the PMCL over many years could experience liver damage and may have an increased risk of getting cancer.
(50) Heptachlor epoxide (ppt)	0.0002	1,000,000	200	0	Breakdown of heptachlor	Some people who drink water containing heptachlor epoxide in excess of the PMCL over many years could experience liver damage and may have an increased risk of getting cancer.

TABLE 546.1 Content Requirements of Consumer Confidence Reports and Public Notices (*continued*)						
(51) Hexachlorobenzene (ppb)	0.001	1000	1	0	Discharge from metal refineries and agricultural chemical factories	Some people who drink water containing hexachlorobenzene in excess of the PMCL over many years could experience problems with their liver or kidneys or adverse reproductive effects and may have an increased risk of getting cancer.
(52) Hexachlorocyclo-pentadiene (ppb)	0.05	1000	50	50	Discharge from chemical factories	Some people who drink water containing hexachlorocyclopenta diene well in excess of the PMCL over many years could experience problems with their stomach or kidneys.
(53) Lindane (ppt)	0.0002	1,000,000	200	200	Runoff or leaching from insecticide used on cattle, lumber, gardens	Some people who drink water containing lindane in excess of the PMCL over many years could experience problems with their kidneys or liver.
(54) Methoxychlor (ppb)	0.04	1000	40	40	Runoff or leaching from insecticide used on fruits, vegetables, alfalfa, livestock	Some people who drink water containing methoxychlor in excess of the PMCL over many years could experience reproductive difficulties.

TABLE 546.1 Content Requirements of Consumer Confidence Reports and Public Notices (*continued*)						
(55) Oxamyl [Vydate] (ppb)	0.2	1000	200	200	Runoff or leaching from insecticide used on apples, potatoes, and tomatoes	Some people who drink water containing oxamyl in excess of the PMCL over many years could experience slight nervous system effects.
(56) PCBs [Polychlorinated biphenyls] (ppt)	0.0005	1,000,000	500	0	Runoff from landfills; Discharge of waste chemicals	Some people who drink water containing PCBs in excess of the PMCL over many years could experience changes in their skin, problems with their thymus gland, immune deficiencies, or reproductive or nervous system difficulties and may have an increased risk of getting cancer.
(57) Pentachloro-phenol (ppb)	0.001	1000	1	0	Discharge from wood preserving factories	Some people who drink water containing pentachlorophenol in excess of the PMCL over many years could experience problems with their liver or kidneys and may have an increased risk of getting cancer.
(58) Picloram (ppb)	0.5	1000	500	500	Herbicide runoff	Some people who drink water containing picloram in excess of the PMCL over many years could experience problems with their liver.

TABLE 546.1
Content Requirements of Consumer Confidence Reports and Public Notices (*continued*)

(59) Simazine (ppb)	0.004	1000	4	4	Herbicide runoff	Some people who drink water containing simazine in excess of the PMCL over many years could experience problems with their blood.
(60) Toxaphene (ppb)	0.003	1000	3	0	Runoff or leaching from insecticide used on cotton and cattle	Some people who drink water containing toxaphene in excess of the PMCL over many years could experience problems with their thyroid, kidneys, or liver and may have an increased risk of getting cancer.
Volatile Organic Chemicals						
(61) Benzene (ppb)	0.005	1000	5	0	Discharge from factories; leaching from gas storage tanks and landfills	Some people who drink water containing benzene in excess of the PMCL over many years could experience anemia or a decrease in blood platelets and may have an increased risk of getting cancer.

TABLE 546.1 Content Requirements of Consumer Confidence Reports and Public Notices (*continued*)						
(62) Carbon tetrachloride (ppb)	0.005	1000	5	0	Discharge from chemical plants and other industrial activities	Some people who drink water containing carbon tetrachloride in excess of the PMCL over many years could experience problems with their liver and may have an increased risk of getting cancer.
(63) Chlorobenzene (ppb)	0.1	1000	100	100	Discharge from chemical and agricultural chemical factories	Some people who drink water containing chlorobenzene in excess of the PMCL over many years could experience problems with their liver or kidneys.
(64) o-Dichloro-benzene (ppb)	0.6	1000	600	600	Discharge from industrial chemical factories	Some people who drink water containing o-dichlorobenzene well in excess of the PMCL over many years could experience problems with their liver, kidneys, or spleen or changes in their blood.

TABLE 546.1 Content Requirements of Consumer Confidence Reports and Public Notices (*continued*)						
(65) p-Dichloro-benzene (ppb)	0.075	1000	75	75	Discharge from industrial chemical factories	Some people who drink water containing p-dichlorobenzene in excess of the PMCL over many years could experience anemia, damage to their liver, kidneys, or circulatory systems.
(66) 1,2-Dichloro-ethane (ppb)	0.005	1000	5	0	Discharge from industrial chemical factories	Some people who drink water containing 1,2-dichloroethane in excess of the PMCL over many years may have an increased risk of getting cancer.
(67) 1,1-Dichloro-ethylene (ppb)	0.007	1000	7	7	Discharge from industrial chemical factories	Some people who drink water containing 1,1-dichloroethylene in excess of the PMCL over many years could experience problems with their liver.
(68) cis-1,2-Dichloroethylene (ppb)	0.07	1000	70	70	Discharge from industrial chemical factories	Some people who drink water containing cis-1,2-dichloroethylene in excess of the PMCL over many years could experience problems with their liver.

TABLE 546.1 Content Requirements of Consumer Confidence Reports and Public Notices (*continued*)						
(69) trans-1,2-Dichloroethylene (ppb)	0.1	1000	100	100	Discharge from industrial chemical factories	Some people who drink water containing trans-1,2-dichloroethylene well in excess of the PMCL over many years could experience problems with their liver.
(70) Dichloromethane (ppb)	0.005	1000	5	0	Discharge from pharma-ceutical and chemical factories	Some people who drink water containing dichloromethane in excess of the PMCL over many years could have liver problems and may have an increased risk of getting cancer.
(71) 1,2-Dichloropropane (ppb)	0.005	1000	5	0	Discharge from industrial chemical factories	Some people who drink water containing 1,2-dichloropropane in excess of the PMCL over many years may have an increased risk of getting cancer.
(72) Ethylbenzene (ppb)	0.7	1000	700	700	Discharge from petroleum refineries	Some people who drink water containing ethylbenzene well in excess of the PMCL over many years could experience problems with their liver or kidneys.

TABLE 546.1 Content Requirements of Consumer Confidence Reports and Public Notices (*continued*)						
(73) Styrene (ppb)	0.1	1000	100	100	Discharge from rubber and plastic factories; leaching from landfills	Some people who drink water containing styrene well in excess of the PMCL over many years could experience problems with their liver, kidneys, or circulatory system.
(74) Tetrachloro-ethylene (ppb)	0.005	1000	5	0	Discharge from factories and dry cleaners	Some people who drink water containing tetrachloroethylene in excess of the PMCL over many years could have problems with their liver and may have an increased risk of getting cancer.
(75) 1,2,4-Trichlorobenzene (ppb)	0.07	1000	70	70	Discharge from textile-finishing factories	Some people who drink water containing 1,2,4-trichlorobenzene well in excess of the PMCL over many years could experience changes in their adrenal glands.
(76) 1,1,1,-Trichloroethane (ppb)	0.2	1000	200	200	Discharge from metal degreasing sites and other factories	Some people who drink water containing 1,1,1-trichloroethane in excess of the PMCL over many years could experience problems with their liver, nervous system, or circulatory system.

TABLE 546.1 Content Requirements of Consumer Confidence Reports and Public Notices (*continued*)						
(77) 1,1,2-Trichloroethane (ppb)	0.005	1000	5	3	Discharge from industrial chemical factories	Some people who drink water containing 1,1,2-trichloroethane well in excess of the PMCL over many years could have problems with their liver, kidneys, or immune systems.
(78) Trichloroethylene (ppb)	0.005	1000	5	0	Discharge from metal degreasing sites and other factories	Some people who drink water containing trichloroethylene in excess of the PMCL over many years could experience problems with their liver and may have an increased risk of getting cancer.
(79) Toluene (ppm)	1		1	1	Discharge from petroleum factories	Some people who drink water containing toluene well in excess of the PMCL over many years could have problems with their nervous system, kidneys, or liver.
(80) Vinyl Chloride (ppb)	0.002	1000	2	0	Leaching from PVC piping; discharge from plastic factories	Some people who drink water containing vinyl chloride in excess of the PMCL over many years may have an increased risk of getting cancer.

TABLE 546.1 Content Requirements of Consumer Confidence Reports and Public Notices (*continued*)						
(81) Xylenes (ppm)	10		10	10	Discharge from petroleum factories; discharge from chemical factories	Some people who drink water containing xylenes in excess of the PMCL over many years could experience damage to their nervous system.
Disinfection Byproducts, Precursors, and Residuals						
(82) TTHM [total trihalomethanes] (ppb)	0.080	1000	80	n/a	Byproduct of drinking water disinfection	Some people who drink water containing trihalomethanes (THMs) in excess of the PMCL over many years could experience problems with their liver, kidneys, or central nervous systems, and may have an increased risk of getting cancer.
(83) Haloacetic acids (HAA) (ppb)	0.060	1000	60	n/a	Byproduct of drinking water disinfection	Some people who drink water containing haloacetic acids in excess of the PMCL over many years may have an increased risk of getting cancer.
(84) Bromate (ppb)	0.010	1000	10	0	Byproduct of drinking water disinfection	Some people who drink water containing bromate in excess of the PMCL over many years may have an increased risk of getting cancer.

TABLE 546.1 Content Requirements of Consumer Confidence Reports and Public Notices (*continued*)						
(85) Chloramines (ppm)	MRDL=4.0		MRDL =4.0	MRDL G=4	Water additive used to control microbes	Some people who use water containing chloramines well in excess of the MRDL could experience irritating effects to their eyes and nose. Some people who drink water containing chloramines well in excess of the MRDL could experience stomach discomfort or anemia.
(86) Chlorine (ppm)	MRDL=4.0		MRDL =4.0	MRDL G=4	Water additive used to control microbes	Some people who use water containing chlorine well in excess of the MRDL could experience irritating effects to their eyes and nose. Some people who drink water containing chlorine well in excess of the MRDL could experience stomach discomfort.

TABLE 546.1 Content Requirements of Consumer Confidence Reports and Public Notices (*continued*)						
(87) Chlorine dioxide (ppb)[b]	MRDL=0.8	1000	MRDL=800	MRDLG=800	Water additive used to control microbes	Some infants and young children who drink water containing chlorine dioxide in excess of the MRDL could experience nervous system effects. Similar effects may occur in fetuses of pregnant women who drink water containing chlorine dioxide in excess of the MRDL. Some people may experience anemia.
(88) Chlorine dioxide, where any two consecutive daily samples collected at the entrance to the distribution system are above the MRDL.[a]	MRDL=0.8			MRDLG=0.8		The chlorine dioxide violations reported today are the result of exceedances at the treatment facility only, not within the distribution system that delivers water to consumers. Continued compliance with chlorine dioxide levels within the distribution system minimizes the potential risk of these violations to consumers.

TABLE 546.1 Content Requirements of Consumer Confidence Reports and Public Notices (*continued*)						
(89) Chlorine dioxide, where one or more distribution system samples are above the MRDL.[a]	MRDL=0.8			MRDLG=0.8		The chlorine dioxide violations reported today include exceedances of EPA standard within the distribution system that delivers water to consumers. Violations of the chlorine dioxide standard within the distribution system may harm human health based on short-term exposures. Certain groups, including fetuses, infants, and young children, may be especially susceptible to nervous system effects from excessive chlorine dioxide exposure.
(90) Chlorite (ppm)	1.0		1.0	0.8	Byproduct of drinking water disinfection	Some infants and young children who drink water containing chlorite in excess of the PMCL could experience nervous system effects. Similar effects may occur in fetuses of pregnant women who drink water containing chlorite in excess of the PMCL. Some people may experience anemia.

TABLE 546.1 Content Requirements of Consumer Confidence Reports and Public Notices (*continued*)						
(91) Total organic carbon (ppm)	TT		TT	n/a	Naturally present in the environment	Total organic carbon (TOC) has no health effects. However, total organic carbon provides a medium for the formation of disinfection byproducts. These byproducts include trihalomethanes (THMs) and haloacetic acids (HAAs). Drinking water containing these byproducts in excess of the PMCL may lead to adverse health effects, liver or kidney problems or nervous systems effects and may lead to an increased risk of getting cancer.

[a]This information is for public notification purposes only.

[b]This information is for the CCR purposes only.

[c]Violations of the treatment technique requirements for filtration and disinfection that involve turbidity exceedances may use the health effects language for turbidity instead.

12VAC5-590-550. Recordkeeping.

A. The owner shall maintain all of the waterworks records in accordance with the Records Retention and Disposition Schedule of the Library of Virginia, General Schedule No. 7 for public utility records of county and municipal governments.

B. The owner shall retain at the waterworks or at a convenient location near the waterworks the following records for not less than the time periods specified:

1. Microbiological analyses and turbidity analyses, including records of any repeat samples collected and meeting the criteria for an extension of the 24-hour period for collecting repeat samples as required under 12VAC5-590-380 -- Five years.

2. Chemical Analyses -- 10 years.

3. The following information shall be provided for subdivisions B 1 and B 2 of this section:

a. Date, place, and time of sampling as well as the name of the person who collected the sample;

b. Identification of sample (e.g., routine, repeat, confirmation sample, source water, other);

c. Date of analysis;

d. Laboratory or person responsible for performing analysis;

e. Analytical method or technique used; and

f. Results of the analysis.

4. Individual filter monitoring required under 12VAC5-590-531 A 2 b -- Three years.

5. Results of disinfection profile including raw data and analysis -- Indefinitely.

6. Disinfection benchmarking including raw data and analysis -- Indefinitely.

7. Original records of all sampling data and analyses, reports, surveys, letters, evaluations, schedules, department determinations, and any other information required by 12VAC5-590-405 A 1 and 12VAC5-590-405 A 2, 12VAC5-590-405 B, 12VAC5-590-405 C, and 12VAC5-590-405 D pertaining to lead and copper -- 12 years.

8. Results from the initial round of source water monitoring under 12VAC5-590-401 B 1 and the second round of source water monitoring under 12VAC5-590-401 B 2 until three years after bin classification under 12VAC5-590-401 D 1 for the particular round of monitoring.

9. Any notification to the department that source water monitoring will not be conducted due to meeting the criteria of 12VAC5-590-401 B 4 -- Three years.

10. Results of treatment monitoring associated with microbial toolbox options under 12VAC5-590-401 E 3 through 12VAC5-590-401 E 7 and with uncovered finished water reservoirs under 12VAC5-590-415, as applicable, -- Three years.

11. Action taken to correct violations of this chapter-- Three years after last action with respect to violation involved.

12. The owner shall retain completed assessment forms for all Level 1 and Level 2 assessments conducted in accordance with 12VAC5-590-392 C, regardless of who conducts the assessment, and documentation of corrective actions completed as a result of those assessments, or other available summary documentation of the sanitary defects and correction actions taken under 12VAC5-590-392 D for a period not less than five years after completion of the assessment or corrective action, whichever is later.

13. Copies of reports, summaries, or communications relating to any sanitary surveys performed -- 10 years following inspection.

14. Variance or exemptions granted (and records related thereto) -- Five years following expiration of the variance or exemption.

15. Cross-connection control program records -- 10 years.

16. The owner of a waterworks that recycles flow, as stipulated in 12VAC5-590-395 C, shall collect and retain on file the recycle flow information for review and evaluation by the department. This information shall be retained for a minimum of 10 years. Information shall include, as a minimum:

a. Copy of the recycle notification submitted to the department.

b. List of all recycle flows and the frequency with which they are returned.

c. Average and maximum backwash flow rate through the filters and the average and maximum duration of the filter backwash process, in minutes.

d. Typical filter run length and a written summary of how the filter run length is determined.

e. The type of treatment provided for the recycle flow.

f. Data on the physical dimensions of the equalization or treatment units, typical and maximum hydraulic loading rates, type of treatment chemicals used, average dose, frequency of use, and frequency at which solids are removed, if applicable.

17. Copies of monitoring plans developed pursuant to this chapter shall be kept for the same period of time as the records of analyses taken under the plan are required to be kept under subsection A or B of this section, except as specified elsewhere in this chapter.

18. The owner shall retain the following additional records:

a. Plant operational records -- five years after the end of the calendar year;

b. Current organizational or staffing chart;

c. Record (As-built) engineering plans and specifications of facilities -- Retain for the life of the facility;

d. Equipment manuals for items in use -- Retain for the life of the equipment or facility;

e. Shop drawings of major equipment in use -- Retain for the life of the equipment;

f. Current list or chart of required laboratory tests with test frequencies and sampling locations;

g. Current preventive maintenance schedule;

h. Records of repair or replacement of equipment in use -- Retain for the life of the equipment;

i. Updated map of water distribution system; and

j. All accident reports -- Three years.

C. The owner of a waterworks with groundwater sources shall maintain the following records:

1. Corrective actions – --10 years.

2. Public notification as required by 12VAC5-590-540 -- Three years.

3. Invalidation of groundwater source samples -- Five years.

4. For consecutive waterworks, notification to the wholesale waterworks of coliform-positive samples -- Five years.

5. For a waterworks required to conduct compliance monitoring:

a. Department-specified minimum residual disinfectant --10 years.

b. Lowest daily residual disinfectant concentration -- Five years.

c. Dates and duration of any failure to maintain the department-specified minimum residual disinfectant concentration for a period of more than four hours -- Five years.

d. Department-specified compliance parameters for alternative treatment and records of the date and duration of any failure to meet the alternative treatment operating requirements for more than four hours -- Five years.

12VAC5-590-560. Safety.

The owner of a waterworks shall institute a safety program to inform personnel of the known hazards, preventive measures, and emergency procedures pertaining to the operation of the waterworks in accordance with VOSH laws and regulations.

12VAC5-590-565. Source water protection.

A. A waterworks owned by a county, city, or town may exercise the authority pursuant to § 15.2-2109 of the Code of Virginia to protect the waterworks from pollution or injury.

B. The owner of a waterworks with a drinking water reservoir may establish a buffer around the intake to limit such uses as body contact recreation and boats powered by engines, pursuant to a plan acceptable to the department.

C. The owner of a waterworks should develop a source water protection plan for all the sources and report ongoing or completed protection initiatives to the department.

12VAC5-590-570. Operational reporting requirements.

A. Monthly operational reports.

1. A classified waterworks is required to report monthly information to the department no later than the 10th of the month following the month during which the monitoring period occurred.

2. A classified waterworks using conventional filtration shall report using the monthly operating report (MOR) form approved by the department. All other classified waterworks shall report the required information specified in Tables 570.1 through 570.14, based on the treatment processes

employed. Monitoring data shall be collected for each day the operating staff attend to the operation of the facilities.

3. To determine if a waterworks using UV reactor systems is operating within validated conditions designed in accordance with 12VAC5-590-1005, the following parameters shall be monitored and reported: (i) on/off status for each reactor; (ii) flow rate through reactor train; (iii) UV intensity as measured by a UV sensor; (iv) lamp status; (v) lamp age; and (vi) UV transmittance. The operational set points shall be reported if set point control is used. The calculated UV dose shall be reported if other than a set point control is used.

4. An unclassified waterworks is required to report quarterly the following information specified in Table 570.1, where applicable, to the department no later than the 10th of the month following the calendar quarter during which the monitoring period occurred.

5. An unclassified waterworks that is using any of the treatment processes described in Tables 570.2 through 570.14 is required to report no later than the 10th of the month following the calendar month during which the monitoring occurred. The report shall contain the required information specified in Tables 570.1 through 570.14 based on the treatment processes employed. The monitoring data shall be collected at a minimum frequency as established by the department.

6. The department may vary the reporting requirements on a case-by-case basis.

Table 570.1 Baseline Data -- All Waterworks
Public water system ID no.
System name
Reporting month and year (reporting quarter and year[a])
Location (county)
Number of connections, monthly average (maximum for reporting period[a])
Population served, monthly average (quarterly average and maximum day[a])
Total source water withdrawn, gpd
Total source water treated, gpd
Total finished water produced, gal/month (for each entry point) or Total water purchased, gal/month (at each consecutive connection)
Operator name (printed and signature)
Operator classification (Class 1 to Class 6)
Operator DPOR certification no.
Name and contact information of the emergency contact person (text, voice phone number)
Required for an unclassified waterworks[a]

Table 570.2 Chlorine Disinfection
Chlorine compound used (chlorine gas, calcium hypochlorite or sodium hypochlorite)
Amount of chlorine compound used at each application point, lb/day
Residual disinfectant concentration (measured as total chlorine, free chlorine, combined chlorine, or chlorine dioxide) at entry point, mg/L
Chlorite concentration (if chlorine dioxide is used), daily measurement at entry point, mg/L

Table 570.3 Chlorine Residual in the Distribution System
Chlorine compound used (chlorine gas, calcium hypochlorite or sodium hypochlorite)
Residual disinfectant concentration, measured as total chlorine, free chlorine, combined chlorine, or chlorine dioxide, mg/L (collected with each total coliform bacteria sample, in accordance with approved sampling plan)

Table 570.4 Rechlorination in the Distribution System
Chlorine compound used (chlorine gas, calcium hypochlorite or sodium hypochlorite)
Amount of chlorine compound used at each application point, lb/day
Free chlorine residual concentration before rechlorination, mg/L
Free chlorine residual concentration after rechlorination, mg/L
Free chlorine residual, mg/L (measured and reported with each total coliform bacteria sample, in accordance with approved sampling plan)

Table 570.5 Iron and Manganese Treatment by Oxidation, Detention and Filtration
Source water iron and manganese concentrations, mg/L (each source)
Oxidant amount used, lb/day
Finished water iron and manganese concentrations, mg/L (each filter)
Finished water pH (each filter)
Filter hours between backwash (each filter)

Table 570.6 Iron and Manganese Treatment by Ion Exchange
Ion exchange material (type, manufacturer, and product name)
Source water iron and manganese concentrations, mg/L (each source)
Finished water iron and manganese concentrations, mg/L (each unit softener)
Finished water pH (each unit softener)
Head loss, psi (each unit softener)
Regeneration date and method (each unit softener)
Backwash date and duration of washing (each unit softener)
Backwash rate, gpm (each unit softener)

Table 570.7 Sequestration of Iron and Manganese
Chemical used (manufacturer and product name)
Quantity used, lb/day (average)
Source water iron and manganese concentrations, mg/L (each source)
Finished water (entry point) iron and manganese concentrations, mg/L
Finished water (entry point) treatment chemical concentration, mg/L
Treatment chemical residual concentration, mg/L (value at distal end of distribution system, report at same frequency as free chlorine residual testing)

Table 570.8 pH Adjustment or Corrosion Control by Chemical Addition
Chemical used (manufacturer and product name)
Quantity used, lb/day (average)
Source water pH
Finished water (entry point) pH
Finished water (entry point) treatment chemical concentration, mg/L (if required water quality parameter for compliance with lead and copper)

Table 570.9 Cation Exchange Softening
Cation exchange material (type, manufacturer, and product name)
Regeneration date and method (each unit)
Backwashing date and duration of washing (each unit)
Softener influent hardness, mg/L as $CaCO_3$ (each source)
Softener effluent hardness, mg/L as $CaCO_3$ (each unit)
Stabilization chemical type, weight, daily dosage
Finished water (entry point) pH
Finished water (entry point) alkalinity, mg/L
Finished water (entry point) hardness, as $CaCO_3$

Table 570.10 Fluoridation
Chemical used (manufacturer and product name)
Fluoride used, lb/day
Fluoride dosage, mg/L (daily)
Water treated, MGD
Finished water (entry point) fluoride concentration, mg/L (maximum, minimum, and average)

Table 570.11 Microfiltration or Ultrafiltration
Hours unit in operation
Source water flow, gpd
Filtrate volume, gpd
Recirculated during suspension mode (volume or percent of feed flow, per day)
Waste volume, gpd
Maximum stabilized flux, gpd/ft^2
Source water turbidity, NTU bench test (daily)
Source water turbidity, NTU in line (collected at same time as bench test)
Source water turbidity, NTU in-line (maximum daily)
Source water alkalinity, mg/L as $CaCO_3$ (daily)
Source water hardness, mg/L as $CaCO_3$ (daily)
Source water temperature, ºC (daily)
Source water pH (daily)
Filtered water turbidity, NTU bench test (daily)
Filtered water turbidity, NTU in line (collected at same time as bench test)
Filtered water turbidity, NTU in line (maximum daily)
Pressure loss across pre-filter, psi (daily) (if pre-filters are automatically cleaned, reporting is not required)
Number of membrane modules in use (daily)
Direct integrity test start time (daily)
Direct integrity test starting pressure, psi (each membrane unit, daily)
Direct integrity test final pressure, psi (daily)
Direct integrity test duration, minutes (daily)
Direct integrity test pressure decay rate, psi/minute (daily)

Table 570.11 Microfiltration or Ultrafiltration (*continued*)
Direct integrity test Log Removal Value (daily)
Trans-membrane pressure, psi (daily)
Trans-membrane pressure before clean-in-place, psi
Trans-membrane pressure after clean-in-place, psi
Cleaning solution used (manufacturer and product name)
pH of rinse water after clean-in-place
Calibrations completed (itemized instruments with dates completed)
Module repairs or replacements (itemized with dates repairs or replacements)
Entry point log inactivation of Giardia by disinfection (daily)

Table 570.12 Reverse Osmosis
Hours unit in operation
Pre-filter inlet pressure, psi (daily)
Pre-filter outlet pressure, psi (daily)
RO Inlet pressure, psi (daily)
RO outlet pressure, psi (daily)
Total permeate flow, gpd
Concentrate flow (bypass), gpd
Finished water flow, gpd
Total finished water (entry point) flow, gpd
Pre RO TDS, mg/L (daily)
Post RO TDS, mg/L (daily)
Pre RO turbidity, NTU (daily)
Post RO turbidity, NTU
Pre RO conductivity, uS/cm (daily)
Post RO conductivity, uS/cm (daily)
Finished water conductivity, uS/cm (daily)
Source water pH (daily)
Permeate pH (daily)
Finished water (entry point) pH (daily)
Module repairs or replacements (itemized with dates of repairs or replacements)

Table 570.13 UV Disinfection
All waterworks using ultraviolet (UV) disinfection must report the following:
Total run time, hours (per unit) Lamp status for each reactor train Lamp age for each reactor train Total production, MGD or gpd Flow Rates, minimum, maximum and average, MGD or gpd for each reactor train
To receive disinfection credit, the following shall also be reported:
Number of off-specification events Total off-specification volume, gal Percent off-specification volume UV Intensity setpoint, W/m^2 (if using intensity setpoint approach, daily) UV Intensity for each reactor, minimum, W/m^2 (if using intensity setpoint approach, daily) UV Intensity sensor calibration date for each reactor Required dose, mJ/cm^2 (if using calculated dose approach) UV Transmittance (UVT) for each reactor, daily percentage (if using calculated dose approach) Calculated dose for each reactor, daily minimum, mJ/cm^2 (if using calculated dose approach) Validated dose for each reactor, daily minimum, mJ/cm^2 (if using calculated dose approach) UVT analyzer calibration date (if using calculated dose approach) UV intensity sensor correction factor

Table 570.14 Ozone Disinfection
All waterworks using ozone disinfection must report the following: Ozone applied, lb/day and mg/L. Bromate concentration (mg/L), at the entry point to the distribution system, monthly.
To receive disinfection credit, the waterworks shall also report: Minimum ozone concentration $C_{initial}$ from first sample point (Effluent Method) or C_{geo} (Log Integration Method) in all contactors during peak flow, daily. Minimum and average ozone concentration C_{final} (mg/L) for each contactor in service, daily. Log Inactivation by ozonation, for Giardia, virus and, if applicable, Cryptosporidium, daily at peak flow and the minimum CT, daily.

B. The owner shall report the following incidents within 24 hours to the department:

1. Water pressure below the 20 psi minimum required in the distribution system, including zero or negative pressure. Examples of these events include treatment plant or pump station shutdowns due to equipment failure, power outages, emptying of storage tanks, and draining of the distribution system during fire flow events.

2. Flooding of clearwells.

3. Flooding of groundwater wells.

4. Any other situation that occurs with the waterworks that presents or may present an imminent and substantial threat to public health.

12VAC5-590-580. General requirements for cross-connection control and backflow prevention.

A. Every owner shall establish and enforce a cross-connection control program (CCCP) in accordance with 12VAC5-590-360. The goal of the CCCP is to prevent the intrusion of contamination into the distribution system via cross-connections and backflow. The owner shall document the CCCP activities in a cross-connection control plan and submit the written document to the department for review and approval.

B. No owner shall install, maintain, or allow a service connection to any premises where cross-connections to a waterworks or a consumer's water system exist, unless the owner and department ensure the cross-connections are adequately safeguarded.

C. No owner shall install, maintain, or allow any connection whereby water from an auxiliary water system may enter a waterworks or consumer's water system, unless the owner and department approve the auxiliary water system, the method of connection, and use of such system].

D. The owner, in accordance with 12VAC5-590-510 C, shall maintain acceptable working pressures in the distribution system to reduce the potential for backflow to occur.

12VAC5-590-600. Cross-connection control program responsibilities.

A. The owner shall establish and implement a CCCP consistent with the extent of the distribution system and the consumers served by the waterworks. The owner shall review the CCCP and written cross-connection control plan not less than every five years and update it as necessary to satisfy the requirements of this chapter. The owner shall submit updates to the department to obtain approval. The department may review the plan upon request. This program shall include at least one designated individual assigned by the owner. Requirements for this position shall include training and experience in cross-connection control programs.

B. The CCCP shall not be in conflict with the USBC and applicable building code regulations, including 13VAC5-63 or subsequent regulations promulgated by the Board of Housing and Community Development.

C. The CCCP shall ensure complete assessments of every consumer's water system and shall determine both the degree of hazard and the appropriateness of existing safeguards to prevent contamination from cross-connections and backflow.

D. The CCCP shall ensure testing, maintenance, and repairs of all backflow prevention assemblies, backflow elimination methods, and backflow prevention devices required and installed pursuant to 12VAC5-590-610.

E. 13VAC5-63-530, which incorporates the International Property Maintenance Code into the USBC, requires testing of RPZ assemblies, double check valve assemblies, double check detector backflow assemblies, and pressure vacuum breaker assemblies after initial installation, immediately after repairs or relocation, and annually thereafter. The CCCP shall establish procedures for completing and monitoring operational tests, or other evaluation procedures as appropriate, at least annually, and after installation, relocation, or repairs, for testable backflow prevention assemblies, devices, and methods that provide containment. The CCCP may include a public education program to:

1. Prompt consumer self-assessments, increase the awareness of cross-connections, and inform the consumer of the public health hazards of backflow.

2. The public education program, if provided as part of the CCCP, shall include, at a minimum, the following:

a. Causes of backflow;

b. Hazards and health effects of cross-connections and backflow;

c. Resources available to identify actual or potential cross-connections;

d. Safeguards to use to eliminate or control the hazards at the point of use; and

e. Sources for additional information.

F. The CCCP shall provide a method to discontinue or refuse water service to the consumer to ensure that the waterworks is adequately protected from cross-connections and backflow if any of the following conditions occur:

1. The consumer does not install, test and maintain a required backflow prevention assembly or backflow elimination method in accordance with the applicable sections of this chapter;

2. The consumer allows a required backflow prevention assembly or backflow elimination method to become inoperable or the consumer removes or bypasses it; or

3. The owner knows an unprotected or inadequately protected cross-connection exists on the premises and determines that there is inadequate backflow prevention at the service connection.

G. In the event of backflow of contaminants into the waterworks, the owner shall promptly take or cause corrective action to confine and eliminate the contamination. The owner shall report the event to the department within one business day in the most expeditious manner. The owner shall submit a written report by the 10th day of the month following the month during which backflow occurred addressing the incident, its causes and effects, and safeguards required or other action taken.

H. The owner shall maintain an inventory and records of testing, repairs, and maintenance of all backflow prevention assemblies, backflow elimination methods, and backflow prevention devices required and installed under 12VAC5-590-610 C. In the case of single-family residences subject to 12VAC5-590-610 C 5, the owner may determine whether or not to maintain an inventory or records. The department recommends the owner follow best practices identified in the AWWA Manual of Water Supply Practices M14 and the EPA Cross-Connection Control Manual.

I. The owner shall maintain an inventory and records of testing, repairs, and maintenance of all backflow prevention assemblies, backflow elimination methods, and backflow prevention devices required and installed under 12VAC5-590-610 E.

J. The owner shall maintain records related to the CCCP implementation, and any other records the department requires in accordance with 12VAC5-590-550.

12VAC5-590-610. Containment of backflow.

A. The owner shall ensure installation of backflow prevention assemblies or backflow elimination methods (i) at the service connection or (ii) downstream of the service connection but before any unprotected takeoffs.

B. Where the consumer's water system is not intricate or complex and where actual or potential cross-connection hazards can be eliminated or controlled, instead of containment, the owner may allow consumers to use point-of-use isolation protection by application of appropriate backflow prevention assemblies, backflow prevention devices, or backflow elimination methods complying with the USBC.

C. A backflow prevention assembly or backflow elimination method shall be installed where the following conditions exist:

1. A substance is handled in such a manner as to create an actual or potential hazard to a waterworks (this shall include premises having sources or systems containing process fluids or waters originating from a waterworks which are no longer under the control of the owner);

2. There exists internal cross-connections that, in the judgment of the owner or the department, may not be easily correctable or have intricate or complex plumbing arrangements that make it impracticable to determine whether or not cross-connections exist;

3. There are security requirements or other prohibitions or restrictions that prevent the assessment of all potential cross-connections that may impair the quality of the water delivered;

4. There is a repeated history of cross-connections being established or reestablished;

5. There are fire protection systems, lawn sprinkler systems, or irrigation systems;

6. The owner or department can show that a potential cross-connection hazard exists.

D. The owner shall ensure that consumers equip premises having booster pumps or fire pumps connected to the waterworks with control devices to prevent a reduction of pump suction line pressure to less than 20 psig.

E. A backflow prevention assembly or backflow elimination method shall be installed at consumer water systems serving the following types of facilities, including:

1. Hospitals, mortuaries, clinics, veterinary establishments, nursing homes, and medical buildings;

2. Laboratories;

3. Piers, docks, and waterfront facilities;

4. Sewage treatment plants, sewage pumping stations, or storm water pumping stations;

5. Food and beverage processing plants;

6. Chemical plants, dyeing plants, and pharmaceutical plants;

7. Metal plating industries;

8. Petroleum or natural-gas processing or storage plants;

9. Radioactive materials processing plants or nuclear reactors;

10. Car washes and laundries;

11. Buildings with commercial, industrial, or institutional occupants served through a master meter;

12. Water loading facilities;

13. Slaughter houses and poultry processing plants;

14. Farms where the water is used for other than household purposes;

15. Commercial greenhouses and nurseries;

16. Health clubs with swimming pools, therapeutic baths, hot tubs, or saunas;

17. Paper and paper-product plants and printing plants;

18. Pesticide or exterminating companies and their vehicles with storage or mixing tanks;

19. Facilities that blend, store, package, transport, or treat chemicals, and their related vehicles;

20. Schools or colleges with laboratory facilities;

21. Highrise buildings (four or more stories);

22. Multiuse commercial, office or warehouse facilities; and

23. Others specified by the owner or the department when reasonable cause can be shown for a potential backflow or cross-connection hazard.

F. All temporary or emergency service connections shall be protected where reasonable cause can be shown for a potential backflow or cross-connection hazard. Backflow prevention assemblies or backflow

elimination methods used shall be appropriately certified or approved to match the requirements of this section.

12VAC5-590-630. Backflow prevention assemblies, devices, and backflow elimination methods for containment.

A. Any backflow prevention assembly or backflow elimination method or backflow prevention device shall be of the approved type and shall comply with the USBC.

B. General safeguards

1. The backflow prevention assembly or backflow elimination method or backflow elimination device used shall depend on the degree of hazard that exists or may exist. The safeguard shall ensure maintenance of the distribution system water quality and its usefulness.

2. The degree of hazard, either high or low, is based on (i) the nature of the contaminant; (ii) the potential of the health hazard; (iii) the potential method of backflow (either by backpressure or by backsiphonage); and (iv) the potential effect on waterworks structures, equipment, and appurtenances used in the storage, collection, purification, treatment, and distribution of potable water. Table 630.1 shall be used as a guide to determine the degree of hazard for any situation.

Table 630.1
Determination of Degree of Hazard

Cross-connections that meet or may meet the following conditions shall be rated at the corresponding degree of hazard.	
High Hazard	Low Hazard
The contaminant would be toxic, poisonous, noxious, unhealthy, or of unknown quality.	The contaminant would only degrade the quality of the water aesthetically or impair the usefulness of the water.
A health hazard would exist.	A health hazard would not exist.
The contaminant would disrupt the service of piped water for human consumption.	The contaminant would not disrupt service of piped water for human consumption.
Backflow would be by either backpressure or backsiphonage.	Backflow would occur by backsiphonage.
Examples: lawn irrigation systems, fire sprinkler systems with chemical additives or antifreeze, sewage, used water, nonpotable water, auxiliary water systems, and mixtures of water and other liquids, gases, or other chemicals.	Examples: food residuals, coffee machines, non-carbonated beverage dispensers, and residential fire sprinkler systems constructed of materials designed for potable water flow.

3. The USBC and the manufacturer's specifications shall be used to determine the appropriateness of the backflow prevention assembly or backflow prevention device application for containment.

C. Owners shall not allow the installation of backflow prevention devices or backflow prevention assemblies with openings, outlets, or vents that are designed to operate or open during backflow prevention:

1. In areas subject to flooding or in pits;

2. In areas with atmospheric conditions that represent a contamination threat to the potable water supply; and

3. In such a manner as to be able to be bypassed.

D. Starting January 1, 2023, persons testing and repairing backflow prevention assemblies and backflow prevention devices shall be certified by a Commonwealth of Virginia tradesman certification program (identified by DPOR as backflow prevention device workers). Until January 1, 2023, persons testing and repairing backflow prevention assemblies and backflow prevention devices shall be qualified to perform such work as demonstrated by possessing a certification or license from a local or state agency

having legal authority or shall possess a certificate of completion of applicable vocational training acceptable to the owner.

Part III - Manual of Practice for Waterworks Design

12VAC5-590-640. General design considerations.

A. Waterworks shall conform to the Public Water Supply Law, Article 2 of Chapter 6 of Title 32.1 of the Code of Virginia. Community waterworks shall be designed to provide for the estimated water demand for 10 to 30 years hence under predicted growth conditions. All waterworks shall be designed so that they can readily be increased in capacity except where circumstances preclude the probability of expansion. Expansion by modular steps should be considered.

B. Waterworks design shall be based on sound engineering practice substantiated in the engineer's design and approved by the department. Historical data or typical usage figures of waterworks with similar service area characteristics and appropriate peaking factors shall be used to support the design. USBC and design standards may be referenced for noncommunity waterworks, as appropriate.

1. Community waterworks shall be designed to meet or exceed the estimated maximum daily water demand of the service area at the design year. The design shall account for diurnal demand patterns and special demands placed on the waterworks such as firefighting, industrial use, and wholesale customers.

2. Noncommunity waterworks shall be designed to meet or exceed the peak hour demand of the proposed services. Either pump capacity or storage capacity or both may be utilized to meet the peak hour demand.

3. Effective storage.

a. Community waterworks shall provide sufficient finished water effective storage to enable the waterworks to meet the estimated maximum daily water demand at the design year. Compliance with this requirement is normally determined by the use of a hydraulic model. In the absence of a hydraulic model, effective storage shall be a minimum of one-half of estimated maximum daily water demand of the waterworks at the design year.

b. There is no minimum finished water effective storage requirement for noncommunity waterworks.

c. Effective storage of atmospheric storage tanks shall be the volume available to store finished water in atmospheric reservoirs or tanks, measured as the difference between the overflow elevation, or the normal maximum operating level, and the minimum storage elevation. For atmospheric tanks that use a portion of their volume to generate distribution system pressure, the minimum storage elevation is that elevation of water in the tank that can provide a minimum pressure of 20 psig throughout that tank's service area under distribution system-wide maximum daily water demand.

d. Effective storage of pressure storage tanks shall be one-third of the nominal pressure vessel storage capacity.

C. Waterworks shall be designed to provide a minimum residual pressure of 20 psig at all service connections. Design shall be based on the most restrictive conditions, defaulting to the greater of peak hour demand or maximum daily water demand plus applicable fire flows. Fire flow design values shall be identified by the engineer after coordination among the owner, local and state building officials, and fire officials. Distribution system hydraulic modeling may be used to demonstrate compliance with this requirement.

D. Materials used in the construction of waterworks that are in contact with the product water shall comply with NSF/ANSI/CAN Standard 61-2020 or an approved equivalent.

12VAC5-590-660. Site location.

A. Wells and water treatment plants shall be located above the projected 100-year flood elevation. A lower elevation may be considered if it can be adequately shown that the wells or treatment plants can be protected from flooding. Site grading and adequate drainage shall be provided. Springs subject to flooding shall not be approved. See 12VAC5-590-840 E for additional well location requirements.

B. The waterworks pumping and treatment facilities shall be readily accessible in all seasons. Access roads shall be provided.

C. Functional aspects of the site shall be considered in design, including the convenience of transportation facilities to the site and the availability of electric power from more than one source.

12VAC5-590-670. Site size.

A. The area reserved around a well or spring site shall conform to 12VAC5-590-840 D and 12VAC5-590-840 E.

B. The treatment plant site shall be of ample size to accommodate expansion, and ample space shall be provided at the treatment site for adequate handling of treatment plant residuals.

C. The disposal of water treatment plant residuals shall conform to the State Water Control Law, Chapter 3.1 of Title 62.1 of the Code of Virginia.

12VAC5-590-680. Treatment process selection and BAT.

A. The following shall be considered when selecting treatment processes: (i) the quality and variability of the source water and (ii) possible future changes in the quality and quantity of the source water.

B. The design shall employ best available technologies (BAT) for achieving compliance with the PMCLs for organic chemicals listed in 40 CFR 141.61 and BAT for achieving compliance with the PMCLs for inorganic chemicals listed in 40 CFR 141.62.

C. The design shall employ BAT for achieving compliance with the PMCLs for radionuclides listed in 40 CFR 141.66, including radium-226, radium-228, uranium, gross alpha particle activity, beta particle, and photon radioactivity. The design shall consider the system size and use limitations for specific technologies listed in 40 CFR 141.66.

D. Alternative technologies may be employed when approved by the department.

E. When treatment technique requirements have been established instead of PMCLs or ALs, the design shall employ processes specified by these requirements.

F. POU devices shall not be used to achieve compliance with the treatment technique for microbial contaminants. POE or POU devices may be considered for short-term interim use when approved as a condition of a variance or exemption issued by the commissioner.

G. For softening, TDS removal, organics removal, and other treatment purposes, the use of RO and NF shall be in accordance with ANSI/AWWA Standard B114-16, or as allowed by the department on a case-by-case basis.

12VAC5-590-700. Metering total water production.

A. The design of all community waterworks shall provide metering of total water production.

B. The design of all NTNCs that provide treatment or have a design capacity of greater than 300,000 gallons per month shall provide metering of total water production.

C. The design of all TNCs that provide treatment or have a design capacity of greater than 300,000 gallons per month shall provide metering of total water production.

D. If the waterworks treatment process results in a waste flow, including filter backwash, ion exchange regenerate, or residual solids, then the design shall provide metering of total source water withdrawn and finished water produced.

E. Metering of total water production at waterworks that do not meet the conditions found in subsections A through D of this section should be provided.

12VAC5-590-720. Building design and construction.

A. In accordance with the USBC, Chapter 6 (§ 36.97 et seq.) of Title 36 of the Code of Virginia, and the Statewide Fire Prevention Code (§ 27.94 et seq.) of Title 27 of the Code of Virginia, all waterworks building design and construction shall include necessary features that will assure a functional and safe environment, including adequate ventilation, lighting, heating, drainage, dehumidification, and accessibility to equipment for operation and maintenance.

B. Consistent with subdivision A of this section, the waterworks building design and layout shall incorporate safety provisions to protect waterworks operators and other personnel, in accordance with Article 1 (§ 40.1-22) of Chapter 3 of Title 40.1 of the Code of Virginia. These provisions must comply with federal occupational safety and health standards and regulations promulgated under 29 USC § 651 et seq. and shall include separation of incompatible chemicals, confined space entry, handrails and guards, ladders, lighting, warning signs, smoke detectors, chlorine leak detectors, protective equipment, safety showers, eye washes, and fire extinguishers.

C. Positive identification of the contents of a piping system shall be by lettered legend giving the name of the contents. Arrows shall be used to indicate the direction of flow. Legends shall be applied close to valves, adjacent to changes in direction and branches, where pipes pass through walls and floors, and at frequent intervals on straight pipe runs. The lettering shall be of such color, size, and location so as to be clearly visible and readable.

D. Common division walls between basins or conduits containing nonpotable water and potable water are prohibited. Vertical double division walls, where separated sufficiently to permit ready access for inspection, are permissible where the division walls are monolithic in construction and are properly keyed into their footings or are cast monolithically with their footings.

E. Shop space and storage facilities shall be provided.

F. Wherever pipes pass through walls of concrete structures, extra wall castings to facilitate expansion and future uses shall be provided.

12VAC5-590-725. Automated monitoring and control systems.

The design of computers, including supervisory control and data acquisition (SCADA) systems if used to monitor and control water treatment and distribution system facilities, shall meet the following general requirements:

1. Data security.

   a. Automated systems used to display and record data or control functions that are connected to the internet shall be secure.

   b. Backup power supply shall be provided to allow orderly shutdown of the computer system and prevent corruption of data. The protection shall also power associated communications equipment.

   c. Adequate hardware shall be in place to allow a high degree of SCADA and computer system reliability and data security.

   d. Adequate hardware and associated facilities shall be provided for data archiving.

2. Equipment protection. SCADA and computer systems shall have adequate protection from voltage surges and spikes on the power supply, external data links, and environmental conditions.

3. Data displaying and recording.

   a. SCADA and computer systems used to meet the continuous recording requirements of this chapter shall record an observation on a minimum frequency of once per 15 minutes, unless a greater recording frequency is required.

b. SCADA and computer systems used to meet the indicating and recording requirements of this chapter shall provide displays that show a minimum 24-hour trend of results for each parameter. The display panel shall be located in an area where it can be routinely viewed by the waterworks operators.

c. SCADA and computer systems used to meet the indicating and recording requirements of this chapter shall monitor the values and provide alerts for the operator by visual display and audible alarms. Alarm conditions shall be recorded into an alarm log.

4. Waterworks pumps, chemical feeders, and other essential electrical equipment controlled through a SCADA or an automated control system shall have the capability for independent manual operation. Where a high degree of reliability is required, a backup control system shall be provided.

12VAC5-590-730. Alternate power sources.

A. An emergency management plan for extended power outages shall be developed for each community waterworks as specified in 12VAC5-590-505.

B. Alternative power sources at all waterworks shall be considered in the design to maintain a minimum level of service during an electrical power outage.

12VAC5-590-760. Laboratory facilities.

A. The design of laboratory facilities shall be compatible with the equipment provided, the water supply, and the design and complexity of the water treatment.

B. The design of community waterworks and NTNCs shall provide for adequate floor and bench space, adequate ventilation, adequate light, adequate separation of incompatible activities, adequate environmental controls, and auxiliary facilities sufficient to carry out reliable testing.

C. Certified analytical laboratory facilities analyzing drinking water shall comply with 1VAC30-41.

12VAC5-590-770. Sampling and monitoring equipment.

A. Sample taps shall be provided so that water samples can be obtained from each source water and each entry point to the distribution system. At waterworks providing treatment, sample taps shall be provided at the entrance and exit of each unit treatment process and at the entry point to the distribution system.

1. For surface water treatment plants, a master control sink shall monitor source water, chemically treated water, settled water, combined filter water, and at the entry point to the distribution system.

2. All sample taps shall discharge in the downward direction and be provided with a suitable air gap to prevent cross-connection.

B. Continuous monitoring instrumentation shall have electronic sensors that continuously read the parameter and shall display results in real time. Continuous recording equipment shall be provided with the monitoring instrument to store in memory or print one data point at least every 15 minutes. Each result shall be a single result at that time; if signal averaging is applied, the averaging period shall not exceed 30 seconds. The recording equipment shall be capable of producing a paper copy or equivalent electronic file showing daily trends, including maximum, minimum, and average values.

12VAC5-590-790. Process water.

Process water shall be taken from the finished water. An approved backflow prevention assembly or device shall be installed on the process water supply pipe before connection to the treatment process or equipment.

12VAC5-590-810. Components, materials, and products.

All components, materials, and products that will be in contact with source water, partially treated water, finished water, or water treatment chemicals shall comply with NSF/ANSI/CAN Standard 61-2020.

12VAC5-590-820. New source water selection and sampling.

A. Preference shall be given to the best available sources of supply that present minimal risks of contamination from point and nonpoint pollution sources that contain a minimum of impurities that may be hazardous to health and that give the greatest potential of ensuring a sufficient quantity of potable water.

B. In all cases, sources shall be selected and maintained on a basis that will assure that the water is continuously amenable to available treatment processes. In selecting the source of water to be developed, the owner shall prove to the satisfaction of the department that the water to be delivered to the consumers will comply with 12VAC5-590-340.

C. All water samples for bacteriological, chemical, physical, and radiological analyses shall be submitted to the DCLS or to a testing laboratory certified by the DCLS. Analytical methods shall be in accordance with 12VAC5-590-440.

12VAC5-590-830. Surface water sources; quantity; quality; development structures.

A. A surface water source includes all tributary streams and drainage basins, natural lakes, and artificial reservoirs or impoundments above the point of water supply intake.

1. The quantity of water at the source shall:

a. Be adequate to supply the water demand of the service area;

b. Provide a reasonable surplus for anticipated growth; and

c. Be adequate to compensate for all losses, including evaporation, seepage, flow-by requirements, etc.

2. The safe yield of the source shall be determined as follows:

a. Simple intake (free-flowing stream). The safe yield is defined as the minimum withdrawal rate available during a day and recurring every 30 years (30 year - one day low flow). To generate the report for this, data is to be used to illustrate the worst drought of record in Virginia since 1930. If actual gauge records are not available for this, gauges are to be correlated from similar watersheds and numbers are to be synthesized; and

b. Complex intake (impoundments in conjunction with streams). The safe yield is defined as the minimum withdrawal rate available to withstand the worst drought of record in Virginia since 1930. If actual gauge records are not available, correlation is to be made with a similar watershed and numbers synthesized in order to develop the report.

Note: Local governments may request this aid from the State Water Control Board (SWCB) by contacting either the Health Department's Office of Water Programs or the SWCB's headquarters office in Richmond.

B. The owner shall conduct, or have conducted, a sanitary survey and a study of the factors, both natural and man-made, which will affect the quality of the water at the source. The results of the sanitary survey shall be submitted to the division. Such survey and study shall include, but shall not be limited to:

1. Obtaining samples over a sufficient period of time to assess the bacteriological, physical, chemical, and radiological characteristics of the water;

2. Determining future uses and effects of impoundments or reservoirs;

3. Determining the degree of control over the watershed that may be exercised by the owner; and

4. Assessing degree of hazard to the source by possible spillage of materials that may be toxic, harmful, or detrimental to treatment processes.

C. Intake structures shall provide for:

1. Withdrawal of water from at least three levels in impoundments or reservoirs. Withdrawal of water from more than one level may be required in run-of-the stream intakes if the quality varies with depth;

2. Separate facilities for release of less desirable water held in storage;

3. Screens on intake ports with provisions for adequate cleaning;

4. Prevention of flooding of access walkways and control valves of intakes on multiple purpose reservoirs; and

5. Velocity of flow through inlet structure such that frazil ice will be held to a minimum.

D. A detention reservoir is a structure into which water is stored for pretreatment to improve water quality prior to other treatment. Where a detention reservoir is required, the development shall assure that:

1. Water quality is protected by controlling runoff into reservoir;

2. Dikes are structurally sound and protected against wind action and erosion;

3. Point of influent flow is separated from the point of withdrawal; and

4. Sufficient detention time is provided in the reservoir as recommended by the designer and approved by the division.

E. In order to protect the public health and guarantee a supply of pure water, terminal reservoirs shall not be utilized for body contact recreation and boats powered by gasoline engines. Large terminal reservoirs may be used for body contact recreation and boats powered by gasoline engines provided a buffer zone acceptable to the division and water purveyor is furnished. Site preparation shall include but not be limited to the removal of brush and trees to the high water elevation, and protection from floods during construction.

12VAC5-590-840. Groundwater sources.

A. A groundwater source includes all water obtained from drilled wells and springs. Wells and springs shall be protected from contamination during construction. All wells intended to serve a waterworks shall be constructed by a certified water well system provider. All wells shall be constructed in a manner to protect groundwater resources by preventing contaminated water or water having undesirable physical, chemical, or radiological characteristics from entering aquifers.

B. All wells located within the Eastern Virginia or the Eastern Shore Groundwater Management Areas shall be constructed in a manner to protect groundwater resources by preventing blending or cross contamination of the aquifers.

1. Wells shall not be constructed with screens in multiple aquifers.

2. Geophysical logging and formation sampling shall be required for all wells during construction, in addition to submitting a Uniform Water Well Completion Report, Form GW-2.

3. Observation and production wells shall be constructed with gravel packs and grout in a manner that prevents movement between aquifers. Gravel pack shall be terminated close to the top of the well screens and shall not extend above the top of the screened aquifer. The remainder of the annular space shall be filled with grout material.

4. Pump intake setting shall be documented and the pump intake shall not be set below the top of a confined aquifer or the bottom of an unconfined aquifer that supplies water to the well.

C. All groundwater sources must be analyzed for chemical, physical, radiological, and bacteriological quality as described in 12VAC5-590-840 K.

D. Wells intended for use as a community waterworks shall be located on a well lot meeting the following minimum requirements:

1. The well lot shall provide a distance of at least 50 feet from the well to all property lines;

2. The owner shall consider the need for a larger well lot for future expansion, the need to provide security measures such as lot fencing, and the need to establish additional well lots for future use;

3. If the well lot does not adjoin a public road, then an access road shall be provided and an access easement recorded as part of the well lot;

4. The well lot shall be graded to divert surface runoff away from the well and to prevent ponding on the well lot; and

5. The well lot and access to the lot shall be located by a survey, and a final plat plan and dedication document prepared and recorded as described in 12VAC5-590-200.

E. Minimum well location requirements:

1. The horizontal distance from the well to any septic tank, sanitary drainfield, pit privy, cesspool, barnyard, animal feed lot, cemetery, geothermal well or source of similar contamination, and all surface runoff from actual or potential sources of contamination shall be at least 50 feet.

2. The horizontal distances from the well to any pipe carrying sewage or pipe in which sewage can back up shall be at least 50 feet.

3. A minimum separation distance of 50 feet shall be maintained between a fuel storage tank and a well; however, a lesser distance may be allowed if the fuel is propane or natural gas, or if it is liquid fuel meeting the following requirements:

a. Liquid fuel tanks shall be located above grade.

b. Liquid fuel tanks shall be double-walled with an inner wall leak-detection alarm or single-walled with a full-capacity containment system constructed of compatible material.

c. Liquid fuel lines shall be located above grade or enclosed in a protective casing if below grade, and liquid fuel tanks shall be provided with a paved and curbed parking pad at the tank filling location.

4. The department shall require a spill response plan if the fuel is stored within 50 feet of the well.

F. The class of well to be constructed shall be determined by the department. A Uniform Water Well Completion Report, Form GW-2, shall be completed and submitted to the department with the project documents, in accordance with procedures in 12VAC5-590-200.

1. Minimum construction requirements for Class I wells:

a. The well shall be drilled and cased to a depth sufficient to exclude undesirable groundwater, but in no case shall this depth be less than 100 feet below finished grade.

b. The diameter of the drill hole shall be at least three inches greater than the outside diameter of the couplings of the casing to be used.

c. For wells constructed in consolidated formations, the lower end of the casing shall terminate in solid rock or other impervious formation when practical to do so.

d. The annular space around the casing shall be grouted to a depth of at least 100 feet in a manner satisfactory to the department. When the outer casing cannot be removed, the annular spacing between the drill hole and the outer casing shall also be sealed in a manner approved by the department.

2. Minimum construction requirements for Class II wells.

a. The well shall be drilled and cased to a depth sufficient to exclude undesirable groundwater, but in no case shall this depth be less than 50 feet below finished grade.

b. The diameter of the drill hole shall be at least three inches greater than the outside diameter of the couplings of the casing to be used.

c. For wells constructed in consolidated formations, the lower end of the enlarged portion of the drill hole should terminate in solid rock or other impervious formation when practical to do so.

d. The annular space around the casing shall be grouted to a depth of at least 50 feet in a manner satisfactory to the department. When the outer casing cannot be removed, the annular spacing between the drill hole and the outer casing shall be sealed in a manner approved by the department.

G. Well construction materials and development.

1. Water used in well construction shall be from a potable water source or from the well under construction.

2. Casing and liner pipe.

a. Steel casing and liner pipe shall meet ASTM, NSF/ANSI/CAN, or AWWA specifications and standards applicable to wells. Steel pipe dimensions shall conform to Table 840.1.

TABLE 840.1 Steel Well Casing Pipe					
STEEL PIPES					
SIZE (inches)	DIAMETER (inches)		THICKNESS (inches)	WEIGHT PER FOOT (pounds)	
	External	Internal		Plain Ends	With Threads and Couplings
4	4.5	4.026	0.237	10.79	11.0
6	6.625	6.065	0.280	18.97	19.18
8	8.625	7.981	0.322	28.55	29.35
10	10.750	10.020	0.365	40.48	41.85
12	12.750	12.000	0.375	49.56	51.15
14	14.000	13.250	0.375	54.57	57.00
16	16.000	15.250	0.375	62.58	
18	18.000	17.250	0.375	70.59	
20	20.000	19.250	0.375	78.60	
22	22.000	21.000	0.500	114.81	
24	24.000	23.000	0.500	125.49	
26	26.000	25.000	0.500	136.17	
28	28.000	27.000	0.500	146.85	
30	30.000	29.000	0.500	157.53	
32	32.000	31.000	0.500	168.21	
34	34.000	33.000	0.500	178.89	
36	36.000	35.000	0.500	189.57	

b. Plastic well casing shall be PVC meeting ASTM F480-14,, NSF/ANSI/CAN Standard 61-2020, or AWWA Standard A100-20. Depths shall not exceed the published resistance to hydraulic collapse pressure of the PVC casing, taking into account the installation techniques and grouting methods. Well casing wall thickness shall be sufficient to withstand anticipated formation and hydrostatic pressures and mechanical forces imposed during installation, well development, and use. PVC well casing shall meet the requirements of ASTM, NSF/ANSI/CAN, and AWWA, as applicable.

c. Heavyweight casing pipe may be required under certain geologic and hydrostatic conditions.

d. Where corrosive conditions exist, materials such as coated casings, stainless steel, bronze, or plastic may be used as casings or linings subject to approval by the department, and meeting the requirements of NSF/ANSI/CAN Standard 61-2020.

3. Packers or other well construction materials shall be of a material that will not impart taste, odors, toxic substances, or bacterial contamination to the water in the well. No lead is to be used in packers, flux, piping, etc.

4. Screens, where required, shall:

a. Be constructed of material that will not be damaged by chemical action of groundwater or future cleaning operations;

b. Have size of openings to be based on sieve analysis of the formation to be screened, and shall be adequate to pass flows at a velocity of 0.1 ft/sec or less; and

c. Be installed so that exposure above the pumping level will not occur.

5. Grouting requirements.

a. Neat cement grout shall consist of Portland cement and water with not more than six gallons of water per 94-pound sack of cement, and shall be in place within 48 hours of well construction. A maximum of 6.0%, by weight, bentonite and 2.0%, by weight, calcium chloride, may be added. Other grout mixes may be approved by the department where special conditions warrant.

b. Application.

(1) Grout shall be installed by means of continuous pressure grouting from the bottom of the annular opening upward in one continuous operation until the annular opening is filled.

(2) Sufficient annular opening shall be provided to permit a minimum of 1-1/2 inches of grout around the protective casing, including couplings, if used.

(3) Before grouting wells, suitable fill material such as bentonite, low-strength cement and sand mix, or similar materials that have been approved by the department shall be added to the annular opening below the grout zone to seal and stabilize these areas. Instead of this requirement, the casing may be grouted for its entire depth.

c. Casing shall be provided with sufficient centralizers attached to the casing to allow unobstructed flow and uniform thickness of the grout.

d. Where plastic well casing is used, the heat of hydration of cement mixtures and the hydraulic collapse pressure of the casing shall be taken into consideration when choosing grout composition and placement in accordance with DEQ guidelines.

6. To prevent tampering and contamination of the source water, unused wells shall be capped and locked. Watertight welded metal plates, set screw caps, or screw-on caps are acceptable for temporarily capping a well until the pumping equipment is installed.

H. A well yield and drawdown test shall be performed in accordance with requirements of this subsection. The department may require additional pumping wells, observation wells, or longer duration tests where site conditions warrant.

1. The yield and drawdown test duration shall be a minimum of 48 hours. Data to be collected during the yield and drawdown test shall be recorded on the Well Yield and Recovery Report form provided by the department. When the source water requirements for a noncommunity waterworks are determined to be three gpm or less over normal hours of operation, the 48-hour minimum drawdown test may be reduced to no less than 12 hours. Any reduction shall be approved by the department before conducting the test.

2. Discharge from the pumping well shall be conveyed away from the test site to avoid recharge.

3. Where multiple wells are intended to be used, the location and geology of each well in the vicinity shall be evaluated. The department shall require that:

a. The yield and drawdown test be performed simultaneously on the multiple wells, or

b. During the yield and drawdown test of the pumping well, the water levels of the neighboring wells shall be monitored. If the water level of the neighboring wells declines in response to the pumping well, then additional evaluation shall be required by a professional engineer or a professional geologist with experience in groundwater source evaluations.

4. The department may consider alternative testing methods and analyses as proposed by professional engineers or professional geologists with experience in groundwater source evaluations. Where geological conditions exist that prohibit an accurate determination of well yield using methods prescribed in this subsection, additional testing procedures shall be required on an individual basis and approved by the department.

5. When an aquifer test is required by DEQ for a well located in a GWMA, the yield and drawdown test may be incorporated into the aquifer test plan protocol if approved by the department before conducting the test.

I. Well appurtenances.

1. A sanitary seal shall be provided on the top of the well casing, or a watertight well cap shall be provided when a pitless adapter is installed.

2. The well casing shall extend at least 12 inches above the concrete floor or apron.

3. Where aprons are used, they shall be centered on the well and measure at least six feet by six feet by six inches thick.

4. Provisions shall be made for venting the well casing to the atmosphere. Where vertical turbine pumps are used, vents into the side of the casing may be necessary to provide adequate venting.

5. Each well casing shall be provided with equipment and appurtenances for measuring the water level elevation in the well. Corrosion-resistant materials shall be used. Where necessary, the appurtenances shall be attached firmly to the drop pipe or pump column and in a manner as to prevent entrance of foreign materials.

6. All pitless well units, adapters, and watertight caps shall be listed by the Water Systems Council as certified products, or as approved by the department.

J. Every new, modified, or reconditioned groundwater well or spring shall be disinfected after placement of the final pumping equipment. Wells shall be disinfected in accordance with AWWA Standard C654-13.

K. Water quality tests. Water quality sampling and analysis shall be conducted for every new, modified, or reconditioned well or spring to determine what treatment, if any, is required. All samples shall be analyzed by DCLS or a testing laboratory certified by DCLS. Water quality analytical methods shall conform to requirements contained in 12VAC5-590-440.

1. Bacteriological quality.

a. Bacteriological samples for new or deepened wells shall consist of a series of 20 samples collected at a minimum of 30-minute intervals during the last 10 hours of the yield and drawdown test. These samples shall be analyzed for both total coliform density and E. coli density. See 12VAC5-590-380 G for groundwater disinfection treatment requirements, and see 12VAC5-590-430 for surface water influence determinations.

b. Bacteriological samples for modified or reconditioned wells shall consist of two samples collected at least 30 minutes apart, at a minimum, while the pump is in continuous operation. These samples shall be analyzed for both total coliform density and E. coli density. More samples may be required by the department, depending on the work performed.

2. Samples for new wells shall be collected for chemical, physical, and radiological contaminants listed in Tables 340.1 through 340.4. SOC tests may be waived by the department if supported by the source water assessment of vulnerability to contamination. Chemical sampling analysis for a TNC may be limited to nitrate and nitrite only. Samples shall be collected at the end of the yield

and drawdown test and after the well water has shown no further change in the clarity of the water. Chemical, physical, and radiological constituent testing for modified or reconditioned wells shall be determined on an individual basis by the department.

L. Observation wells:

1. Shall be constructed in accordance with the requirements of DEQ if they are constructed in a GWMA. Otherwise, they shall be constructed in accordance with 12VAC5-630-420 if they are to remain in service as observation wells after completion of the groundwater study.

2. Shall be protected to preclude the entrance of contamination.

M. Sealing of select zones. All zones containing water of undesirable quality or zones to be protected but excluded from final well completion shall be grouted from a point at least five feet above the zone to a point at least five feet below the zone.

N. Gravel packed wells:

1. The gravel utilized shall be free of foreign material, properly sized, washed, and then disinfected before or during placement.

2. The gravel refill pipes, when used, shall be incorporated within the pump foundation or concrete apron and terminated with screwed or welded caps at least 12 inches above the pump house floor or concrete apron.

3. The gravel refill pipes in the grouted annular opening shall be surrounded by a minimum of 1-1/2 inches of grout.

4. A means for the prevention of leakage of grout into the gravel pack of the screen shall be provided.

5. The minimum protective casing and grouted depth shall be acceptable to the department.

6. Wells located in a GWMA shall have gravel packing installed in accordance with 12VAC5-590-840 B 3.

O. Radial water collector systems shall be considered on an individual basis by the department.

P. Flowing artesian wells located outside a GWMA will be considered on an individual basis by the department.

1. The well shall be equipped with a pitless adapter specifically designed for pressurized artesian wells.

2. Special well construction, casing, and sealing may need to be considered for flowing artesian wells.

Q. Capacity determination of wells used for community waterworks shall meet the daily water demand.

1. Capacity of wells located in consolidated rock formations shall be determined by the well sustainable yield, and the actual installed (production) well pump capacity, whichever value is less. The sustainable yield shall be calculated as follows:

(A x 1440 min/day) / 1.8 = gpd well sustainable yield, where A = well yield (gpm) determined by the yield and drawdown test conducted in accordance with 12VAC5-590-840 H.

2. Capacity of wells located in unconsolidated formations shall be determined by the well yield and the actual installed (production) well pump capacity, whichever value is less.

R. Waterworks serving 50 or more residential connections employing only wells providing the source water shall include at least two wells. If only two wells are provided, then the second well shall be rated for at least 30% of the waterworks permit capacity.

S. The owner of a waterworks serving fewer than 50 residential connections with a single well providing the source water shall provide or have ready access to a replacement pump and other components and materials needed for pump replacement. Instead of this requirement, the owner may provide 48 hours of total finished water storage volume based on the maximum daily water demand.

T. Springs.

1. The water quality of spring sources shall be established by obtaining samples over a period of time agreeable to the department to assess the bacteriological, physical, chemical, and radiological characteristics.

2. Springs shall be housed in a permanent structure and protected from entry of surface water.

3. The amount of land required for protection of the spring source shall be determined by the owner and approved by the department.

4. The design of spring sources shall provide for continuous disinfection.

5. The capacity of spring sources shall be determined using actual flow data.

a. Sufficient daily flow data shall be collected to conduct a frequency distribution analysis. The capacity of a spring source is defined as the low flow rate for one day with a projected recurrence period of 30 years (i.e., 30-year, one-day low flow).

b. The Log-Pearson Type III method of frequency distribution analysis shall be used to make the determination, with a minimum of 1,000 daily flow measurements.

c. If sufficient data is not available to conduct the analysis specified in this subsection, then the lowest recorded daily flow rate may be considered to be the spring capacity. Sufficient flow records shall be available to capture the spring flow during drought conditions, and shall be acceptable to the department.

12VAC5-590-850. Appropriate treatment.

A. The design of water treatment facilities shall depend upon the evaluation of the nature and quality of the particular source water to be treated and the required quality of the finished water. Treatment process selection shall follow the requirements of 12VAC5-590-680.

B. The design of water treatment facilities shall address safety considerations as required in 12VAC5-590-560.

12VAC5-590-860. Chemical application.

A. Plans and specifications shall be submitted for evaluation and approval, as required in Part I (12VAC5-590-200 through 12VAC5-590-220), and shall include:

1. Descriptions of feed equipment, including maximum and minimum feed ranges;

2. Location of feeders, piping layout, and points of application;

3. Chemical storage and handling facilities;

4. Specifications for chemicals to be used;

5. Operating and control features; and

6. Descriptions of testing equipment and procedures.

B. Chemicals shall be applied to the water at such points and by such means as to:

1. Assure maximum efficiency of treatment;

2. Provide maximum protection to the consumer;

3. Provide maximum safety to operators;

4. Assure satisfactory mixing of the chemicals with the water;

5. Provide maximum flexibility of operation through various points of application, when appropriate;

6. Prevent backflow or backsiphonage between multiple points of feed through common manifolds; and

7. Provide for the application of pH-affecting chemicals to the source water before the addition of the coagulant in turbidity removal processes.

C. Feed equipment.

1. Where chemical feed is necessary for the treatment of the source water, such as chlorination, coagulation, or other essential processes, a standby feeder or combination of feeders shall be available to provide the required chemical dose with the largest feeder out of service.

2. Feeders shall be of such design and capacity to meet the following requirements:

a. Feeders shall be able to supply the necessary amounts of chemical at an accurate rate throughout the range of feed at all times.

b. Proportioning of chemical feed to the rate of flow shall be provided where the water flow is not constant or where specifically required by the department.

c. Positive displacement type solution feed pumps, or gravity feed through rotameters, shall be used to feed liquid chemicals, but should not normally be used to feed chemical slurries.

d. Chemical contact materials and surfaces shall be resistant to the aggressiveness of the chemical solution.

e. Dry chemical feeders shall:

(1) Measure chemicals volumetrically or gravimetrically;

(2) Provide effective solution of the chemical in the solution pot;

(3) Provide gravity feed from solution pots; and

(4) Completely enclose chemicals to prevent emission of dust to the room.

f. No direct connection shall exist between any sewer and a drain or overflow from the feeder or solution chamber or tank.

g. A separate chemical waste tank should be considered.

3. Chemical feed equipment:

a. Shall be located near points of application to minimize length of feed lines;

b. Shall be readily accessible for servicing and repair, and observation of operation; and

c. Shall be located within a protective curbing so that chemicals resulting from equipment failure, spillage, or accidental drainage shall not enter the water in conduits or treatment or storage basins.

4. Control.

a. Feeders shall be capable of both manual and automatic control with the automatic control reverting to manual control as necessary;

b. Feeders shall be manually started following shutdown, unless otherwise approved by the department; and

c. Automatic chemical dose controls with residual analyzers shall provide alarms for critical values and shall include indicating and recording equipment.

5. Solution tanks. All solution tanks shall be manufactured of materials suitable for food contact or that meet the requirements of 12VAC5-590-810.

a. Means shall be provided to maintain uniform strength of solution, consistent with the nature of the chemical solution. Continuous agitation shall be provided to maintain slurries in suspension.

b. Solution tanks shall be of sufficient number and capacity to assure continuous chemical application during tank servicing, and the access openings shall be curbed and fitted with tight covers.

c. Each tank exceeding 30 gallons in capacity or fixed in place shall be provided with a drain unless other means of dewatering the tank are provided.

(1) Direct connection between any tank or drain and a sewer is prohibited.

(2) All drains shall terminate at least two pipe diameters, but not less than two inches, above the rim of the receiving sump, conduit, or waste receptacle.

d. Means shall be provided to indicate the solution level in the tank.

e. Process water shall enter the tank above the rim at a distance of two pipe diameters but not less than two inches.

f. Chemical solutions shall be kept covered.

g. Buried or subsurface chemical storage or solution tanks are prohibited.

h. Overflow pipes, when provided, shall:

(1) Be turned downward, and when located outside, be provided with an appropriately sized screened end to prevent entry of insects and small animals;

(2) Have free discharge;

(3) Be located where noticeable; and

(4) Be directed so as not to contaminate the water or be a hazard to operating personnel.

6. Weighing scales.

a. Shall be provided for weighing cylinders at all water treatment plants utilizing chlorine gas; for large water treatment plants, indicating and recording type are desirable;

b. Shall be provided for fluorosilicic acid feed systems in conjunction with a loss-of-weight recorder;

c. Shall be considered for volumetric dry chemical feeders; and

d. Shall be accurate to measure increments of 0.5% of load.

7. Feed lines.

a. Shall be as short as possible in length of run and be:

(1) Of durable, corrosion-resistant material;

(2) Easily accessible throughout the entire length;

(3) Protected against freezing; and

(4) Readily cleanable;

b. Shall slope upward from chemical source to feeder, when conveying gases.

c. Shall introduce corrosive chemicals in a manner as to minimize potential for corrosion.

d. Shall be designed consistent with scale forming solids depositing properties of the water, chemical solution, or mixture conveyed.

e. Shall not carry chlorine gas beyond the chlorine feeder room unless the chlorine is under vacuum.

f. Shall be designed so that liquid alum does not mix with water before the point of application.

8. Process water.

a. Water used for dissolving dry chemicals, diluting liquid chemicals, or operating chemical feeders shall be:

(1) From a safe, approved source;

(2) Protected from contamination by appropriate means;

(3) Ample in supply and adequate in pressure;

(4) Provided with means for measurement when preparing specific solution concentrations by dilution; and

(5) Properly treated for hardness when necessary.

b. Where a booster pump is required, a spare pump shall be provided.

c. Backflow prevention shall be achieved by appropriate means such as:

(1) An air gap between the fill pipe and overflow rim of the solution or dissolving tank, and equivalent to two pipe diameters but not less than two inches;

(2) An approved reduced pressure zone backflow preventer, consistent with the degree of hazard, aggressiveness of chemical solution, back pressure sustained, location, and available means for maintaining and testing the device; or

(3) A satisfactory vacuum relief device.

D. Chemicals.

1. Storage.

a. Space shall be provided where at least 30 days of chemical supply can be stored, based on the average dose and average annual water treatment plant flow rate. Storage shall be at a location that is convenient for efficient handling and safety. Lesser storage capacity may be approved if the owner can demonstrate that the local suppliers or other conditions will provide an uninterrupted source of chemicals.

b. Cylinders of chlorine gas shall be:

(1) Isolated from operating areas;

(2) Restrained in position to prevent upset; and

(3) Stored in rooms separate from ammonia storage.

c. Liquid chemical storage tanks shall:

(1) Have a liquid level indicator; and

(2) Have an overflow and a receiving basin or drain capable of receiving accidental spills or overflows.

d. Special precautions shall be taken with sodium chlorite to eliminate any danger of explosion.

e. Activated carbon. The following special precautions shall be taken in areas where activated carbon is stored, handled, and fed.

(1) Isolated, cool, and dry areas free from sources of ignition shall be provided for activated carbon storage;

(2) Electrical equipment, devices, and materials shall comply with applicable codes;

(3) Ventilation in areas associated with the storage, handling, and feeding of activated carbon shall be localized so as not to cause dust or material to be drawn into other areas; and

(4) Activated carbon shall not be stored with strong oxidants such as ozone, liquid chlorine (i.e., compressed chlorine gas), and permanganate.

f. Chemicals shall be stored in covered or unopened shipping containers, unless the chemical is transferred into an approved covered storage unit.

g. Solution storage or day tanks supplying feeders directly should have sufficient capacity for one day of operation.

h. Acid storage tanks shall be vented to the outside atmosphere, but not through vents in common with day tanks.

2. Handling.

a. Provisions shall be made for measuring quantities of chemicals used to prepare feed solutions.

b. Storage tanks and pipelines for liquid chemicals shall be specific to the chemicals and not for alternates.

c. Chemicals that are incompatible shall not be fed, stored, or handled together.

d. Provisions shall be made for the proper transfer of dry chemicals from shipping containers to storage bins or hoppers to mitigate the quantity of dust that may enter the room in which the equipment is installed. Control shall be provided by use of:

(1) Vacuum pneumatic equipment or closed conveyor systems;

(2) Facilities for emptying shipping containers in special enclosures; or

(3) Exhaust fans and dust filters that put the hoppers or bins under negative pressure.

e. Precautions shall be taken with electrical equipment to prevent explosions and other hazards.

f. Acids shall:

(1) Be kept in closed, acid-resistant shipping containers or storage units; and

(2) Not be handled in open vessels, but should be pumped in undiluted form from original containers, through a suitable hose, to the point of treatment or to a covered day tank.

g. Carts, elevators, and other appropriate means shall be provided for lifting chemical containers to mitigate excessive lifting by operators.

h. Provisions shall be made for disposing of empty containers by an approved procedure that will mitigate exposure to the chemical.

E. Housing.

1. Structures, rooms, and areas accommodating chemical feed equipment shall provide convenient access for servicing, repair, and observation of operation.

2. Floor surfaces shall be smooth and impervious, slip-proof, and well drained.

3. Open basins, tanks, and conduits shall be protected from chemical spills or accidental drainage.

F. Operator safety. Safety provisions shall protect people at the waterworks from chemical exposures in accordance with VOSH laws and regulations.

1. Gases from feeders, storage, and equipment exhausts shall be conveyed to the outside atmosphere, above grade, and remote from air intakes.

2. See 12VAC5-590-1000 and 12VAC5-590-1001 for special provisions for handling and storing chlorine.

3. A plastic bottle of hydrochloric acid (muriatic acid in commercial form) shall be available for ammonia leak detection where ammonia gas is used or stored.

4. At least one pair of rubber gloves with long gauntlets, a dust respirator of a type that complies with VOSH laws and regulations for toxic dusts, and an apron or other protective clothing shall be provided for each operator in any shift who will handle dry chemicals.

5. Facilities such as emergency eye wash and showers shall be provided for washing of the face, gloves, and protective equipment.

12VAC5-590-865. Conventional filtration treatment.

A. Conventional filtration treatment is generally used for surface water sources. It is defined as a series of four processes: coagulation, flocculation, sedimentation, and filtration. The specific design parameters shall consider the water supply characteristics and variability in quality due to seasonal and climatic events.

B. Conventional filtration treatment plants shall provide staged, multiple treatment process units to allow individual units to be taken out of service without disrupting operation.

C. The department may require presedimentation of waters containing high turbidity or organics (as measured by TOC).

1. Presedimentation basins utilizing a coagulant feed shall have hoppered bottoms or shall be provided with continuous sludge removal equipment. The minimum hydraulic detention time shall be three hours. The department may require greater detention times depending on the source water quality and the level of pretreatment required.

2. Presedimentation basins without coagulant feed shall provide a minimum hydraulic detention time of 24 hours. The design shall address future needs for solids removal and handling.

3. Incoming water shall be dispersed across the full width of the line of travel as quickly as possible. Short circuiting shall be minimized. The department may require baffling on large basins.

4. Provisions for bypassing presedimentation basins shall be provided.

5. Surface runoff shall be prevented from entering presedimentation basins or reservoirs.

6. Dikes shall be structurally sound and protected against wind action and erosion.

12VAC5-590-871. Coagulation and flocculation.

A. Rapid mixing is the rapid dispersion of chemicals throughout the water to be treated, usually by violent agitation, to promote coagulation.

1. Rapid mix basins or inline static mixers shall be provided.

2. Basins shall be equipped with mechanical mixing devices. Other arrangements, such as baffling, may be acceptable under special conditions and only when approved by the department. Where mechanical mixing devices are utilized, duplicate units or spare mixing equipment shall be provided.

3. Rapid mix basins with mechanical mixers should be based upon the mean temporal velocity gradient "G" (expressed as units of seconds^{-1}). The owner's engineer shall submit the basis for the selected velocity gradient considering the chemicals to be added and water temperature. Typical values for G and T are:

TABLE 871.1
Rapid Mix Basin GT Values

T (seconds)	G (seconds^{-1})
20	1,000
30	900
40	700
60	600

a. The point of application of the coagulant shall be at the point of maximum mixing intensity;

b. The physical configuration of the mixing basin shall be designed to eliminate vortexing; and

c. Mechanical mixers should be designed to allow speed variation with a highest speed of at least three times the lowest speed.

B. Flocculation mixing is the agitation of treated water at low velocity gradients for sufficient time to agglomerate coagulated particles.

1. Basin inlet and outlet design shall prevent short circuiting and destruction of floc. A drain and overflow shall be provided. Multiple units shall be provided for continuous operability, and each basin shall be designed so that individual basins may be isolated without disrupting plant operation. Basins shall be arranged to allow for either series or parallel operation.

2. Design parameters:

a. The minimum detention time shall be 30 minutes for water treatment plants employing rapid rate gravity filters, and 20 minutes for water treatment plants using high rate gravity filters. Basin flow-through velocity should not be less than 0.5 ft/min or greater than 1.5 ft/min.

b. The design of the flocculation units shall be based upon the value of GT, which is ordinarily in the range of 20,000 to 200,000. The owner's engineer should establish the value of GT through experimentation.

c. Agitators shall be driven by variable speed drive units with peripheral tip speed of the paddles ranging from 0.5 to 3.0 ft/sec.

d. To control short circuiting in mechanical flocculators, at least three successive compartments should be provided. In addition, special attention should be given to the ports between compartments to further suppress short circuiting.

e. To accomplish maximum power input and reduce particle shearing, tapered flocculation should be provided.

f. In basins utilizing vertical shaft flocculators, wing walls, or stators shall be provided to prevent vortexing.

3. Flocculation and sedimentation basins shall be as close together as possible. The velocity gradient of the flocculated water through pipes or conduits to settling basins shall not be greater than the velocity gradient utilized in flocculating the water. Where velocity gradient is not used as a design parameter, the linear velocity in pipes and conduits from the flocculators to the settling basin shall not exceed 0.5 ft/sec unless otherwise approved by the department. Allowances shall be made to minimize turbulence at bends and changes in direction.

4. Baffling may be used for flocculation in small water treatment plants only when approved by the department. The design should allow the velocity gradients noted in subdivision B 3 of this subsection to be maintained.

12VAC5-590-872. Sedimentation.

A. The water treatment plant capacity, source water quality, and filtration process used shall be considered in determining the number and design of sedimentation basins.

B. The minimum settling time shall be four hours for water treatment plants employing rapid rate gravity filters, and a minimum of three hours for water treatment plants using high rate gravity filters. Reduced settling times may be approved by the department where effective settling is demonstrated. Effective settling time shall be calculated using the volume of the basins from the stilling wall to the submerged effluent orifice or weir, including the volume under launders or finger weirs.

C. Inlets shall be designed to distribute the water equally and at uniform velocities. Open ports, submerged ports, stilling walls, and similar entrance arrangements are required. Port velocities should be in the range of 0.5 to 1.5 ft/sec. Where stilling walls are not provided, a baffle shall be constructed across the basin close to the inlet and shall project several feet below the water surface to dissipate inlet velocities and provide uniform flows across the basin.

D. Outlet weirs or submerged orifices shall be designed to maintain settling velocities in the basin and minimize short circuiting. Outlet weirs and submerged orifices shall be designed as follows:

1. The rate of flow over the outlet weir shall not exceed 20,000 gpd/ft of the outlet launder.

2. Submerged orifices shall not be located lower than three feet below the normal water surface.

3. The entrance velocity through the submerged orifices shall not exceed 0.5 ft/sec.

E. The linear velocity in pipes and conduits from settling basins shall not exceed 1.0 ft/sec.

F. Rectangular sedimentation basins shall be designed with a length-to-width ratio of at least 4:1.

G. Surface overflow rates shall be within the range of 0.25 to 0.38 gpm/ft^2 in water treatment plants using rapid rate filters, and a maximum of 0.5 gpm/ft^2 for water treatment plants using high rate filters. Increased surface overflow rates and reduced settling times may be approved by the department where effective settling is demonstrated. The length and area between launders and finger weirs may be included in determining length-to-width ratio and overflow rates.

H. Basins shall be provided with a means for dewatering. Basin bottoms shall slope toward the drain not less than one foot in 12 feet unless mechanical sludge collection equipment is provided.

I. In areas where settling basins are subject to high and frequent cross winds, windbreaks shall be considered. Covers or enclosures shall be considered in locations subject to freezing.

J. The velocity through settling basins shall not exceed 1.0 ft/min. The basins shall be designed to minimize short circuiting. Baffles shall be provided as necessary to minimize short circuiting.

K. Multiple basins shall be provided for continuous operability, and each basin shall be designed so that individual basins may be isolated without disrupting plant operation.

L. Mechanical sludge collecting equipment shall be considered for all plants.

M. Sedimentation basins with tube or plate settlers shall meet the following design requirements:

1. Inlet and outlets shall be designed to maintain velocities suitable for settling in the basin and minimize short circuiting. Plate units shall be designed to ensure even flow distribution across the units.

2. Drain piping from the settler units shall be sized to facilitate a quick flush of the basin and to prevent flooding other portions of the plant.

3. Where units are located outdoors, adequate freeboard shall be provided above the top of the settlers to prevent freezing.

4. The maximum loading for tube settlers shall be two gpm/ft^2 of cross-sectional area unless higher rates are demonstrated through pilot plant or in-plant demonstration studies.

5. The maximum loading for plate settlers shall be 0.5 gpm/ft^2 based upon 80% of the projected horizontal plate area.

6. Flushing lines shall be provided to facilitate maintenance and shall be properly protected against backflow or backsiphonage.

12VAC5-590-873. Solids contact treatment units.

A. Solids contact units shall be acceptable for combined flocculation and clarification where source water characteristics are not variable and flow rates are uniform. When approved, these units shall be designed for the maximum uniform rate and shall be adjustable to changes in flow that are less than the design rate and for changes in water characteristics.

B. A minimum of two units shall be provided.

C. A rapid mix device designed in accordance with 12VAC5-590-871 A shall be provided. Mixing devices shall be constructed to:

1. Provide good mixing of the source water with previously formed sludge particles; and

2. Prevent deposition of solids in the mixing zone.

D. Flocculation equipment designed in accordance with 12VAC5-590-871 B shall:

1. Be equipped with an adjustable drive mechanism;

2. Ensure that coagulation occurs in a separate chamber or baffled zone within the unit; and

3. Provide a flocculation period of at least 20 minutes.

E. The sludge equipment shall provide either internal or external sludge concentrators in order to obtain a concentrated sludge with a minimum of waste water. Sludge removal systems shall provide:

1. Sludge pipe sizes of not less than three inches in diameter;

2. Piping arrangements to prevent clogging and to facilitate cleaning;

3. Valves that are located outside the tank for accessibility;

4. A means to observe or sample sludge being withdrawn from the unit;

5. A time clock with proportional timer with automatic blowoff; and

6. Suitable controls for sludge withdrawal.

F. Cross-connections.

1. Blowoff outlets and drains shall terminate and discharge at a place satisfactory to the department; and

2. Cross-connection control shall be included for the potable water mains used to flush sludge lines.

G. The detention time shall be established on the basis of the source water characteristics and other local conditions that affect the operation of the unit. The minimum detention time shall be two hours for suspended solids contact clarifiers.

H. Orifices shall produce uniform rising rates over the entire area of the tank and shall provide for an exit velocity not to exceed 1.0 ft/sec.

I. Upflow rates shall not exceed 1.0 gpm/ft² of area at the sludge separation line.

12VAC5-590-874. Gravity filtration.

A. At least two gravity filter units shall be provided in conventional filtration treatment plants and direct filtration treatment plants.

B. Filter loading rates shall not exceed 2.0 gpm/ft^2 of filter area for rapid rate filters and shall not exceed 4.0 gpm/ft^2 for high rate filters, during normal operation. Alternative loading rates may be approved by the department when effective filtration is demonstrated.

C. The filter structure shall be so designed as to comply with the following:

1. The walls within the filter shall be vertical;

2. The filter walls shall not protrude into the filter media;

3. There shall be no common wall between filtered or finished water and any lesser quality water;

4. The filter shall be covered by a superstructure if determined necessary under local climatic conditions;

5. There shall be head room to allow normal inspection and operation;

6. A curb at least four inches high shall surround each filter to prevent floor drainage into the filter;

7. The maximum velocity gradient of treated water in pipes and conduits to the filters shall not exceed that used in flocculation. Where velocity gradient is not used as a design parameter, the linear velocity in pipes and conduits from settling basins to filters shall not exceed 1.0 ft/sec;

8. Influent pipes or conduits, where solids loading is heavy, shall be straight and equipped with cleanouts;

9. Backwash water drain capacity shall be sufficient to carry the maximum flow;

10. Access in the form of walkways not less than 24 inches in width shall be provided to each filter; and

11. The normal operating water surface on a filter shall be at the same hydraulic grade level as the sedimentation basin, if no intermediate treatment process is provided.

D. Backwash water troughs shall be so designed as to provide:

1. Bottom elevation of the trough above the maximum level of expanded media during backwashing;

2. At least a two-inch freeboard inside the trough at the maximum rate of wash;

3. A level top or edge;

4. Spacing so that each trough serves an equal area of each filter; and

5. Maximum horizontal travel of suspended particles to reach the trough not to exceed 3.0 ft.

E. Filter media shall be free from detrimental chemical or bacterial contaminants. Acceptable filter media shall include anthracite coal, silica sand, garnet sand, and GAC. Other natural or synthetic media

may be approved by the department when pilot-scale or full-scale demonstration studies demonstrate that the media is capable of meeting the filter effluent turbidity treatment technique requirements in Part II (12VAC5-590-395) of this chapter.

1. Filters may be of single media, dual media, or multimedia design depending upon the water to be treated and the specific filtration process employed. A total media depth of not less than 27 inches shall be provided after cleaning and scraping.

2. Types of filter media:

a. Anthracite coal. A sieve analysis shall be provided. Anthracite media shall have:

(1) An effective size from 0.45 to 0.55 mm with a uniformity coefficient not greater than 1.65 when used alone.

(2) An effective size from 0.8 to 1.2 mm with a uniformity coefficient not greater than 1.85 when used in dual or multimedia filters.

b. Silica sand. A sieve analysis shall be provided. The media shall be clean silica sand having an effective size from 0.35 to 0.55 mm and a uniformity coefficient not greater than 1.65.

c. Garnet sand. A sieve analysis shall be provided. The media shall have an effective size from 0.15 to 0.35 mm.

d. Granular activated carbon (GAC) may be used as a media for filtration. The department may require pilot studies where precursor or organics removal is a treatment objective. The design shall include the following:

(1) GAC media shall meet the basic specifications for filter media contained in this section, except the uniformity coefficient shall not be greater than 2.0. The department may allow larger size media based upon pilot-scale or full-scale demonstration testing. The department may require that a layer of sand media be placed below the GAC.

(2) Provisions shall be made for periodic treatment of GAC filter material for the control of bacteria and other growths.

(3) Provisions shall be made for GAC media replacement or regeneration.

(4) Only materials suitable for use with GAC media filters shall be utilized.

F. Support media.

1. Sand. A sieve analysis shall be provided. A three-inch layer of sand shall be used as a supporting media for the filter media where supporting gravel is used and shall have an effective size from 0.8 to 2.0 mm and a uniformity coefficient not greater than 1.7.

2. Gravel. When used as the supporting media, gravel shall consist of hard, rounded particles and shall not include flat or elongated particles. The coarsest gravel shall be 2-1/2 inches in size when the gravel rests directly on the strainer system and shall extend above the top of the perforated laterals or strainer nozzles. Not less than four layers of gravel shall be provided in accordance with the size and depth distribution specified in Table 874.1.

3. Changes of gravel depths and sizes may be considered by the department where proprietary filter bottoms are proposed.

TABLE 874.1 Gravity Filter Gravel Support Bed	
SIZE	DEPTH
2-1/2 - 1-1/2 inches	5 - 8 inches
1-1/2 - 3/4 inches	3 - 5 inches
3/4 - 1/2 inches	3 - 5 inches
1/2 - 3/16 inches	2 - 3 inches
3/16 - 3/32 inches	2 - 3 inches

G. Filter bottoms and strainer systems. The department may allow deviations from requirements of this subdivision for high rate filters and for proprietary filter bottoms. Porous plate bottoms shall not be used where iron, manganese, or hard water may result in clogging. The design of manifold-type collection systems shall:

1. Minimize loss of head in the manifold and laterals;

2. Assure even distribution of backwash water and an even rate of filtration over the entire area of the filter;

3. Provide a ratio of the area of the final openings of the strainer systems to the area of the filter of about 0.003;

4. Provide a total cross-sectional area of the laterals at about twice the total area at the final openings; and

5. Provide a manifold that has a cross-sectional area which is 1-1/2 to two times the total area of the laterals.

H. Surface wash or air scouring of filters shall be provided.

1. All rotary surface wash devices shall be designed with:

a. Provisions for water pressures of at least 45 psig;

b. A vacuum breaker or other device or assembly to prevent backsiphonage; and

c. Adequate surface wash water to provide 0.5 - 1.0 gpm/ft^2 of filter area.

2. Air scouring shall provide for:

a. An air flow rate of three to five scfm/ft^2 of filter area when air is introduced in the underdrain. A lower air flow rate shall be used when the air scour distribution system is placed above the underdrain.

b. A method for avoiding loss of filter media during backwashing.

c. A fluidization backwash following air scour sufficient to restratify the filter media. The backwash water delivery system shall be in accordance with this section except the rate of flow should not exceed 8.0 gpm/ft^2 unless operating experience demonstrates that a higher rate is necessary to remove scoured particles from the filter media.

I. Turbidity monitoring.

1. Indicating and recording turbidimeters meeting the requirements of 12VAC5-590-770 B shall be provided for:

a. The source water;

b. The settled water from each sedimentation basin;

c. The filter effluent from each filter; and

d. The CFE.

2. Finished water indicating and recording turbidimeters shall be considered if chemical pH adjustment occurs following filtration.

3. The location of the turbidity sample tap shall allow turbidity to be monitored for both the filtered water and the filter-to-waste water.

4. The design may incorporate an operator selected filter effluent high turbidity alarm.

J. Appurtenances.

1. A sampling tap shall be placed between each filter and the effluent rate-of-flow controller to sample filtered water and filter-to-waste water. The location of sample taps shall allow turbidity to be monitored of both the filtered water and the filter-to-waste water.

2. Indicating and recording loss-of-head gauges shall be provided on all filters having a capacity of greater than 100 gpm. An indicating loss-of-head gauge shall be provided on all filters having a capacity of 100 gpm or less.

3. Indicating and recording rate-of-flow gauges shall be provided on all filters having a capacity of greater than 100 gpm. An indicating and totalizing water meter may be used instead of an indicating and recording gauge on filters having a capacity of 100 gpm or less.

4. Effluent rate-of-flow controllers of the direct acting, indirect acting, or constant rate types shall be provided on each filter.

a. All control devices used shall incorporate an auxiliary shutoff valve in the filter effluent line. Indirect and direct acting effluent rate-of-flow control devices shall start operation from the closed position. Failure of indirect acting controllers shall not result in any increase in the rate of flow.

b. Filter effluent rate-of-flow control that simply maintains a constant water level on the filter is prohibited.

c. Control devices shall be configured to prevent exceeding the design filter hydraulic loading rate when any filter is taken out of service.

5. Provisions for draining the filter-to-waste (rewash) with appropriate backflow prevention and rate control shall be provided on each filter. The filter-to-waste design flow rate shall be equal to the filtration rate.

6. A high pressure hose and hose rack shall be provided to allow washing down filter walls.

K. Backwash provisions.

1. Filtered or finished water shall be applied uniformly across the filter in an upflow direction to provide at least 50% media expansion during all operating conditions. This will normally require backwash flow rates of up to 20 gpm/ft^2 depending on media size, media specific gravity, uniformity coefficient, and water temperature.

2. The backwash water shall be provided at the required rate by backwash pumps, backwash water tanks, the high service main, or a combination of these methods. Consideration should be given to including provisions to obtain backwash water from the distribution system or other sources and to supply backwash water during plant start-up or during catastrophic events.

3. At least two backwash water pumps shall be installed unless an alternate means of obtaining backwash water is available.

4. The volume of backwash water provided shall be sufficient to backwash one filter at the design backwash flow rate and duration during the warmest water temperature. This backwash water volume shall be in addition to any other water storage requirements.

5. A backwash water controller or valve shall be provided on the main backwash water supply line to obtain the desired rate of filter wash with the backwash water valves on the individual filters open wide.

6. Consideration shall be given to provide for seasonal adjustments of the backwash flow rate to ensure proper backwashing while preventing media loss and to conserve water.

7. The rate-of-flow indicator on the main backwash water supply line shall be located so that it may easily be read by the operator during the backwashing process.

8. Where backwash water pumps are provided, a means for air release shall be installed between the backwash water pump and the backwash water valve.

L. Other design considerations.

1. Roof drains shall not discharge into the filter or basins and conduits preceding the filters.

2. Provision shall be made for continuous operation of all other filtering units while one filtering unit is out of operation.

3. High rate filtration shall be provided with precise coagulation control. A multiple six-gang stirring machine for performing jar tests shall be provided in addition to one or more of the following means of controlling the coagulation process:

a. Zeta potential, as measured by microelectrophoresis.

b. Pilot filters. Where dual pilot filters are used, two units shall be provided. Each pilot filter shall consist of a small filter (about six inches in diameter) containing the same type and depth of media as the plant filters. The pilot filter shall be equipped with recording turbidimeters on the effluent to measure the filterability of the water as reflected by turbidity monitoring.

c. Streaming current monitor, defined as a continuous sampling instrument that measures the electric current generated when water flows past suspended particles contained in the water.

4. High rate filtration shall be provided with indicating and recording pH monitoring equipment for:

a. The source water;

b. The rapid mix effluent; and

c. The finished water leaving the treatment plant.

12VAC5-590-875. Direct filtration.

A. Direct filtration is defined as a series of treatment processes, including coagulation and filtration but excluding sedimentation. Direct filtration shall be considered only for treatment of high quality and seasonally consistent surface water sources or GUDI sources.

B. An in-plant demonstration study or pilot study shall be required to demonstrate acceptable performance of direct filtration. The study shall be conducted over a sufficient time to treat all expected source water conditions throughout the year. The pilot plant filter shall be of a similar type and operated in the same manner as proposed for full-scale operation.

C. The department may require presedimentation meeting the requirements of 12VAC5-590-865 C to be provided (in the treatment sequence) to direct filtration treatment plants.

D. Rapid mix coagulation and flocculation shall be provided, meeting the requirements of 12VAC5-590-871.

E. Filters shall be dual media or multimedia gravity filters. Design of filtration units shall meet requirements for rapid rate or high rate gravity filters in 12VAC5-590-874, including filter structure, filter media, support gravel, backwash provisions, rate-of-flow control, surface wash, or air scour. Alternative designs may be considered by the department.

F. Turbidity monitoring.

1. Indicating and recording turbidimeters meeting the requirements of 12VAC5-590-770 B shall be provided for:

a. The source water;

b. The filter effluent from each filter; and

c. The CFE.

2. Finished water indicating and recording turbidimeters shall be considered if chemical softening occurs following filtration.

G. Where automatic unit process control is provided, manual override of all automatic features shall be provided.

1. Automatic start-up of treatment plant unit processes is prohibited.

2. Valve actuators shall be provided with manual override capability.

H. The plant design should allow for the future installation of sedimentation basins.

12VAC5-590-880. Diatomaceous earth filtration.

A. Diatomaceous earth filtration shall be limited to treatment of a surface water source, a GUDI source, or both with low turbidity and low bacterial contamination, and may be used for iron removal from groundwater.

B. Pilot plant study. Installation of a diatomaceous earth filtration system shall be preceded by a pilot plant study on the water to be treated.

C. Types of filters. Pressure or vacuum diatomaceous earth filtration units will be considered for approval.

D. Treated water storage. Treated water storage capacity in excess of normal requirements shall be provided to:

1. Allow operation of the filters at a uniform rate during all conditions of system demand at or below the approved filtration rate, and

2. Guarantee continuity of service during adverse source water conditions without bypassing the system.

E. Number of units. At least two filtering units shall be provided at plants having a rated capacity of more than 100 gpm.

F. Precoat.

1. Application. A uniform precoat shall be applied hydraulically to each septum by introducing a slurry to the tank influent line and employing a filter-to-waste or recirculation system.

2. Quantity. Diatomaceous earth in the amount of 0.2 lb/ft^2 of filter area.

G. Body feed. A body feed system to apply additional amounts of diatomaceous earth slurry during the filter run is required.

1. Quantity. Rate of body feed is dependent on source water quality and characteristics and must be determined in the pilot plant study.

2. Adequate accessibility to the feed system and slurry lines is required.

3. Continuous mixing of the body feed slurry is required.

4. Consideration should be given to providing a coagulant coating (alum or suitable polymer) of the body feed.

H. Rate of filtration. The hydraulic loading rate shall not exceed 1.5 gpm/ft^2 of filter area. The filtration rate shall be controlled.

I. Head loss. The head loss shall not exceed 30 psi for pressure diatomaceous earth filters, or a vacuum of 15 inches of mercury for a vacuum system.

J. Recirculation. A recirculation or holding pump shall be employed to maintain a differential pressure across the filter when the unit is not in operation to prevent the filter cake from dropping off the filter elements. A minimum recirculation rate of 0.1 gpm/ft§ filter area shall be provided.

K. Septum or filter element. The filter elements shall be structurally capable of withstanding maximum pressure and velocity variations during filtration and backwash cycles, and shall be spaced so that no less than one inch is provided between elements or between any element and a wall. Means shall be provided to check the septum for cleanliness or damage. Consideration should be given to providing septum assemblies where an individual septum can be removed, cleaned, repaired, and replaced.

L. Inlet design. The filter influent shall be designed to prevent scour of the diatomaceous earth from the filter element.

M. Backwash. Provision shall be made for periodic backwashing of the filter. A satisfactory method to thoroughly remove and dispose of spent filter cake shall be provided.

N. Appurtenances. The following shall be provided for every filter:

1. Sampling taps for source and filtered water;

2. A loss-of-head or a differential pressure gauge;

3. A rate-of-flow indicator, preferable with totalizer; and

4. A throttling valve used to reduce rates below normal during adverse source water conditions.

O. Turbidity monitoring. Indicating and recording turbidimeters meeting requirements of 12VAC5-590-770 B shall be provided for:

1. The source water;

2. The effluent from each filter unit; and

3. The CFE.

P. An operation and maintenance manual shall be provided for all diatomaceous earth filtration units. The manual shall include the following:

1. A detailed description of the treatment units and the control of each unit for optimal performance;

2. A preventative maintenance schedule;

3. The manual adjustment and override procedures for all automatic control features; and

4. A troubleshooting guide for typical problems.

Q. The owner shall require the equipment manufacturer to provide onsite start-up and follow-up training.

12VAC5-590-881. Slow sand filtration.

A. Slow sand filters shall be approved only after a pilot study demonstrates that the water supply contains sufficient nutrients for use of this treatment technology.

B. At least two filters shall be provided. In all cases, the filters shall be capable of meeting the design maximum daily water demand with one filter out of service.

C. Sand shall be clean silica sand that meets the following criteria:

1. The effective size shall be between 0.15 mm and 0.35 mm;

2. The uniformity coefficient shall not exceed 2.5; and

3. The sand depth shall not exceed 55 inches. A minimum depth of 30 inches is required for normal operation.

D. Supporting media gravel shall meet the requirements of 12VAC5-590-874 F.

E. Structural details.

1. All slow sand filters shall be covered.

2. Sufficient head room shall be provided for normal movement on the filter by operating personnel for periodic sand removal operations.

3. Adequate manholes and access ports shall be provided for moving sand off and onto the filter.

4. There shall be no common wall between the finished water and any water of lesser quality.

5. All filters shall be protected from freezing.

F. General design requirements.

1. Filter to waste shall be provided for all slow sand filters.

2. Water entering the filter shall be distributed in a manner so that the surface of the filter shall not be disturbed in any way.

3. The nominal rate of filtration range shall be from 45 to 150 gpd/ft^2 (0.031 to 0.10 gpm/ft^2) of sand area.

4. The minimum depth of water over the filters shall be three feet. The maximum depth of water over the filters shall not exceed five feet. An overflow capable of handling the maximum flow to the filter shall be provided at the maximum filter water level.

5. Underdrains shall be provided to assure an even rate of filtration across the filter surface. The maximum velocity of water in the lateral underdrains shall be 0.75 ft/sec. The underdrain spacing shall not exceed three feet.

6. Each filter shall be capable of being filled with water from the bottom up.

7. Each filter shall be equipped with a loss-of-head gauge; a rate-of-flow control device such as an orifice, weir, or butterfly valve; a weir or effluent pipe designed to assure that the water level over the filter never drops below the sand surface; and filtered water sample taps.

8. Monitoring, indicating, and recording turbidimeters meeting the requirements of 12VAC5-590-770 B shall be provided for:

a. The source water;

b. The filter effluent from each filter unit; and

c. The CFE.

9. The filters shall be designed to operate to waste after scraping or replacement of the sand, until the ripening process is complete and the turbidity meets the requirements of 12VAC5-590-395 A 2 b (3).

12VAC5-590-882. Membrane filtration.

A. Applicability. This section pertains to the use of membrane filtration as follows:

1. For pathogen and turbidity log removal credits in accordance with Table 500.1 in 12VAC5-590-500, the use of MF and UF are allowed.

2. For softening, total dissolved solids (TDS) removal, organics removal, and other treatment purposes, reverse osmosis (RO) and nanofiltration (NF) are allowed in accordance with 12VAC5-590-680 G.

B. Membrane filtration systems shall meet all requirements contained in 12VAC5-590-401 E 6 b to be granted removal credit for Giardia lamblia and Cryptosporidium.

C. A demonstration study shall be conducted on the water to be treated before the installation of a membrane filtration system unless the owner can demonstrate to the satisfaction of the department that the source water quality range over all four seasons of a year will be adequately treated by the proposed design.

D. All membrane treatment units for pathogen and turbidity removal shall employ MF or UF using hollow fiber, positive pressure-driven membrane filtration technology. They may employ either an inside-to-outside or outside-to-inside flow direction.

E. The number of membrane units shall be a function of the overall treatment facility capacity, waterworks capacity, and water demand. Multiple membrane units shall be provided where the treatment facility design capacity exceeds 0.5 MGD.

F. Approved materials and chemicals.

1. All membrane materials, associated piping, and other components in contact with the water shall be in accordance with 12VAC5-590-810.

2. Chemicals used in any membrane cleaning process shall be in accordance with 12VAC5-590-515.

G. Turbidity monitoring. Continuous indicating and recording equipment meeting the requirements of 12VAC5-590-770 B shall be provided for the following locations:

1. Source water;

2. Pretreated water, such as by coagulation, flocculation, and sedimentation (if applicable);

3. Filtrate from each membrane unit; and

4. Combined filter effluent, where more than one membrane unit is installed.

H. Indicating and recording equipment for entry point chlorine residual monitoring shall be provided. Indicating and recording equipment for filtered water temperature monitoring shall be provided.

I. Pressure monitoring:

1. Indicating equipment shall be provided for monitoring the pressure drop across any prefilter.

2. Indicating and recording equipment shall be provided for monitoring the pressure drop across membrane modules, (i.e., transmembrane pressure).

3. Integrity monitoring. Indicating and recording equipment for direct integrity test monitoring shall be provided and shall document the date, time, and results of every test performed on each unit.

J. Flow measurement. Equipment shall be provided for measuring or calculating the following flows:

1. Source water, gpm and totalized;

2. Filtrate from each unit, gpm and totalized;

3. Flux from each unit, gpd/sf;

4. Recirculation to each unit, gpd or percent of feed flow, if applicable;

5. Entry point, gpm and totalized; and

6. Waste.

K. An alarm system shall be provided that will report alarm conditions and shut down the treatment plant and entry point flow as necessary.

1. All alarms shall be reported to a location manned 24 hours per day or to a person on call and shall report alarm conditions audio-visually at the water treatment plant.

2. At a minimum, the following points shall be monitored by the alarm system. Alarm and shut down set point conditions will be determined by the department on an individual basis.

a. Feed water flow;

b. Feed water turbidity, if required by the department;

c. Filtrate turbidity from each unit exceeding operational control criteria;

d. Membrane direct integrity test initiation, failure, and exceeding operational control criteria; and

e. Entry point disinfectant residual.

L. Sample taps shall be provided to monitor the following:

1. Source water;

2. Source water storage tank effluent;

3. Feed water after prefiltration;

4. Filtrate from each membrane unit;

5. Combined filtrate from all units;

6. Entry point; and

7. Additional sample taps to monitor the presence of cleaning solutions used in either the backwash or cleaning operations.

M. Equipment shall be provided, using variable frequency drive or other suitable means to adjust the feed pump output in order not to exceed the design flux in the event modules are taken off line.

N. Pressure gauges.

1. A portable, pocket-type pressure gauge of the correct range and accuracy for the application and with the capability of being calibrated shall be provided to check the pressure readings of the pressure transducers installed on the membrane units.

2. At each location of a pressure transducer, a 1/4-inch diameter pressure gauge with American National Standard Taper Threads **(**NPT) connection shall be provided to facilitate the connection of a portable, pocket-type test gauge.

O. Clean-in-place systems, including tanks, piping, all joints, and valves, shall be compatible with the cleaning solution and shall be corrosion resistant.

P. An operation and maintenance manual shall be provided for all membrane filtration treatment units. The operation and maintenance manual shall include the following:

1. A maintenance schedule for each piece of equipment.

2. Operation procedures, including software user instructions.

3. A troubleshooting guide.

4. Identification of specific proprietary equipment or software not available to the owner or operator.

5. A service call number.

6. DIT requirements.

7. Chemical cleaning instructions.

8. A detailed description of the treatment units and the control of each unit for optimal performance.

Q. A means shall be provided to isolate a compromised module or fiber or both. A means to visually inspect modules while simultaneously conducting the DIT shall be provided. Alternatively, sonic testing equipment that provides a relative accelerometer reading shall be provided where visual inspection cannot be performed.

12VAC5-590-883. Bag and cartridge filtration.

A. Bag or cartridge filtration shall be limited to treating a surface water source, a GUDI source, or both with low turbidity.

B. A pilot plant study shall be conducted on the water to be treated before the installation of a bag or cartridge filter system.

C. Bag and cartridge filtration systems shall be granted removal credit for Giardia lamblia and Cryptosporidium in accordance with 12VAC5-590-401 E 6 a, provided that they meet the requirements of this section.

D. General design requirements.

1. All system components such as housing, bags, cartridges, gaskets, O-rings, and other components in contact with water shall be in accordance with 12VAC5-590-810. All cartridge filter housing

shall be certified by the ASME certification program, or equivalent, for pressure vessels and stamped with the appropriate certification mark.

2. Indicating and recording turbidimeters meeting requirements of 12VAC5-590-770 B shall be provided for the source water and the CFE. The department may require indicating and recording effluent turbidimeters for each filter unit.

3. The maximum flux rate across the final filter shall not exceed 0.2 gpm/ft^2.

4. Maximum differential pressure across the cartridge filter shall not exceed 20 psi.

5. Pressure gauges and sampling taps shall be provided before and after each bag or cartridge filter.

6. Provisions to accomplish filter-to-waste shall be provided.

7. Automatic start-up of bag or cartridge filters is prohibited.

8. An alarm system shall be provided that will report alarm conditions and shut down the treatment plant and entry point flow.

a. All alarms shall be reported to a location manned 24 hours per day or to a person on call and shall report alarm conditions audio-visually at the water treatment plant.

b. The following shall be monitored by the alarm system:

(1) Source water turbidity;

(2) Feed water flow;

(3) If applicable, filtrate turbidity from each unit exceeding operational control criteria;

(4) Combined filter effluent turbidity exceeding operational control criteria;

(5) Differential pressure at each unit; and

(6) Entry point disinfectant residual.

9. At least two filtering units shall be provided at plants having a rated capacity of greater than 100 gpm.

E. Operation and maintenance documents shall be provided for all bag or cartridge filter units and shall include:

1. Detailed description of the bag or cartridge treatment units and the control of each unit for optimal performance.

2. Procedural criteria, such as pressure differential, turbidity, and other parameters, and expected frequency of bag or cartridge filter replacement.

3. A preventative maintenance schedule.

4. Manual adjustment and override procedures for any automatic control features.

5. Troubleshooting guide for typical problems.

F. The owner shall require the equipment manufacturer to provide onsite start-up and follow-up training.

12VAC5-590-895. Pre-engineered package treatment units.

A. Pre-engineered package treatment units are defined as predesigned, factory built, and transported virtually assembled to the operation site. The provisions of 12VAC5-590-290 shall apply.

B. General design considerations.

1. A rapid mix unit process shall be provided. The design shall meet requirements of 12VAC5-590-871 A.

2. Flocculation units shall meet requirements of 12VAC5-590-871 B or as identified and justified in the approved PER.

3. Sedimentation units shall meet requirements of 12VAC5-590-872 or as identified and justified in the approved PER.

4. Filters shall be dual media or multimedia gravity filters. Design of filtration units shall meet the requirements of 12VAC5-590-874 or as identified and justified in the approved PER.

5. Indicating and recording turbidimeters meeting requirements of 12VAC5-590-770 B shall be provided for the:

a. Source water;

b. Applied water to each filter;

c. Filter effluent from each filter; and

d. CFE.

6. Sufficient overflows and drains shall be provided to maintain a maximum water level within the plant, including the depth of water over the filters, and to facilitate complete draining of the package unit.

7. Where automatic unit process control is provided, operator adjustment of chemical feed rates, times, and sequences shall be provided as well as a manual override of all automatic features.

a. Automatic start-up of water treatment unit processes is prohibited.

b. Valve actuators shall be provided with manual override capability.

8. Treatment units installed at ground level shall be provided with stairways, walkways, or other suitable means to allow access for operation and maintenance and observation of all treatment process units. Filters shall be adequately accessible to facilitate evaluation of the entire filter bed for media condition and placement, fluidization during backwashing, and evaluation of compaction during filtration.

C. An operation and maintenance manual shall be provided for all pre-engineered package treatment units. The operation and maintenance manual shall include the following:

1. A detailed description of the treatment units and the control of each unit for optimal performance.

2. A preventative maintenance schedule.

3. Manual adjustment and override procedures for any automatic control features.

4. A troubleshooting guide for typical problems.

D. The owner shall require the equipment manufacturer to provide onsite start-up and follow-up training.

12VAC5-590-900. Cation exchange softening.

A. The softening design selected shall be based upon the mineral qualities of the source water and the desired finished water quality in conjunction with requirements for disposal of sludge or brine water, cost of the plant, cost of the chemicals, and the plant location.

B. Iron, manganese, or a combination of the two, in the oxidized state or unoxidized state, shall not exceed 0.3 mg/L in the water applied to the cation exchange material.

C. The units shall be of pressure or gravity type of either an upflow or downflow design, using automatic or manual regeneration.

D. The design capacity for hardness removal shall not exceed 20,000 grains/ft^3 when the resin is regenerated with 0.3 pounds of salt per kilograin of hardness removed.

E. The depth of the cation exchange material shall not be less than three feet.

F. The hydraulic loading rate should not exceed seven gpm/ft^2 and the backwash rate should be six to eight gpm/ft. ^{2}

G. The freeboard shall depend upon the specific gravity of the media and the direction of the water flow.

H. The bottoms, strainer systems, and support for the cation exchange material shall conform to criteria provided for rapid rate gravity filters. See also 12VAC5-590-874.

I. Facilities shall be included for even distribution of brine over the entire surface of both upflow and downflow units. Backwash, rinse, and air relief discharge pipes shall be installed in a manner as to prevent any possibility of backsiphonage.

J. A bypass shall be provided around the cation exchange units to produce a blended water of desirable hardness. Meters shall be installed to measure total water delivered to the distribution system and on each softener unit. An automatic proportioning or regulating device and shutoff valve should be provided on the bypass line. In some installations, it may be necessary to treat the bypassed water to obtain acceptable levels of iron and manganese in the finished water.

K. Waters having turbidity of five NTUs or more shall not be applied directly to the cation exchange softener. Silica gel materials should be used for water having a pH above 8.4 and should not be used when iron is present. When the applied water contains a chlorine residual, the cation exchange material shall be a type that is not damaged by the chlorine residual. Phenolic resin shall not be used.

L. Sampling taps shall be provided for the collection of representative samples for both bacteriological and chemical analyses. The taps shall be located to provide for sampling of the softener influent, softener effluent, and the blended water. The sampling taps for the blended water shall be at least 20 feet downstream from the point of blending.

M. Brine measuring or salt-dissolving tanks and wet salt storage facilities shall be covered. The makeup water inlet shall have a free fall discharge of two pipe diameters but not less than two inches above the maximum liquid level of the unit or be protected from backsiphonage. Water for filling the tank should be distributed over the entire surface by pipes above the maximum brine level in the tank. The salt shall be supported on graduated layers of gravel under which is a suitable means of collecting the brine. Wet salt storage basins must be equipped with manhole or hatchway openings having raised curbs and watertight covers with overhanging edges similar to those required for finished water reservoirs. Overflows, where provided, shall be turned down, have a proper free fall discharge and be protected with noncorrodible screens or self-closing flap valves.

N. Wet salt storage basins shall have sufficient capacity to store at least a 30-day operating supply.

O. Stabilization of the finished water for corrosion control shall be considered.

P. Suitable disposal must be provided for the brine waste.

Q. Pipes and contact materials shall be resistant to the aggressiveness of the salt.

12VAC5-590-910. Aeration.

A. Aeration treatment is acceptable for oxidation, separation of gases, or for taste and odor control. General design requirements include the following:

1. The aerated water shall be chlorinated following aeration.

2. The equipment shall incorporate materials resistant to deterioration and corrosion and shall be designed to eliminate the potential for fouling problems from calcium carbonate and iron precipitation and from algae, slime, and bacteriological growth. Disinfection capability shall be provided before the aeration treatment units.

3. The equipment shall be easily accessed and serviced.

4. The air introduced into the treatment units shall be filtered and shall be free of insects, obnoxious fumes, dust, dirt, and other contaminants. If blowers are located inside a building, then the air intakes shall extend to the outside and be furnished with appropriate air filters.

5. Air exhaust outlets shall be located to avoid induced contaminants, particularly at or near occupied areas or blower intakes.

6. Duplicate blowers, motors, or multiple treatment units shall be required for treatment processes designed to meet the drinking water quality standards in 12VAC5-590-340.

B. Natural, forced, or induced draft aeration units shall be designed to provide an adequate liquid distribution and countercurrent of air through the enclosed aeration column, and adequately seal the water outlet to prevent unwanted loss of air.

C. Pressure aeration means the injection of compressed air into the water to be treated, typically for oxidation. Pressure aeration shall not be approved for removal of dissolved gases. Filters following pressure aeration shall have adequate exhaust devices for the release of air. Pressure aeration devices shall be designed to provide thorough mixing of compressed air with the water being treated.

D. Packed tower aeration (air stripping) is suitable for removing VOCs, THMs, carbon dioxide, and radon.

1. Justification shall be provided for the selected design parameters (e.g., height and diameter of the unit, air-to-water ratio, packing depth, surface loading rate, and other features). The design shall consider the effects of temperature change and the resulting impact in contaminant removal efficiency. Pilot plant studies may be required to substantiate the design.

2. The packing material used shall be resistant to the aggressiveness of the water, dissolved gases, and cleaning materials, and shall meet requirements of 12VAC5-590-810.

3. Water shall be evenly distributed at the top of the tower using spray nozzles or orifice-type distributor trays that will prevent short circuiting. A mist eliminator above the water distribution system may be required.

4. A means to allow for discharge and wasting of water or chemicals used to clean the tower shall be provided.

5. Sample taps shall be provided in the influent and effluent piping.

6. The design shall prevent freezing of the influent riser and effluent piping.

7. An overflow pipe discharging 12 to 24 inches above the ground and over a drainage inlet structure or splash pad shall be provided.

8. A sufficient number of access ports with a minimum diameter of 24 inches shall be provided to facilitate inspection, media replacement, media cleaning, and maintenance of the unit interior.

9. A positive air flow sensing device and a pressure gauge shall be installed on the air influent line. If the aeration unit is designed to remove a contaminant with a PMCL, then the positive air flow sensing device shall be an integral part of an automatic control system that will turn off the influent water if positive air flow is not detected.

E. Other methods of aeration shall be designed to meet the particular needs of the water to be treated and are subject to the approval of the department.

12VAC5-590-920. Iron and manganese control.

A. Iron and manganese control, as used in this section, refers solely to treatment processes designed specifically for this purpose. The treatment process used will depend upon the character of the source water. The selection of one or more treatment processes shall meet specific local conditions as determined by engineering investigations, including chemical analyses of representative samples of water to be treated, and receive the approval of the department. The department may require that pilot studies be conducted.

B. Iron and manganese removal by oxidation and filtration.

1. Oxidation shall be accomplished by aeration or by chemicals, such as chlorine, potassium permanganate, sodium permanganate, or a combination thereof.

2. The design shall consider:

a. pH adjustment to promote rapid oxidation;

b. A pre-settling tank located ahead of the filters to remove oxidized iron and increase filter run times;

c. A manganese-oxide coating on the filter media, such as manganese greensand. The total depth of media shall not be less than 30 inches. Media shall have an effective size from 0.3 to 0.35 mm and a uniformity coefficient of no more than 1.6. Following initial placement of the media, care shall be taken to remove fines by backwashing and skimming the surface; and

d. An anthracite cap layer over the manganese-oxide coated media having a depth of six to 18 inches.

3. Aeration shall be designed in accordance with 12VAC5-590-910.

4. Flow proportional chemical feeders shall be provided, and the feed rate shall be adequately controlled by using feeders that are paced by water meters to prevent an over-dosage of chemical. A flow switch in place of a flow proportional feeder may be permissible.

5. Sample taps shall be provided before the application of the oxidant, immediately ahead of filtration, and at the filter effluent.

6. Pressure filters shall include provisions for:

a. Pressure gauges on the inlet and outlet pipes of each filter or a differential pressure gauge on each filter;

b. An easily readable meter or flow indicator on each battery of filters. A flow indicator is recommended for each filtering unit;

c. Filtration, backwashing, and filter-to-waste of each filter individually:

(1) Backwash water shall be evenly distributed in an adequate quantity to achieve at least a 30% media bed expansion during backwashing. The backwash rate shall be based on the media;

(2) The top of the backwash water collection trough shall be at least 18 inches above the media surface;

(3) An underdrain system to efficiently collect the filtered water and to distribute an adequate quantity of backwash water to achieve at least a 30% media bed expansion during backwashing;

d. Flow indicators and controls are located so that they are easily readable while operating the control valves;

e. An air release valve on the highest point of each filter;

f. An accessible manhole to facilitate inspections and repairs for filters greater than 36 inches in diameter;

g. A means to observe the wastewater during backwashing; and

h. Construction to prevent cross-connection.

C. Iron and manganese removal by ion exchange shall only be approved for removing low concentrations (less than 0.5 mg/L) of combined iron and manganese. The department may require pilot studies be conducted to determine post-exchange pH/alkalinity adjustment. See 12VAC5-590-900 for general ion exchange design requirements.

D. Sequestering iron and manganese.

1. Sequestration with polyphosphates shall be considered for polishing filtered water; however, it shall not be used where the residual iron, manganese, or combination thereof exceeds 1.0 mg/L.

2. Phosphate feed rates shall be determined by the product manufacturer and shall not exceed 10 mg/L.

3. Feed equipment shall be in accordance with the requirements of 12VAC5-590-860.

4. Stock phosphate solution shall be disinfected in accordance with manufacturer recommendations unless the phosphate solution is fed directly from the covered shipping container.

5. Sodium silicate or other silicate-based chemicals for the sequestration of iron and manganese shall be approved by the department on an individual basis. Operational data from actual full-scale facilities treating waters of similar quality or pilot tests may be required.

E. Sampling taps shall be provided for control purposes. Taps shall be located on each source water, each treatment unit influent, and each treatment unit effluent.

F. Iron and manganese testing equipment shall be provided. Iron testing equipment shall be capable of accurately measuring iron concentration as low as 0.1 mg/L. Manganese testing equipment shall be capable of accurately measuring manganese concentration as low as 0.05 mg/L.

G. The department may approve proprietary treatment processes for the removal of iron and manganese on an individual basis. Operational data from actual full-scale facilities treating waters of similar quality or pilot tests may be required. The provisions of 12VAC5-590-290 may apply.

12VAC5-590-930. Fluoridation.

A. The board recommends that all community waterworks in Virginia be optimally fluoridated. Fluoridation feed systems shall be designed to deliver the optimum fluoride ion concentration as determined by the U.S. Department of Health and Human Services.

B. Fluoride compounds. Commercial sodium fluoride, sodium fluorosilicate (also called sodium silicofluoride), and fluorosilicic acid (also called hydrofluorosilicic acid) shall conform to the applicable AWWA standards or NSF/ANSI/CAN Standard 60-2020, as appropriate.

C. Fluoride compound storage. Fluoride chemicals shall be isolated from other chemicals to prevent cross contamination. Compounds shall be stored in covered or unopened shipping containers in a separate room (except sodium fluoride saturators) with the chemical feeder.

D. Chemical feed installations.

1. Scales and loss-of-weight recorders for dry chemical feeders and hydrofluorosilicic acid feeders shall be provided.

2. Fluoride metering pumps shall have an accuracy so that the actual feed rate will be within 5.0% of the intended feed rate.

3. The point of application shall be located to provide adequate mixing.

4. All fluoride feed lines shall be provided with adequate anti-siphon devices.

5. Design of fluoride saturators shall consider:

a. The source water hardness. The water applied to the sodium fluoride saturator feeders shall be softened if the hardness exceeds 50 mg/L.

b. The fluoride source. Use only sodium fluoride in the saturators.

c. A flow restrictor with a maximum flow of 2.0 gpm on all upflow saturators.

6. Adequate fluoride feed rate control and mixing shall be provided.

7. Provisions shall be made for venting fluorosilicic acid carboys to the outside of the building when the carboys are in use.

E. Suitable protective equipment shall be provided which includes gloves, aprons, dust mask, and goggles.

F. Suitable equipment shall be provided for wet mopping and hosing dust that might accumulate in the plant. Dry feeders shall be equipped with bag loading hoppers.

G. Equipment shall be provided for measuring the quantity of fluoride ion in the water. Testing equipment shall be colorimetric or electrode type as approved by the department.

12VAC5-590-940. Fluoride removal.

A. Fluoride removal may be accomplished by blending with a different quality water or by removal treatment. Where fluoride removal is required, the treatment units shall be designed to achieve a finished water fluoride concentration that is below the SMCL.

B. Blending. Blended water shall result in all water delivered to the distribution system being of the same quality.

C. Treatment.

1. Treatment shall include ion exchange, activated alumina, bone char, RO, or electrodialysis. The selected design shall be supported by pilot studies, unless at least two pilot studies or two prototype plants have demonstrated that the selected design is feasible. These studies or prototypes shall be for waters having characteristics similar to the water that is to be treated.

2. Water pH shall be adjustable to an optimum level to achieve the best fluoride removal.

3. With any one unit out of service, the remaining units shall be capable of treating the maximum plant flow rate.

4. Filter clogging constituents such as iron having a concentration greater than 1.0 mg/L shall be removed before fluoride removal.

5. Test equipment shall be provided and must be accurate to at least 0.1 mg/L.

6. An operation and maintenance manual shall be provided.

12VAC5-590-950. Corrosion control or stabilization.

A. Water that is unstable due either to natural causes or to the treatment applied to the water shall be stabilized.

B. Deposition of calcium carbonate film. The desired calcium carbonate film may be obtained by using either soda ash or caustic soda when the alkalinity of the water exceeds about 35 mg/L. Soft waters should be treated with lime to provide the required calcium. Soft waters that also have a low carbon dioxide content may need a mixture of lime and soda ash to provide both calcium and carbonate for the calcium carbonate film.

C. Phosphates or other corrosion inhibitors may be used for corrosion control when applied in accordance with manufacturer recommendations and when they meet the requirements of 12VAC5-590-515. Stock phosphate solution shall be disinfected in accordance with manufacturer recommendations unless the phosphate solution is fed directly from the covered shipping container.

D. Cathodic protection shall be acceptable for preventing or reducing corrosion of the inner surfaces of water storage tanks and standpipes and the outer surface of metal pipe.

E. Laboratory equipment shall be provided for determining the effectiveness of stabilization treatment and the concentration of chemicals in the treated water.

12VAC5-590-960. Taste and odor control.

A. The continuous or periodic treatment of source waters with copper sulfate and other copper compounds to kill algae or other growths shall be controlled to prevent a copper concentration in excess of 1.0 mg/L, as copper, in the finished water leaving the treatment plant.

B. Surface water aerators or diffused aeration systems shall be acceptable for de-stratifying reservoirs, reducing or eliminating seasonal turnover, and releasing compounds in the anaerobic or anoxic zones.

C. Addition of chemical oxidants at the source water intake, in the source water pump station discharge line, at the head of the treatment plant, or within the treatment train shall be acceptable for treating tastes and odors. Effective oxidants include chlorine, chlorine dioxide, potassium permanganate, and ozone. If breakpoint chlorination is proposed, then the actual breakpoint of the water shall be determined accurately. "Breakpoint chlorination" means the addition of chlorine to water until the chlorine demand has been

satisfied, chlorine and ammonia nitrogen reactions are near completion, and further additions of chlorine result in a free chlorine residual that is directly proportional to the amount of chlorine added.

D. Powdered activated carbon (PAC). When taste and odor problems are anticipated on an intermittent basis, the addition of PAC shall be considered, and a pilot study shall be conducted to determine the optimum dosage. Multiple PAC feed locations shall be evaluated to provide maximum contact time, including the rapid mixer, the flocculation basins, and at the midpoint of the sedimentation basins.

1. PAC shall not be applied near the point of chlorine or other oxidant application.

2. Continuous agitation or resuspension equipment shall be required to keep the PAC from depositing in the slurry or storage tank.

3. All mechanisms for handling dry PAC shall be tightly sealed. Dust collection is required at all installations.

4. The PAC feed lines to the application points shall be sized to handle the PAC suspension and should be equipped with flushing provisions.

E. GAC media shall be acceptable in conventional gravity filters or in separate contactors to reduce taste and odor.

F. Ozonation shall be acceptable for taste and odor control.

12VAC5-590-975. Removal of radionuclides.

A. Processes for the removal of radionuclides specified as BAT are identified in 40 CFR 141.66. The specific process and equipment proposed for removal of radionuclides shall to the satisfaction of the department have a demonstrated history of successful performance with similar water quality characteristics and performance requirements. Otherwise, the procedures of 12VAC5-590-290 shall apply.

B. When manganese greensand filter systems are utilized, the design shall meet the requirements of 12VAC5-590-920 B. In addition, a chemical contact tank with a minimum detention time of 30 minutes shall be provided. Laboratory or pilot studies may be required to demonstrate compliance with the radium standard when using a filtering treatment system for groundwater with total radium greater than 10 pCi/L.

C. Waste handling, disposal, and permitting shall be given special consideration early in the design process.

D. Occupational exposure shall be considered in the project design.

E. Provisions for operational control monitoring of the radionuclides requiring removal or of acceptable surrogates shall be included in the project design.

12VAC5-590-985. GAC contactors.

A. Granular activated carbon (GAC) contactors may be used to adsorb natural organic compounds, taste and odor compounds, and SOCs. The most common applications of GAC contactors in drinking water treatment plants are (i) post-filtration adsorption and (ii) filtration-adsorption, in which some or all of the filter media in a granular media filter is replaced with GAC.

B. General requirements.

1. A demonstration study using bench-scale or pilot-scale tests shall be conducted to determine the GAC media effectiveness, adsorption efficiency, and regeneration frequency.

2. GAC contactors shall be sized for the optimum empty bed contact time.

3. A minimum of two contactor units shall be provided.

4. Bypassing the GAC facility may be permissible under certain circumstances to accommodate seasonal water quality fluctuations and allow for blending water.

C. Hydraulic configuration.

1. Pressure vessel installation may be configured in parallel or in series.

2. For pressure contactors, pre-filter and post-filter pressure gauges shall be installed at each individual contactor unit.

3. The rate of flow through the contactors shall be controlled either manually or automatically to ensure equal flow through each contactor.

D. Design details.

1. For pressure contactors, the maximum pressure loss through the vessels shall be as determined by the product manufacturer.

2. Sample taps, isolation valves, and bypass piping shall be provided before and after each individual contactor unit.

3. Pipes, tanks, and appurtenances shall be corrosion resistant.

4. The GAC facility shall provide the ability to filter-to-waste to prevent carbon fines in the effluent water.

5. Unless otherwise approved by the department, disinfection shall be accomplished following the GAC contactors.

6. If backwashing of GAC specific units is required, then unchlorinated filtered water shall be used.

7. Turbidity monitoring of contactor effluent shall be considered.

8. The facility design shall include provisions for spent carbon disposal, GAC delivery, and storage.

12VAC5-590-990. Waterworks waste.

A. With the exception of sanitary sewage and flows recycled through the water treatment system, the wastes generated during the operation of water filtration plants constitute industrial wastes and are subject to the State Water Control Law (Chapter 3.1 (§ 62.1-44.2 et seq.) of Title 62.1 of the Code of Virginia).

Industrial wastes generated by water treatment facilities include the following:

1. Filter backwash water;

2. Coagulant residuals;

3. Softening residuals;

4. Iron and manganese residuals;

5. Settled solids from presedimentation units; and

6. Brine wastes.

B. After receipt and review of plans and specifications from the consulting engineer for the water treatment facilities, the department will advise DEQ of any proposal to treat and discharge industrial wastes into state waters. The department will submit a letter or report to DEQ that includes the following:

1. Capacity of the proposed treatment facilities;

2. Location of the proposed facilities;

3. Proposed final disposition of the treated waste effluent;

4. Name and address of the consulting engineer; and

5. Name and address of the owner.

C. Except for recycle flows as described in 12VAC5-590-395 C, the owner will need to satisfy DEQ's requirements for the final disposal of these wastes.

D. The sanitary wastes from water treatment plants must receive treatment. Wastes from these facilities shall be discharged either directly to a sanitary sewer system or to an individual waste disposal facility providing suitable treatment approved by the State Water Control Board.

12VAC5-590-1000. Disinfection.

A. The objective of disinfection is to prevent the occurrence of waterborne diseases from the consumption of drinking water.

B. Primary disinfection shall be provided for all surface water sources, all spring sources, all GUDI sources, and all well sources determined to be of questionable bacteriological quality as required by the department. Consideration shall be given to minimizing the formation of DBPs when designing a disinfection process. Waterworks with groundwater sources requiring disinfection under this section shall meet the requirement of 12VAC5-590-421 A 1 d.

C. All pipes, tanks, and equipment that convey, store, or treat potable water shall be disinfected with chlorine before being placed in service in accordance with the following AWWA standards where applicable: C651-14, C652-19, and C653-20.

D. All residual disinfectant determinations shall be made using methods identified in 12VAC5-590-440.

1. The project documents shall outline the procedures and include the disinfectant dosage, contact time, and method of testing the results of the procedure.

2. Methods of disinfection other than chlorination may be considered by the department on an individual basis.

12VAC5-590-1001. Chlorination.

A. General design requirements.

1. Chlorine feed capacity shall be capable of meeting the disinfection requirements under all operating conditions.

a. Chlorine feed systems for primary disinfection at a waterworks using a surface water source, a GUDI source, or both shall provide sufficient capacity to achieve the required microbial log inactivation specified in Table 500.1.

b. Chorine feed systems for primary disinfection at a waterworks using groundwater sources shall provide sufficient capacity to achieve 4-log virus inactivation and removal.

c. Chlorine feed systems for secondary disinfection at a waterworks shall provide sufficient capacity to achieve a minimum chlorine residual at the entry point of 0.2 mg/L for more than 4 hours.

2. Chlorine feed systems for disinfection at a waterworks using a surface water source, a GUDI source, or both shall be sized to deliver the required dose with the largest unit out of operation. Small hypochlorination installations for groundwater source waterworks shall have a spare metering pump, unless it can be demonstrated to the satisfaction of the department that spare equipment is readily available from a local supplier. Spare parts shall be available for all chlorinators to replace parts that are subject to wear and breakage.

3. Consideration shall be given to providing multiple chlorine feed points at all waterworks. For conventional filtration treatment plants, chlorine feed points shall be provided for the source water, applied water to the filters, and filter effluent.

4. The piping providing the water for preparing the chlorine solution shall be designed to prevent contamination of the "bulk treated" finished water.

a. At all facilities treating surface water, pre-filtration and post-filtration disinfection systems shall operate independently of each other to prevent possible siphoning of partially treated water into the clearwell.

b. The water piping to each ejector shall have a separate shutoff valve. A master shutoff valve is prohibited.

5. Provisions shall be made to ensure uniform mixing of the chlorine with the water near the point of application.

6. Residual and contact time.

a. The owner of a waterworks using a surface water source, a GUDI source, or both shall provide a minimum residual (C) and contact time (T) as calculated in accordance with 12VAC5-590-500.

b. The owner of a waterworks using a groundwater source that is required to disinfect shall provide a minimum residual (C) and contact time (T) to achieve 4-log virus inactivation and removal based on maximum design flow rate. Provisions shall be made to prevent short circuiting. The contact basin shall be designed utilizing the appropriate baffle factors referenced in Table 500.15 of 12VAC5-590-500.

7. Automatic proportioning chlorinators shall be provided where the rate of flow is not reasonably constant.

8. Equipment shall be provided for measuring the chlorine residual, employing any method specified in 12VAC5-590-440. The equipment shall be capable of a chlorine residual measurement to the nearest 0.1 mg/L.

9. Continuous chlorine residual analyzers shall be provided at all waterworks that are required to filter and that serve 3,300 or more persons or at any waterworks required by the department. Where a continuous chlorine residual analyzer is provided, the department may require that the design incorporate an operator-selected high or low chlorine residual alarm.

B. Gas chlorine feed systems.

1. Equipment.

a. An ample supply of potable water shall be available for operating the chlorinator. Where a booster pump is required, duplicate equipment shall be provided, and when necessary, standby power shall be provided as well. Equipment for backflow prevention shall be provided. A pressure gauge shall be provided on each chlorinator mixing water piping.

b. Scales for weighing cylinders shall be provided at all waterworks using chlorine gas. At large waterworks, scales of the indicating and recording type shall be considered. Scales shall be recessed unless they are of the low-platform type.

c. Where a manifold of several cylinders is required to evaporate sufficient chlorine, consideration shall be given to the installation of gas evaporators.

d. Automatic switch-over of chlorine cylinders shall be provided to assure continuous disinfection.

2. Chlorine gas leak detection.

a. Automatic chlorine gas leak detection with strategically located sensors and related alarm equipment shall be provided for all installations.

b. A bottle of ammonia hydroxide solution shall be provided for detecting chlorine gas leaks.

3. Emergency cylinder repair kits shall be provided.

4. Consideration shall be given to the provision of caustic soda solution reaction tanks for absorbing the contents of leaking one-ton cylinders where the cylinders are in use.

5. Piping and connections for chlorine gas.

a. Pressure gauges shall be installed on the piping to each chlorinator. Piping systems shall be well supported and adequately sloped to allow drainage. Suitable allowance shall be made for pipe expansion due to changes in temperature.

b. Fittings and appurtenances shall be suitable for handling dry chlorine.

6. Building design.

a. Any building to house chlorine equipment or containers shall be designed and constructed to protect all components of the chlorine system from fire hazards. See 12VAC5-590-720.

b. If gas chlorination equipment and chlorine cylinders are to be in a building used for other purposes, a gas-tight partition shall separate this room from any other portion of the building. Doors to this room shall open only to the outside of the building and shall be equipped with panic hardware. These rooms shall be at ground level and should be separated from the feed area.

c. At least two means of exit shall be considered from each separate room or building in which chlorine is stored, handled, or used. All exit doors shall open outward.

d. A clear glass, gas-tight window shall be installed in an interior wall of the chlorinator room to permit the chlorinators to be viewed without entering the room.

e. Feed lines shall not carry chlorine gas beyond the chlorine feeder room unless the chlorine is under vacuum.

f. Chlorinator rooms shall be provided with a means of heating so that a temperature of at least 60°F can be maintained, but the room should be protected from excess heat. Cylinders shall be kept at essentially room temperature for at least 24 hours before use unless an evaporator is employed.

g. Forced, mechanical ventilation that provides one complete air change per minute shall be installed in all chlorine feed rooms and rooms where chlorine cylinders are stored. The inlet to the air exhaust duct from the room shall be near the floor, and the point of discharge shall be located so as not to contaminate the air inlet to any building or inhabited areas. Air inlets shall be located so as to provide cross ventilation with air and at a temperature that will not adversely affect the chlorination equipment. The vent hose shall run without traps from the chlorinator and shall discharge to the outside atmosphere above grade.

h. The electrical controls for the fans and lights shall automatically operate when the door is opened and can be manually operated from the outside without opening the door.

C. Calcium hypochlorite and sodium hypochlorite feed systems.

1. Both calcium hypochlorite and sodium hypochlorite shall be acceptable for disinfection.

2. Hypochlorite solution feeders of the positive displacement type shall be provided.

3. Adequate mixing of the calcium hypochlorite or sodium hypochlorite solutions shall be provided.

4. Special design considerations for bulk delivery systems:

a. Bulk sodium hypochlorite storage tanks shall be constructed of corrosion-proof materials. Pumps, piping, materials, and appurtenances exposed to the sodium hypochlorite shall be suitable for such use.

b. Sodium hypochlorite storage facilities shall be designed to keep ambient temperature and lighting low. Sodium hypochlorite fumes are corrosive and tanks shall be vented to the outside. Tanks shall be designed for ease of filling, draining, and transfer of contents.

c. Piping, valves, pumps, and pipe accessories shall be designed and configured so as not to allow accumulation of gases that could cause air locking or loss of prime in chemical feed piping or pumps.

d. The design shall provide a system of local or general exhaust features to keep employee exposures below the airborne exposure limits, as described in the Safety Data Sheet for the chemical used, in accordance with federal occupational safety and health standards (29 CFR § 1910.1200 (g)). Local exhaust ventilation is generally preferred because it controls contaminant emissions at the source and thus, preventing dispersion into the general work area which could result in corrosion or exposure. Exhaust equipment and accessories shall be corrosion proof.

e. An eye wash fountain and quick-drench facilities in the immediate work area shall be provided.

12VAC5-590-1002. Chloramination.

A. Chloramines shall be acceptable for secondary disinfection. Chloramines are formed by the reaction of ammonia and chlorine. Multiple chemical species may be created; however, monochloramine is the desired form.

B. The process shall be controlled to minimize formation of dichloramine and nitrogen trichloride, which can create objectionable taste and odors. Control should be sufficient to limit free ammonia leaving the chloramination facility to no more than 0.1 mg/L as nitrogen.

C. pH adjustment facilities shall be provided to maintain pH in the range of 7 to 8.

D. When use of chloramines is proposed, the potential increase of lead leaching within the distribution system shall be considered. Additional distribution system monitoring may be required by the department.

E. The owner shall inform the public before initiating any disinfection process involving chloramines, as directed by the department.

12VAC5-590-1003. Chlorine dioxide addition.

A. Chlorine dioxide may be considered as a pre-oxidant to control tastes and odors, reduce color, oxidize iron and manganese, and reduce DBPPs. Chlorine dioxide may be used for primary disinfection. Where chlorine dioxide is used, consideration shall be given to the formation of the byproducts chlorite and chlorate.

B. Chlorine dioxide is generated onsite from sodium chlorite and either chlorine gas or hypochlorite solution. Chlorine dioxide generation equipment shall be factory assembled, pre-engineered units with a minimum efficiency of 95%. The excess free chlorine shall not exceed 3.0% of the theoretical stoichiometric concentration required.

C. The owner shall inform the public before using chlorine dioxide, as directed by the department.

12VAC5-590-1004. Ozonation.

A. Ozone may be considered as a pre-oxidant to control tastes and odors, reduce color, oxidize iron and manganese, reduce DBPPs, and used for primary disinfection. Where ozone is used, consideration shall be given to the level of bromide and formation of brominated byproducts.

B. Ozone systems are typically comprised of four basic subsystems: ozone generation, feed gas preparation, ozone contactors, and off-gas disposal.

C. The PER shall evaluate water and gas flow rates, oxygen source, generator selection and sizing, contactor design, treatment process location, exhaust gas collection and destruction, and operator requirements.

D. Treatability studies using bench-scale or pilot-scale tests may be required as part of the PER to address the following:

1. Alternate points of ozone application;

2. Ozone demand tests, applied dose, transferred dose, and decay rates; and

3. Ozone byproducts, including bromide and bromate analyses.

E. Ozone systems shall be granted disinfection credit for Giardia lamblia, Cryptosporidium, and viruses, in accordance with 12VAC5-590-401 E 7 and 12VAC5-590-500, provided that they meet the requirements of this section.

1. Ozone residual levels shall be monitored continuously and recorded. For waterworks that claim inactivation credit for ozone, a minimum of two dedicated, online monitors per ozone contactor shall be provided. The location of the monitors shall be acceptable to the department. A portable ozone monitor shall be provided as a backup.

2. Ozone systems using multiple, consecutive contact chambers with gaseous ozone injected in the initial chambers, shall be designed to measure the ozone residual and compute log inactivation of Giardia and virus using the $C_{effluent}T_{10}$ Method or the Log Integration CT_{10} Method, as described in

the "Long Term 2 Enhanced Surface Water Treatment Rule Toolbox Guidance Manual," EPA Office of Water (4606), EPA 815-R-09-016, April 2010.

3. Sampling lines shall be designed to minimize the reaction time (typically less than 10 seconds conveyance time).

F. Alarms shall be provided for ozone process control safety. Automatic shutdown features shall be considered.

12VAC5-590-1005. Ultraviolet light (UV) disinfection.

A. All UV reactors shall conform to NSF/ANSI/CAN standards.

B. Each reactor train shall be equipped with an individual flow meter or a single flow meter in conjunction with differential pressure sensors in each treatment train. Reactors shall be sized to treat the design flow.

C. Hydraulic design shall ensure that lamps are submerged and that the entrance of air, negative pressure, or pressure surges in the reactors is prevented. Open channel flow reactors are prohibited.

D. A pressure gauge shall be provided upstream of each reactor. The design shall ensure that the reactor's maximum rated pressure cannot be exceeded.

E. Water quality parameters that may affect UV disinfection system performance shall be evaluated, including calcium, iron, manganese, hardness, and alkalinity. Pretreatment shall be considered for water quality parameters that may result in lamp sleeve fouling.

F. A building to enclose and protect all UV equipment shall be provided. Adequate space between control panels, power supply, and the reactor equipment shall be provided to allow for routine operation and maintenance, including removing lamp and wiper assemblies and for off-line chemical cleaning of reactor lamps.

G. An operation and maintenance manual shall be provided for all UV reactors.

H. UV systems may be used for primary disinfection and shall be granted log inactivation credit for Giardia lamblia, Cryptosporidium, and viruses in accordance with Table 401.7, provided that they meet the requirements of 12VAC5-590-401 E 7 c and this subsection.

1. Only UV reactors that have undergone independent, third-party oversight of the validation testing on a fully assembled system to determine the operating conditions under which the reactors deliver the required UV dose shall be considered for log inactivation credit.

2. The dose-monitoring strategy shall be either the UV intensity set point approach or the calculated dose approach as described in the "Ultraviolet Disinfection Guidance Manual For The Final Long Term 2 Enhanced Surface Water Treatment Rule," Office of Water (4601), EPA 815-R-06-007, November 2006. The dose-monitoring strategy shall be demonstrated through the UV reactor validation testing.

3. At least two reactors shall be provided. Reactors shall be sized to treat the design flow with the largest reactor out of service.

4. Continuous monitoring sensors shall be provided to measure UV intensity. A continuous sensor shall also be provided to measure ultraviolet transmittance (UVT) if the calculated dose approach is utilized.

a. The number of sensors provided shall be the same as that used in validation testing of the reactor.

b. Output from a continuous UVT analyzer shall be capable of being input directly into a control loop for each UV reactor, a SCADA system, or both. A bench-top spectrophotometer may be provided instead of a continuous UVT analyzer.

c. All signals from the sensors shall be displayed for operator response and for recordation.

d. At least one reference sensor for calibration of online UV intensity sensors shall be provided. Reference sensors shall be capable of calibration against a traceable standard.

e. Continuous recording equipment shall be provided with the monitoring sensors to store in memory or print one data point at least every four hours.

5. A means of flow distribution and control among multiple reactors shall be provided. The hydraulic flow profiles and piping configuration shall be identical to or more protective than that tested during equipment validation.

a. For onsite validation, the inlet and outlet piping configuration for the UV facility shall be designed according to manufacturer recommendations and to accommodate any site-specific constraints.

b. To avoid jetting flow and swirling flow, consideration shall be given to exclude expansions for at least 10 pipe diameters upstream of the reactor and to exclude out-of-plane 90-degree bends in series.

c. Each UV reactor shall be capable of being isolated and removed from service. Isolation valves upstream and downstream of each reactor, a drain, and sample taps for each reactor treatment train shall be provided. If the isolation valves are also used for flow control, then the flow control valve shall be located downstream of the UV reactor to limit the disturbance of the flow entering the UV reactor. Bypass piping shall not be allowed.

d. The lateral piping for each UV reactor train shall be sized and configured to provide approximately equal head loss through each UV reactor train over the validated range of flow rates.

6. The control system shall be capable of meeting the monitoring and reporting requirements in 12VAC5-590-401 and 12VAC5-590-570.

7. Automatic shutdown capability under critical alarm conditions shall be provided, including lamp or ballast failure, low liquid level, and high temperature. Alarms shall be provided for low UV validated dose, low UV intensity, low UV transmittance, high flow rate, and mechanical wiper failure.

8. Ground-fault circuit interrupters shall be provided for all lamps. Backup power shall be considered.

9. The owner shall develop a start-up plan and submit the plan to the department for approval. The plan shall include functional testing, determination of validated operating conditions and control settings, performance testing, development of an operation and maintenance manual, and inspection schedules.

I. UV systems not intended for primary disinfection may be used provided that they meet the requirements of this subsection.

1. Continuous sensors to measure UV intensity shall be considered.

2. Each UV reactor shall be capable of being isolated, removed from service, and be provided with bypass piping.

3. Automatic shutdown capabilities shall be provided in the event of lamp or ballast failure.

12VAC5-590-1010. Basic pumping facility design criteria.

Pumping facilities shall be designed to maintain the sanitary quality of pumped water. All pumps shall be accessible for servicing and repair.

12VAC5-590-1020. Location.

A. The pumping station shall be located to meet the hydraulic needs of the distribution system, preserve the quality of the water pumped, and shall consider the availability of a power or a fuel supply.

B. The station shall be:

1. Elevated to a minimum of one foot above the 100-year flood elevation or protected to that elevation;

2. Accessible at all times unless allowed to be out of service by the department;

3. Graded around the station so as to lead surface drainage away from the station; and

4. Protected to prevent vandalism and entrance by animals or unauthorized persons.

12VAC5-590-1040. Pump stations.

A. Enclosures.

1. The structure that houses a pump shall be of durable construction, fire and weather resistant, and furnished with lockable, outward opening doors. Underground structures shall be waterproofed.

2. Floors.

a. Pump house floors shall be of good quality concrete with adequate reinforcement and have a minimum thickness of six inches.

b. Pump house floors shall slope at least 1/8 inch per foot toward a screened four-inch-diameter floor drain to the atmosphere or other provisions for gravity drainage.

c. The pump house finished floor elevation should be at least six inches above the finished grade.

3. Openings in floors or roofs or elsewhere for removal of heavy or bulky equipment shall be provided.

a. Craneways, hoist beams, eyebolts, or other adequate facilities for servicing or removal of pumps, motors, or other heavy equipment shall be provided.

b. Adequate means of access shall be provided to lubrication points of equipment if these are located at intermediate points between floors.

4. Heat shall be provided for the safe and efficient operation of the equipment.

5. Adequate ventilation shall be provided for all pumping stations. Forced draft ventilation of at least six changes of air per hour (continuous operation) shall be provided for:

a. All rooms, compartments, pits, and other enclosures below grade; and

b. Any area where an unsafe atmosphere may develop or where excessive heat may build up.

6. In areas where excess moisture could cause hazards to safety or damage to equipment, means for dehumidification shall be provided.

7. Pump stations shall be adequately lighted throughout. All electrical work shall conform to the requirements of the applicable codes.

8. Stair design shall be in accordance with the USBC.

9. Pump stations shall have adequate space for the installation of additional units if needed and for the safe servicing of all equipment.

10. Pump stations shall be designed so that each pump has an individual suction line or the lines shall be so manifolded to ensure similar hydraulic and operational conditions.

B. Suction wells shall:

1. Be watertight;

2. Have floors sloped to allow removal of water and entrained solids;

3. Be covered or otherwise protected against contamination, including contamination by pump lubricants; and

4. Have two pumping compartments or other means to allow the suction well to be taken out of service for inspection, maintenance, or repair.

C. Groundwater well enclosures and aprons.

1. The floor at the well pump house shall meet the requirements of subdivision A 2 of this section.

2. Well pump aprons surrounding the well shall (i) be of quality reinforced concrete, (ii) extend a minimum of three feet in all directions from the well casing, (iii) be at least six inches thick, and (iv) be sloped 1/8 inch per foot away from the well.

3. Well houses or well pump stations in pits are prohibited.

D. Spring enclosures shall be vented by properly hooded and screened pipe extending at least 12 inches above the pump floor or ground surface.

12VAC5-590-1050. Pumps and controls.

A. General.

1. Pumps, pump motors, and all accessories shall be controlled in a manner that they will operate at their rated capacity. Where two or more pumps are installed, provision shall be made for proper alternation of the pumps. Alternation may be automatic or manual. Provision shall be made to prevent operation of the pump in the event of a backspin cycle.

2. All pumps shall be driven by motors designed to operate over the full range of operating conditions.

3. All pumps shall be served by control equipment that has overload protection for the air temperature encountered.

4. Electrical controls shall be protected to the 100-year flood elevation and should be located above grade.

5. If standby power is provided by onsite generators or engines, then the provisions for filling the fuel storage tank, the fuel tank itself, and the fuel line shall be designed to protect the waterworks and source water from contamination.

6. Pumps shall be lubricated with water of equal or better quality than the water being pumped or with food grade oil. Water seals shall not be supplied with water of a lesser sanitary quality than that of the water being pumped. Where pumps are sealed with potable water and are pumping water of lesser sanitary quality, the seal shall:

a. Have an air gap of at least two inches or two pipe diameters, whichever is greater, where a break-tank is provided; or

b. Be provided with an approved RPZ assembly.

7. When automatic pre-lubrication of pump bearings is necessary and an auxiliary power supply is provided, the pre-lubrication line shall be provided with a valved bypass around the automatic control.

8. A suitable outlet for drainage from pump glands shall be provided without discharging onto the floor.

B. Booster pumps.

1. Booster pumps, except those connected to supply mains not containing service connections and except those taking suction directly from storage facilities, shall be located or controlled so that:

a. They will not produce negative gauge pressure in their suction line; and

b. The intake pressure shall be at least 20 psi when the pump is in normal operation.

2. An automatic pressure cutoff or a pressure-regulating valve shall be provided to prevent the suction line pressure from dropping to below 10 psi.

3. Automatic or remote control devices shall have sufficient range between the start and cutoff pressure, or another mechanism that will prevent excessive cycling of the pumps.

4. At least two pumping units shall be provided.

a. If only two units are provided, then each shall be capable of delivering the peak hour demand, taking into account storage contributions.

b. If more than two units are installed, then they shall have sufficient capacity so that if any one pump is out of service, the remaining pumps are capable of meeting the peak hour demand, taking into account storage contributions.

c. When using booster pumps to transfer water from atmospheric storage tanks to hydropneumatic tanks located upstream of an entry point into the distribution system, the combined capacity of the two pumps shall equal or exceed the peak hour demand. If fire flow is provided, then a pump separate from the transfer pumps shall be provided to deliver the required fire flow.

d. When booster pumping is required for small noncommunity systems, the reserve capacity requirements may be reduced in accordance with the type and size of system served.

5. Controls shall be provided to shut off pumps in the event that suction conditions may result in cavitation.

12VAC5-590-1065. Piping, valves, and meters.

A. Piping shall:

1. Be adequately sized to minimize energy losses;

2. Not be subject to contamination;

3. Have watertight joints;

4. Be properly anchored to prevent movement;

5. Be protected against surge or water hammer;

6. Have proper labels to identify the contents of the pipes (12VAC5-590-720 C); and

7. Have all exposed piping, valves, and appurtenances protected against physical damage and freezing.

B. Pumps shall be adequately valved to allow satisfactory operation, maintenance, and repair.

1. If foot valves are necessary, then they shall have a net valve area of at least 2-1/2 times the area of the suction pipe and they shall be screened.

2. Each pump shall have shutoff valves on both suction and discharge sides of the pump.

3. Each pump shall have a positive-acting check valve on the discharge side between the pump and shutoff valve or suitable control features to prevent flow reversal.

4. Surge relief valves or slow-acting check valves shall be designed to minimize hydraulic transients.

5. Discharge control valves and appurtenances shall be located above the pump floor when an above-ground discharge is provided.

6. Pumps shall be equipped with an air release or vacuum relief valve located upstream from the check valve, with exhaust or relief piping terminating in a down-turned position at least 18 inches above the floor and covered with a corrosion-resistant screen.

C. Gauges. Each pump shall have a standard pressure gauge on its discharge line capable of displaying the maximum allowable pressure of the pump and shall have a standard pressure gauge or a compound gauge when appropriate on its suction line.

D. Meters.

1. All booster pump stations located within the distribution system should be fitted with a flow rate indicating and totalizing meter with recording capabilities.

2. A totalizing water meter to measure water production shall be provided for each well and shall be located upstream of the well blowoff.

E. Additional requirements for well discharge piping.

1. Valves shall be provided to allow testing and control of each well.

2. A nonthreaded sampling tap shall be provided for water sampling that discharges in a downward direction and away from the well casing.

3. A standard pressure gauge shall be provided to indicate well discharge pressure. The gauge shall be capable of displaying pressure under all operating conditions.

4. Blowoff.

a. A separate means to pump (i.e., blowoff) water of unsatisfactory quality to a point away from the groundwater source shall be provided. Blowoff discharge shall not create a cross-connection.

b. Systems shall be equipped with a watertight cap or a screened discharge.

c. Erosion protection at the point of waste discharge shall be provided.

12VAC5-590-1080. Basic finished water storage structure design criteria.

A. The materials and designs used for finished water storage structures, including associated pipe and valves, shall provide stability and durability as well as protect the quality of the stored water. Steel, concrete, composite, and plastic storage structures shall be designed, constructed, cleaned, disinfected, and tested in accordance with the following AWWA standards, where applicable: D100-11, D103-19, D107-16, D108-19, D110-13, D115-20, D120-19, D121-12, and C652-19.

B. Safety cages, rest platforms, roof-ladder handrails, and other safety devices shall be provided as required by VOSH laws and regulations.

C. Location of finished water storage structures.

1. The bottom of ground-level reservoirs, storage tanks, and standpipes should be placed above finished grade to ensure positive drainage away from the structure.

2. Where the bottom must be below normal ground surface, it shall be placed above the groundwater table. Sewers, drains, standing water, and similar sources of contamination shall be kept at least 50 feet from the finished water storage structure. Pipe conforming to water distribution pipe standards of 12VAC5-590-1110, pressure tested in place without leakage, shall be used for gravity sewers at lesser separations.

3. The top of all storage facilities shall not be less than two feet above the normal ground surface and shall be above the 100-year flood elevation. Any clearwell constructed under filters may be exempted from this requirement when the total design gives the same protection.

D. Pressure variation. The maximum variation between normal operational high and low water levels in finished water storage structures which float on a distribution system shall not exceed 30 feet.

E. Level controls.

1. Adequate controls shall be provided to enable sufficient tank turnover, water quality maintenance, avoidance of overflows, and efficient operations.

2. A telemetery system with recording capability shall be considered to transmit the operating levels in distribution system storage facilities to a location where qualified personnel may access the data at all times.

3. Altitude valves or equivalent controls shall be provided.

4. For tanks with a monitoring system, warnings or alarms indicating overflow, low level, and pump malfunction shall be provided.

12VAC5-590-1081. Atmospheric tank storage.

A. Protection.

1. All finished water storage structures shall have suitable watertight roofs or covers that exclude birds, animals, and insects.

2. All finished water storage structures shall be designed to prevent vandalism and entrance by animals or unauthorized persons.

B. Finished water storage structures shall be designed to facilitate turnover of water. Consideration shall be given to locating inlet and outlet pipes at different elevations and locations, tank mixers, and other acceptable means to avoid stagnation. Excessive storage capacity shall be avoided to prevent water quality deterioration. See 12VAC5-590-640 B 3.

C. Drains.

1. No drain on a finished water storage structure shall create a cross-connection hazard.

2. All finished water storage structures shall be equipped with separate drains discharging to the atmosphere. Drainage of finished water storage structures to the distribution system through inlet and outlet piping is prohibited.

D. Overflows.

1. Finished water storage structures shall be provided with a downward-discharging, screened overflow pipe. The discharge pipe shall be brought down near the ground surface and into a drainage inlet structure or a splash plate that will divert the overflow away from the storage structure. The overflow pipe discharge shall be high enough above normal or graded ground surface to prevent the entrance of surface water.

2. Overflow pipe screens shall be installed so as to withstand the force of overflows. Properly designed flapper valves or rubber flex-type valves may be used instead of screens if approved by the department.

E. Inlet and discharge pipes.

1. Elevated tanks with riser pipes over eight inches in diameter shall have protective bars over the riser opening inside the tank.

2. Inlet and outlet pipes from water storage facilities shall be located in a manner that will prevent the flow of sediment into the distribution system.

F. Finished water storage structures shall be designed with convenient access to the interior for cleaning and maintenance. Ladders, ladder guards, balcony railings, and safely located entrance hatches shall be provided where applicable. Hatches, manholes, or scuttles above the waterline shall be:

1. Framed at least four inches, preferably six inches, above the surface of the roof at the opening; on ground-level structures, manholes should be elevated 24 to 36 inches above finished grade;

2. Fitted with a solid watertight cover that overlaps the framed opening and extends vertically down around the frame at least two inches (shoebox type);

3. Hinged at one side; and

4. Fitted with a locking device.

G. Finished water storage structures shall be vented by separate vent structures. Open construction between the side wall and roof is prohibited.

1. Vents shall prevent the entrance of surface water.

2. Vents shall exclude birds, animals, and insects and be constructed of noncorrodible material. Screens shall be designed to be frost-free or capable of relieving pressure or vacuum in the event of frosting or clogging.

3. Vents on ground-level structures shall terminate in an inverted U construction, with the vent terminating 24 to 36 inches above roof or finished grade.

H. Penetrations. The roof and sidewalls of all structures shall be watertight with no openings except properly constructed vents, manholes, overflows, risers, drains, pump mountings, control ports, or piping for inflow and outflow.

1. All pipes running through the roof or sidewall of a finished water storage structure shall be welded or properly gasketed in metal tanks or should be connected to standard wall castings that were placed during the forming of a concrete structure; these wall castings shall have flanges imbedded in the concrete.

2. Valves and controls shall be located outside the finished water storage structure so that valve stems and similar projections will not pass through the roof or top of the structure.

3. Downspout pipes for roof drainage shall not enter or pass through the structure.

I. All finished water storage structures and their appurtenances, especially the riser pipes, overflows, and vents shall be designed to prevent freezing that will interfere with proper functioning.

J. Every catwalk over finished water in a storage structure shall have a solid floor with raised edges designed so that shoe scrapings and dirt will not fall into the water.

K. The area surrounding a ground-level structure shall be graded in a manner that will prevent surface water from standing within 50 feet of the structure.

L. Proper protection shall be given to metal surfaces by paints or other protective coatings, by cathodic protective devices, or both, in accordance with the NSF/ANSI/CAN Standard 61-2020, AWWA Standards D102-17, D104-17, and D106-20, or an approved equivalent, where applicable.

M. All finished water storage facilities shall be cleaned to remove all dirt and loose materials before disinfection of the structure. Only potable water shall be used to clean and rinse the water storage facilities. All equipment including brooms, brushes, spray equipment, and worker's boots shall be disinfected before they are used to clean the storage facilities.

N. Disinfection. All finished water storage facilities shall be satisfactorily disinfected in accordance with AWWA Standard C652-19 before being placed in operation. The disinfection of the storage facilities shall be repeated until it is determined, by bacteriological testing, that the water is free of coliform bacteria.

12VAC5-590-1082. Pressure tank storage.

A. When hydropneumatic tanks are used, they shall comply with the requirements of state and local laws and regulations for the construction and installation of unfired pressure vessels.

B. Pressure tanks shall be located above the normal ground surface with the operating end of the tank containing the inlet pipe, the pressure gauge, and other appurtenances projecting into a building with climate controls to prevent freezing. Alternatively, it may be completely housed, if adequate access is provided for inspection, removal, and replacement.

C. Pressure tanks shall have bypass piping to permit operation of the system while the tank is being cleaned, repaired, or painted.

D. Pressure tanks shall have an access manway, a drain, and control equipment consisting of a pressure gauge, water sight glass, automatic or manual air blowoff, pressure and vacuum relief valves, and mechanical means for adding air. Pressure tanks smaller than than 120 gallons and bladder tanks are not required to have an access manway, sight glass, or vacuum relief valve.

E. Pressure tanks and pumps shall be designed to minimize pump cycling and to operate within manufacturer recommendations.

12VAC5-590-1090. Plant storage.

A. Backwash water storage tanks shall be sized in conjunction with available pump units and finished water storage to provide the filter backwash water required. Consideration shall be given to the possibility of having to wash more than one filter at a time or several filters in succession.

B. Clearwell storage shall be sized, in conjunction with distribution system storage, to relieve the filters from having to follow fluctuations in water use or meet peak demands, including filter backwash water. When finished water storage is used to provide proper contact time for disinfection, special attention shall be given to size, drawdown, and baffling. Plant clearwells shall be equipped with a raised viewing port having a clear glass or plastic viewing window and a submerged, waterproofed electric light.

C. Finished water shall not be stored or conveyed in a compartment adjacent to nonpotable water when the two compartments are separated by a single wall.

D. Receiving basins and pump wet wells for finished water shall be designed as finished water storage structures.

12VAC5-590-1110. Distribution system materials.

Pipe, fittings, joints, valves, hydrants, and coatings shall conform to AWWA standards.

12VAC5-590-1120. Minimum pipe size.

A. The minimum size pipe for water distribution mains shall be four inches in diameter. Pipes of lesser diameter may be used in the following instances:

1. When the run is less than 300 feet, two-inch diameter pipe may be used.
2. When the run is less than 600 feet but more than 300 feet, three-inch diameter pipe may be used.
3. Any departure in sizing shall be justified by hydraulic analysis and future water demands.

B. Fire hydrants shall not be connected to water mains that are not designed to carry fire flows. Connection of a fire hydrant to a pipe of less than six inches in diameter is prohibited.

C. Where a noncommunity waterworks serves a single building, the plumbing shall be in accordance with the USBC. Where a noncommunity waterworks serves two or more buildings, the pipe shall be of sufficient size to provide adequate flow and pressure in order to meet the system demands.

12VAC5-590-1130. Distribution system design.

A. Dead-ends should be minimized by the looping of water mains.

B. Where dead-end water mains occur, a means of effective flushing shall be provided.

C. No flushing device shall be directly connected to any sewer.

12VAC5-590-1140. Installation and testing of water mains.

A. Adequate supports and restraints shall be provided for all pipes.

B. A continuous and uniform bedding shall be provided in the trench for all buried pipe.

C. Stones and rocks found in the trench shall be removed to a depth of at least six inches below the bottom of the pipe and selected fill bedding provided.

D. Installed pipe shall be pressure-tested and meet allowable leakage as specified in accordance with AWWA Standards C600-17, C604-17, and C605-13, where applicable.

E. Any plastic or other nonmetallic pressurized pipe installed underground shall be provided with a material conductive of electricity or some other means of locating the buried pipe.

12VAC5-590-1150. Separation of water mains and sanitary sewers.

A. The following factors shall be considered in providing adequate separation of water mains and sanitary sewers:

1. Materials and types of joints for water and sanitary sewer mains;
2. Soil conditions;
3. Service branch connections into the water main and sanitary sewer mains;
4. Compensating variations in the horizontal and vertical separations;
5. Space for repairs and alterations of water and sanitary sewer mains;

6. Offsetting of pipes around manholes; and

7. Identification of the physical restraints preventing normal separation.

B. Parallel installation of water mains and sanitary sewers.

1. Under normal conditions, water mains shall be laid at least 10 feet horizontally from a sanitary sewer or sewer manhole. The distance shall be measured edge-to-edge.

2. Under unusual situations when local conditions prevent a horizontal separation of 10 feet, the water main may be laid closer to a sanitary sewer or sewer manhole provided that:

a. The bottom (invert) of the water main shall be at least 18 inches above the top (crown) of the sanitary sewer;

b. Where this vertical separation cannot be obtained, the sanitary sewer shall be constructed of water distribution pipe and pressure tested in place in accordance with 12VAC5-590-1110 and 12VAC5-590-1140;

c. The department may approve concrete encasement of the water main or other physical barrier;

d. The sewer manhole shall be of watertight construction and tested in place; and

e. No water pipes shall pass through or come into contact with any part of a sewer manhole.

C. Crossing of water mains and sanitary sewers.

1. Under normal conditions, water mains crossing sanitary sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sanitary sewer whenever possible.

2. Under unusual situations when local conditions prevent a vertical separation described in subdivision C 1 of this section, the following construction shall be used:

a. Sanitary sewers passing over or under water mains shall be constructed of the materials described in subsection B of this section and shall be constructed to a point 10 feet beyond and on each side of the crossing; and

b. Water mains passing under sanitary sewers shall, in addition, be protected by providing:

(1) A vertical separation of at least 18 inches between the bottom of the sanitary sewer and the top of the water main;

(2) Adequate structural support for the sanitary sewers to prevent excessive deflection of the joints and the settling on and breaking of the water main; and

(3) That the length of the water main be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the sanitary sewer.

D. The minimum horizontal separation distance between water mains and septic tanks and drainfields, measured edge-to-edge, shall be 10 feet. Greater separation distances shall be provided wherever practical.

E. Water mains shall be located a safe horizontal distance from sources of contamination not already mentioned in this section, such as sewage treatment works and industrial complexes. The owner's engineer shall contact the department to determine the safe separation distances.

12VAC5-590-1160. Valve, air relief, meter, and blowoff chambers.

A. Standard fire hydrants or blowoffs shall be considered to enable removal of sediment and air accumulations.

B. Drains in chambers or pits that contain valves, blowoffs, meters, or other appurtenances to a distribution system shall not be connected directly to any storm drain or sanitary sewer, nor shall blowoffs or air relief valves be connected directly to any sanitary sewer.

C. Chambers or pits shall be drained to the surface of the ground where they are not subject to flooding by surface water or to absorption pits located above the seasonal groundwater table elevation. The backfill

material for the water main may serve as an absorption pit if granular embedment material is laid from the pipe bedding up through the final backfill layer for the entire length of pipe in the chamber. Sump pumps may be used where other means are not practicable.

D. Chambers or pits shall be designed to facilitate air-valve inspection and servicing.

E. Air relief and blowoff piping.

1. The open end of an air relief pipe shall be extended from the manhole or enclosing chamber to a point at least one foot above ground and provided with a screened, downward facing elbow. The exposed pipe and appurtenances shall be protected from vandalism and other damage.

2. When an aboveground extension is not practical or desired, the open end of the air relief pipe or blowoff shall be extended.

a. Where the pit or chamber is provided with proper drainage and is not otherwise subject to high groundwater levels, surface flooding, ponding, and contaminant or pollutant spills, the open end may be provided with a screened, downward facing elbow. The valve chamber or pit shall be vented to provide sufficient air flow to allow proper operation of the air valve. Air valves fitted with a smooth vent port and screened hood are allowable under these conditions.

b. Where the pit or chamber is not properly drained or is otherwise subject to high groundwater levels, surface flooding, ponding, and contaminant or pollutant spills, a manually operated valve or blowoff shall be used and the open end shall be fitted with a watertight cap or other means to prevent contamination from entering the pipe and valve.

c. The installation and testing specifications shall require field verification by the owner's engineer of the groundwater elevation and surface water drainage, as needed in circumstances or situations where this is of potential concern, before placement of the pit or chamber.

12VAC5-590-1170. Hydrants.

A. Fire hydrants.

1. To avoid cross-connection and contamination, dry barrel fire hydrants:

a. Should be located in areas that are not subject to high groundwater, flooding, surface water ponding, and contaminant or pollutant spills. When this is not practical, consideration shall be given to:

(1) Piping the drain port to daylight with screening on the end of the pipe; or

(2) Plugging the drain port and marking the hydrant for seasonal dewatering.

b. Shall comply with the ANSI/AWWA C502-18 standard, to include drain ports that are physically isolated from the drinking water system by the hydrant stem valve; and

c. Shall be drained to the ground surface or to a dry well provided exclusively for this purpose. Fire hydrant drains shall not be connected to sanitary sewers or storm drains.

2. Fire hydrants shall be connected only to water mains adequately designed for fire flows in accordance with the requirements of 12VAC5-590-1120 B.

B. Yard hydrants.

1. Shall have a hose connection vacuum breaker, meeting ASSE 1011-2017 or ASSE 1052-2016, if the hydrant has hose threads and is not already protected with an integral vacuum breaker.

2. To avoid cross-connection and contamination, yard hydrants installed in areas subject to high groundwater, flooding, contaminant, or pollutant spills or in areas where surface water ponds shall:

a. Meet ASSE 1057-2012, Performance Requirements for Freeze Resistant Sanitary Yard Hydrants with Backflow Protection; or

b. Have hydrant drain ports that are piped to daylight with screening on the end of the pipe; or

c. Be contained from the rest of the distribution system by a backflow prevention assembly suitable for a high hazard.

3. Frost-proof yard hydrants with weep holes draining below grade are allowed provided they are not installed in areas subject to high groundwater, to flooding, or to contaminant or pollutant spills or in areas where surface water ponds.

C. Hydrants and flushing devices not designed for fire protection may be connected to pipe of less than six inches in diameter, consistent with 12VAC5-590-1120 A.

12VAC5-590-1180. Surface water crossings.

A. Surface water crossings, both over and under water, present special challenges and shall be discussed with the department before project documents are prepared.

B. Aerial water crossings. The pipe above water crossings shall be:

1. Adequately supported;

2. Protected from freeze damage;

3. Accessible for repair or replacement; and

4. Above the 100-year flood elevation.

C. Under water crossings.

1. The pipe shall be of special construction, suitable to the method of installation and having flexible watertight joints.

2. Where rigid pipe is used, valves and taps shall be provided at both ends of the water crossing so that the section can be isolated for tests or repair; the valves and taps shall be easily accessible and not subject to flooding.

12VAC5-590-1210. Disinfection and testing of water mains.

A. All water mains shall be disinfected in accordance with AWWA Standard C651-14 before being placed in operation. The disinfection of the mains shall be repeated until it is determined by bacteriological testing that the water is free of coliform bacteria.

B. Project documents shall provide the details of the procedure and include the disinfectant application technique, dosage, contact time, method of testing the results of the procedure, and use or disposal of the disinfecting water.

12VAC5-590-1220. Pipe cover.

All buried distribution pipe shall be provided with sufficient earth or other suitable cover or encasement to prevent from freezing and provide protection from damage by external forces.

12VAC5-590-1230. Service connection metering.

A. All new service connections in community waterworks shall be metered.

B. Water pipe and appurtenances between the water main and the service connection shall conform to all applicable codes.

12VAC5-590-1235. Water loading stations.

A. The station and its piping and valving arrangement shall be designed to prevent unauthorized use, tampering, and vandalism.

B. An air gap or RPZ assembly shall be provided on the potable water fill connection to prevent backflow into the waterworks.

C. The piping and valving arrangement shall prevent contaminants from being transferred from a hauling tank or vessel to others subsequently using the water loading station.

D. Hoses used to fill potable water tanks and vessels shall be approved for potable water contact.

E. Hoses shall not come into contact with the ground or other contaminated surface and shall otherwise be handled, maintained, and stored in a manner to prevent contamination.

Forms

Uniform Water Well Completion Report, Form GW-2 (rev. 8/2016)

Application for Monitoring Waivers (rev. 3/2019)

Waterworks Permit Application, ODW-001 (filed 10/2019)

Operational Evaluation Reporting Form (filed 10/2019)

Waterworks Level 1 Assessment (rev. 9/2017)

Waterworks Level 2 Assessment (rev. 9/2017)

Well Yield and Recovery Report Form, ODW-002 (filed 10/2020)

Documents Incorporated by Reference

U.S. Department of Commerce (https:/www.commerce.gov/):

Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure, NBS Handbook 69 issued June 5, 1959 and amended August 1963, U.S. Department of Commerce

U.S. Environmental Protection Agency (https:/www.epa.gov/):

Ultraviolet Disinfection Guidance Manual for the Final Long Term 2 Enhanced Surface Water Treatment Rule, Office of Water, EPA 815-R-06-007, November 2006

Consensus Method for Determining Groundwaters Under the Direct Influence of Surface Water Using Microscopic Particulate Analysis (MPA), EPA 910/9-92-029, Environmental Services Division, October 1992

The Stage 2 Disinfectants and Disinfection Byproducts Rule (Stage 2 DBPR) Implementation Guidance, Office of Water, EPA 816-R-07-007, August 2007

Long Term 2 Enhanced Surface Water Treatment Rule Toolbox Guidance Manual, Office of Water, EPA 815-R-09-016, April 2010

NSF International, P.O. Box 130140, 789 N. Dixboro Road, Ann Arbor, MI 48105 (http://www.nsf.org/):

NSF/ANSI/CAN Standard 60-2020, Drinking Water Treatment Chemicals - Health Effects, 2020

NSF/ANSI/CAN Standard 61-2020, Drinking Water System Components - Health Effects, 2020

ASSE International.18927 Hickory Creek Drive, Suite 220, Mokena, IL 60448 (https://www.asse-plumbing.org/):

ASSE Standard #1011-2017, Performance Requirements For Hose Connection Vacuum Breakers, 2017

ASSE Standard #1052-2016, Performance Requirements For Hose Connection Backflow Preventers, 2016

ASSE Standard #1057-2012, Performance Requirements For Freeze Resistant Sanitary Yard Hydrant with Backflow Protection, 2012

ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959 (https://www.astm.org/):

ASTM F480-14, Standard Specification for Thermoplastic Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR), SCH 40 and SCH 80, March 1, 2014

American Water Works Association, 666 W. Quincy Avenue, Denver, CO 80235 (https://www.awwa.org/):

AWWA Standard, ANSI/AWWA A100-20, Water Wells, eff. 7/1/2020

AWWA Standard, ANSI/AWWA B114-16, Reverse Osmosis and Nanofiltration Systems for Water Treatment, eff. 5/1/2016

AWWA Standard, ANSI/AWWA C502-18, Dry-Barrel Fire Hydrants, eff. 1/1/2019

AWWA Standard, ANSI/AWWA C600-17, Installation of Ductile-Iron Mains and Their Appurtenances, eff. 7/1/2017

AWWA Standard, ANSI/AWWA C604-17, Installation of Buried Steel Water Pipe - 4 In. (100 mm) and Larger, eff. 8/1/2017

AWWA Standard, ANSI/AWWA C605-13, Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings, eff. 2/1/2014

AWWA Standard, ANSI/AWWA C651-14, Disinfecting Water Mains, eff. 2/1/2015

AWWA Standard, ANSI/AWWA C652-19, Disinfection of Water-Storage Facilities, eff. 4/1/2020

AWWA Standard, ANSI/AWWA C653-20, Disinfection of Water Treatment Plants, eff.9/1/2020

AWWA Standard, ANSI/AWWA C654-13, Disinfection of Wells, eff. 7/1/2013

AWWA Standard, ANSI/AWWA D100-11, Welded Carbon Steel Tanks for Water Storage, eff. 7/1/2011

AWWA Standard, ANSI/AWWA D102-17, Coating Steel Water-Storage Tanks, eff. 12/1/2017

AWWA Standard, ANSI/AWWA D103-19, Factory-Coated Bolted Carbon Steel Tanks for Water Storage, eff. 1/1/2020

AWWA Standard, ANSI/AWWA D104-17, Automatically Controlled, Impressed-Current Cathodic Protection for the Interior Submerged Surfaces of Steel Water Storage Tanks, eff. 12/1/2017

AWWA Standard, ANSI/AWWA D106-20, Sacrificial Anode Cathodic Protection Systems for the Interior Submerged Surfaces of Steel Water Storage Tanks, eff. 8/1/2020

AWWA Standard, ANSI/AWWA D107-16, Composite Elevated Tanks for Water Storage, eff. 1/1/2017

AWWA Standard, ANSI/AWWA D108-19, Aluminum Dome Roofs for Water Storage Facilities, eff.11/1/2019

AWWA Standard, ANSI/AWWA D110-13 (R-18), Wire- and Strand-Wound, Circular, Prestressed Concrete Water Tanks, eff. 8/1/2018

AWWA Standard, ANSI/AWWA D115-20,Tendon-Prestressed Concrete Water Tanks, eff. 7/1/2020

AWWA Standard, ANSI/AWWA D120-19, ThermosettingFiberglass-Reinforced Plastic Tanks,[eff. 10/1/2019

AWWA Standard, ANSI/AWWA D121-12, Bolted Aboveground Thermosetting Fiberglass-Reinforced Plastic Panel-Type Tanks for Water Storage, eff. 6/1/2012

Repealed Sections.

12VAC5-590-20 Authority for regulations.

12VAC5-590-30 Purpose of regulations.

12VAC5-590-60 Compliance with the Administrative Process Act.

12VAC5-590-80 Procedure.

12VAC5-590-160 Types of hearings.

12VAC5-590-170 Request for hearing.
12VAC5-590-180 Hearing as a matter of right .
12VAC5-590-280 Procedure for obtaining a construction permit for well sources.
12VAC5-590-400 Radiological quality.
12VAC5-590-410 Determination of compliance.
12VAC5-590-420 Treatment technique requirement.
12VAC5-590-425 Raw water monitoring requirements for groundwater sources.
12VAC5-590-460 Personnel.
12VAC5-590-590 Cross connections.
12VAC5-590-620 Type of protection required.
12VAC5-590-650 Objectives of a waterworks.
12VAC5-590-690 Capacity of waterworks.
12VAC5-590-710 Site layout.
12VAC5-590-740 Maintenance and servicing of equipment.
12VAC5-590-750 Shop space and storage.
12VAC5-590-780 Wall castings.
12VAC5-590-800 Disinfection.
12VAC5-590-870 Mixing and sedimentation.
12VAC5-590-890 High-rate treatment processes.
12VAC5-590-970 Removal of volatile synthetic organic chemicals (VOCs).
12VAC5-590-980 Microscreening.
12VAC5-590-1030 Groundwater facilities.
12VAC5-590-1060 Automatic and remote controlled stations.
12VAC5-590-1070 Appurtenances.
12VAC5-590-1100 Distribution storage.
12VAC5-590-1190 Water services and plumbing.
12VAC5-590-1200 Water pressure in systems.
12VAC5-590-1240 General.
12VAC5-590-1250 Exceptions to Article 1 of Part III.
12VAC5-590-1260 Exceptions to Article 2 of Part III.
12VAC5-590-1270 Exceptions to Article 5 of Part III.
12VAC5-590-1280 Exceptions to Article 6 of Part III.

Historical Notes

The *Waterworks Regulations* (effective June 23, 2021) are the result of significant changes that included amending out-of-date regulations, incorporating technologies and procedures that have come into use since the last major revision in 1993, and reorganizing sections to make them easier to understand and follow. These amendments included the repeal of several sections noted above. This regulatory action was deliberate to enable a comprehensive update to the previous *Waterworks Regulations*, including actions in Part I – General Framework for Waterworks Regulations, Part II – Operation Regulations for Waterworks, and Part III – Manual of Practice for Waterworks Design. Part IV – Exceptions for Noncommunity Waterworks to Specific Sections of the Manual of Practice (Part III) was incorporated into Part III, and the appendices similarly incorporated into the body of the final regulations or, where they were no longer relevant, deleted. Many of the changes simply refined and provided further clarity to the existing regulations.

The updates to Part I included deleting some of the definitions, revising the existing definitions, and adding some new ones. Other changes to Part I addressed permit requirements, the Waterworks Advisory Committee, business plans, variances, exemptions, and other administrative details.

Updates to Part II involved reorganizing much of the content into smaller sections to improve clarity and readability, without changing the requirements in the regulations that are necessary for the state to retain primary enforcement responsibility for waterworks in Virginia. The changes to Part II addressed sodium monitoring, cross-connection control, operator requirements, evaluation for groundwater under the direct influence of surface water (GUDI), and requirements for waterworks to provide notification to the commissioner and consumers if they make changes to start or stop fluoridation programs. These changes also included adding the option to reduce the monitoring frequency for bacteriological contaminants at qualified, well-operated transient noncommunity waterworks.

Updates to Part III addressed new technology and current industry standards for waterworks design, including automated control systems and alternate power requirements, hydrants, and reorganizing existing content into smaller sections to improve clarity and readability.

Since 1993, new EPA Rules were promulgated and, in the interest of expediency, were adopted into the prevailing *Waterworks Regulations* under the "Exempt" action allowed under the Administrative Process Act (APA), where public comment was not solicited. Additionally, due to Code requirements, Virginia made some changes to the *Waterworks Regulations.*

- Lead and Copper Rule (LCR): Promulgated June 7, 1991. Effective date in Virginia *Waterworks Regulations 11/15/1995.* Impacted sections: 12VAC5-590-10, 12VAC5-590-50, 12VAC5-590-340, 12VAC5-590-370, 12VAC5-590-410, 12VAC5-590-420, 12VAC5-590-530, 12VAC5-590-540, 12VAC 5-590-550, and Appendices B, F, and M.
- Consumer Confidence Report (CCR) Rule: Promulgated August 19, 1998. Effective date in Virginia *Waterworks Regulations 8/3/2000.* Impacted section: 12 VAC5-590-370; section 12VAC5-590-545 and Appendix O added.
- Interim Enhanced Surface Water Treatment Rule (IESWTR): Promulgated December 16, 1998. Effective date in Virginia *Waterworks Regulations 4/6/2005.* Impacted sections: 12VAC5-590-10, 12VAC5-590-370, 12VAC5-590-410, 12VAC5-590-420, 12VAC5-590-500, 12VAC5-590-530, 12VAC5-590-540, 12VAC5-590-550, and Appendices L, M, and O.
- Stage 1–Disinfectant Residuals, Disinfection Byproducts, and Disinfection Byproduct Precursors (D/DBP) Rule: Promulgated December 16, 1998. Effective date in Virginia *Waterworks Regulations 7/3/2002.* Impacted sections:12VAC5-590-10, 12VAC5-590-370, 12VAC5-590-410, 12VAC5-590-420, 12VAC5-590-440, 12VAC5-590-500, 12VAC5-590-530, 12VAC5-590-540, 12VAC5-590-550; and Appendices B and F.
- Revised Lead and Copper (Minor Revisions) (LCR) Rule: Promulgated January 12, 2000. Effective date in Virginia *Waterworks Regulations 6/4/2003.* Impacted sections: 12VAC5-590-10, 12VAC5-590-370, 12VAC5-590-420, 12VAC5-590-440, 12VAC5-590-530, and Appendix M.
- Public Notification (PN) Rule: Promulgated May 4, 2000. Effective date in Virginia *Waterworks Regulations 9/10/2003.* Impacted sections: 12VAC5-590-140, 12VAC5-590-150, 12VAC5-590-370, 12VAC5-590-380, 12VAC5-590-400, 12VAC5-590-410, 12VAC5-590-440, 12VAC5-590-530, 12VAC5-590-540, and Appendices B and O; adding Appendix P; repealing Appendices F and H.
- Radionuclide (Rad) Rule: Promulgated December 7, 2000. Effective date in Virginia *Waterworks Regulations*
- Arsenic Rule: Promulgated January 22, 2001. Effective date in Virginia *Waterworks Regulations 9/6/2006.* Impacted sections: 12VAC5-590-10, 12VAC5-590-370, 12VAC5-590-410, 12VAC5-590-440, 12VAC5-590-545, 12VAC5-590-820, and Appendix N.

- Filter Backwash Recycle Rule (FBRR): Promulgated June 8, 2001. Effective date in Virginia *Waterworks Regulations 7/16/2003.* Impacted sections: 12VAC5-590-420, 12VAC5-590-530, 12VAC5-590-550, 12VAC5-590-990, and Appendices F and G.
- Long-Term 1 (LT1) Enhanced Surface Water Treatmetnt Rule: Promulgated January 14, 2002. Effective date in Virginia *Waterworks Regulations 7/26/2006.* Impacted section: 12VAC5-590-530.
- Long-Term 2 (LT2) Enhanced Surface Water Treatmetnt Rule: Promulgated January 5, 2006. Effective date in Virginia *Waterworks Regulations 12/10/2008.* Impacted sections: 12VAC5-590-10, 12VAC5-590-370, 12VAC5-590-410, 12VAC5-590-420, 12VAC5-590-440, 12VAC5-590-500, 12VAC5-590-530, 12VAC5-590-540, 12VAC5-590-545, and 12VAC5-590-550.
- Stage 2–Disinfection Byproducts Requirements (D/DBP) Rule: Promulgated January 4, 2006. Effective date in Virginia *Waterworks Regulations 12/10/2008.* Impacted sections: 12VAC5-590-10, 12VAC5-590-370, 12VAC5-590-410, 12VAC5-590-420, 12VAC5-590-440, 12VAC5-590-500, 12VAC5-590-530, 12VAC5-590-540, 12VAC5-590-545, and 12VAC5-590-550.
- Groundwater Rule (GWR): Promulgated November 8, 2006. Effective date in Virginia *Waterworks Regulations 12/7/2011.* Impacted sections: 12VAC5-590-10, 12VAC5-590-340, 12VAC5-590-350, 12VAC5-590-370, 12VAC5-590-380, 12VAC5-590-410, 12VAC5-590-420, 12VAC5-590-440, 12VAC5-590-460, 12VAC5-590-500, 12VAC5-590-530, 12VAC5-590-540, 12VAC5-590-545, 12VAC5-590-550; and adding 12VAC5-590-379, 12VAC5-590-421, and 12VAC5-590-425.
- Revised Lead and Copper (Short-Term Revisions) (LCR) Rule: Promulgated October 10, 2007. Effective date in Virginia *Waterworks Regulations 10/13/2010.* Impacted sections: 12VAC5-590-10, 12VAC5-590-50, 12VAC5-590-370, 12VAC5-590-410, 12VAC5-590-420, 12VAC5-590-530, 12VAC5-590-545, 12VAC5-590-550; and adding 12VAC5-590-375, 12VAC5-590-385, and 12VAC5-590-405.
- Revised Total Coliform Rule (RTCR): Promulgated February 13, 2013. Effective date in Virginia *Waterworks Regulations 11/2/2016.* Impacted sections: 12VAC5-590-10, 12VAC5-590-140, 12VAC5-590-150, 12VAC5-590-350, 12VAC5-590-370, 12VAC5-590-379, 12VAC5-590-380, 12VAC5-590-440, 12VAC5-590-530, 12VAC5-590-540, 12VAC5-590-545, 12VAC5-590-550; and adding 12VAC5-590-392.
- Variances and Exemptions. Effective date in Virginia *Waterworks Regulations 5/18/2005.* Impacted sections: 12VAC5-590-140 and 12 VAC 5-590-150.
- Correction of Technical Errors. Effective date in Virginia *Waterworks Regulations 5/3/2006.* Impacted sections: 12VAC5-590-370, 12VAC5-590-400, 12VAC5-590-410, 12VAC5-590-440, 12VAC5-590-540, and Appendices B and N.
- Emergency Management Plan (Emergency Regulation). Effective date in Virginia *Waterworks Regulations 10/18/2006.* Impacted section: 12VAC5-590-505 added.
- Consumer Confidence Rule providing for a waiver to community waterworks serving less than 10,000 persons. Effective date in Virginia *Waterworks Regulations 3/1/2012.* Impacted section: 12VAC5-590-545.
- Defining Chronically Noncompliant Waterworks and Providing Enforcement Actions Against Recalcitrant Waterworks. Effective date in Virginia *Waterworks Regulations 6/21/2012.* Impacted section: 12VAC5-590-10; and adding 12VAC5-590-125.
- Amendments primarily changing the definition of "domestic use or usage" and adding definition for "human consumption," revising the definitions of "pure water" and "waterworks," and made necessary changes in other sections to reflect the changes in definitions. Effective date in Virginia *Waterworks Regulations 10/10/2014.* Impacted sections: 12VAC5-590-10, 12VAC5-590-630, and 12VAC5-590-690.