WATERWORKS ADVISORY COMMITTEE MEETING

Sydnor Hydro, Inc., 2111 Magnolia St, Richmond, VA 23223

Thursday, March 16, 2017
10:00 am

AGENDA (draft)

9:40 Arrival, meet and greet (on your own)

Time*	Minutes	Agenda Item
10:00	5	1. Call to order – Introduction of members and guests
10:05	5	2. Agenda adoption / Adoption of January 2016 Minutes
10:10	5	3. Public comment period
10:15	5	4. WAC representatives meet with Health Commissioner
10:20	100	5. Review of Waterworks Regulations Revisions a. Cross connection b. Operators c. Source capacity d. Other
12:00		6. Update member contact information if necessary; ADJOURN

*NOTE: Times are approximate

Next scheduled meeting: May 18, 2017
Sydnor Hydro, Inc. 2111 Magnolia St, Richmond, VA

DEPARTMENT OF HEALTH

Proposed Amended Waterworks Regulations

Part I

General Framework for Waterworks Regulations

~~Article 1~~

~~Definitions~~

Contents

12VAC5-590-10. Definitions and abbreviations.

A. Definitions. As used in this chapter, the following words and terms 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.

"Air gap separation" means the unobstructed vertical distance through the free atmosphere between the lowest ~~opening from any pipe or faucet supplying pure water to a tank, plumbing fixture, or other device and the rim of the receptacle.~~ point of the potable water outlet and the flood rim of the receiving vessel.

~~"Annual daily water demand" means the average rate of daily water usage over at least the most recent three-year period.~~

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

"Approved" means material, equipment, workmanship, process or method that has been accepted by the commissioner as suitable for the proposed use.

"Auxiliary water system" means any water system on or available to the premises other than the waterworks~~. These auxiliary waters~~ and may include water from a source such as wells, lakes, or streams~~; process fluids, or used water~~. They may be polluted or contaminated, ~~or~~ objectionable, ~~or~~ of questionable quality, constitute an unapproved water ~~source~~ supply or system over which the ~~water purveyor~~ waterworks owner does not have control.

"Backflow" means the undesirable reversal of flow of water or mixtures of water and other liquids, ~~mixtures~~ gases, or other substances into ~~the distribution piping of~~ a waterworks ~~from any source or sources other than its intended source~~ or a consumer's water supply system.

"Backflow ~~prevention device~~ elimination method" means ~~any approved device, method, or type of construction intended to prevent backflow into a waterworks~~ the air gap separation or physical disconnection that will eliminate the cross connection.

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

"Backflow prevention device" means a mechanical unit designed to stop the reversal of flow that is not testable because it does not have inlet and outlet shutoff valves or test cocks. Backflow prevention devices are not generally designed or constructed to withstand backpressure. Backflow prevention devices generally include 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 backflow" 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. They are typically constructed of a ~~nonrigid~~ non-rigid, 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~~ naturally infiltrated into groundwater through a river bed or ~~bank(s)~~bank or bands. Infiltration is typically enhanced by the hydraulic gradient imposed by a nearby pumping water supply or other ~~well(s)~~well or wells.

“Best available technology” or “BAT” means the best technology, treatment techniques, or other means that the commissioner finds, after examination for efficacy under field conditions and not solely under laboratory conditions ~~and in conformance with applicable EPA regulations~~, are available (taking cost into consideration).

"Board" means the State Board of Health.

~~"Breakpoint chlorination" means the addition of chlorine to water until the chlorine demand has been satisfied and further additions result in a residual that is directly proportional to the amount added.~~

"Cartridge filters" means pressure-driven separation devices that remove particulate matter larger than one micrometer using an engineered porous filtration media. They 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 any agency proceeding or determination as defined in Chapter 40 (§ 2001) of Title 2.2 of the Code of Virginia.

"Chlorine" means dry chlorine.

“Chlorine gas” means dry chlorine in the gaseous state.

~~"Chlorine solution (chlorine water)" means a solution of chlorine in water.~~

~~"Chronically noncompliant waterworks" or "CNC" means a waterworks that is unable to provide pure water for any of the following reasons: (i) the waterworks' record of performance demonstrates that it can no longer be depended upon to furnish pure water to the persons served; (ii) the owner has inadequate technical, financial, or managerial capacity to furnish pure water to the people served; (iii) the owner has failed to comply with an order issued by the board~~

~~or the commissioner; (iv) the owner has abandoned the waterworks and has discontinued supplying pure water to the persons served; or (v) the owner is subject to a forfeiture order pursuant to § 32.1-174.1 of the Code of Virginia.~~

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

~~"Coliform bacteria group" means a group of bacteria predominantly inhabiting the intestines of man or animal but also occasionally found elsewhere. It includes all aerobic and facultative anaerobic, gram-negative, non-sporeforming bacilli that ferment lactose with production of gas. Also included are all bacteria that produce a dark, purplish-green colony with metallic sheen by the membrane filter technique used for coliform identification.~~

"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 ~~begins~~ began January 1, 1993, and ~~ends~~ ended December 31, 2001; the second ~~begins~~ began January 1, 2002, and ~~ends~~ ended December 31, 2010; the third ~~begins~~ began January 1, 2011, and ends December 31, 2019.

"Compliance period" means a three-year calendar year period within a compliance cycle. Each compliance cycle has three three-year compliance periods. Within the ~~first~~ second compliance cycle, the first compliance period ~~runs~~ ran from January 1, ~~1993~~ 2002, to December 31, ~~1995~~ 2004; the second ran from January 1, ~~1996~~ 2005, to December 31, ~~1998~~ 2007; the third ran from January 1, ~~1999~~ 2008, to December 31, ~~2001~~ 2010. Within the third compliance cycle, the first compliance period ran from January 1, 2011 to December 31, 2013, the second runs from January 1, 2014 to December 31, 2016, and the third runs from January 1, 2017 to December 31, 2019.

“Comprehensive performance evaluation” or ~~CPE~~ “CPE” means a thorough ~~review~~ evaluation and analysis of a treatment plant's performance-based capabilities and associated administrative, operational and maintenance practices. It is conducted to identify factors that may be adversely impacting a plant's capability to achieve compliance and emphasizes approaches that can be implemented without significant capital improvements. For purposes of compliance with 12VAC5-590-530 E 1 b (2), the comprehensive performance evaluation shall consist of at least the following components: assessment of plant performance; evaluation of major unit processes; identification and prioritization of performance limiting factors; assessment of the applicability of comprehensive technical assistance; and preparation of a CPE report.

"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 ~~has no water production or source facility of its own and that obtains all of its water from another permitted waterworks or~~ receives ~~some or~~some or all of its finished water from one or more ~~wholesale~~ 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 formation" means hard rock-material strata of sedimentary-, igneous-, or metamorphic- type rock.

"Consumer" means any person who drinks water 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 supply system by installing an appropriate backflow prevention assembly or backflow elimination method at the service connection.

"Contaminant" means any ~~objectionable or hazardous~~ hazardous or objectionable 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 ~~connection or structural arrangement, direct or indirect~~ actual or potential link, connection or physical arrangement, direct or indirect, between used water, an auxiliary system, or other source of contamination to the waterworks ~~whereby~~ through which backflow can occur.

"CT" or "CT calc" means the product of "residual disinfectant concentration" (C) in mg/L determined before or at the first customer, and the corresponding "disinfectant contact time" (T) in minutes, (i.e., "C" x "T").

~~"Daily fluid intake" means the daily intake of water for drinking and culinary use and is defined as two liters.~~

~~"Dechlorination" means the partial or complete reduction of residual chlorine in water by any chemical or physical process at a waterworks with a treatment facility.~~

~~"Degree of hazard" means the level of health hazard, as derived from an evaluation of the potential risk to health and the adverse effect upon the waterworks.~~

"Department" means the Virginia Department of Health.

"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 ~~oxidant (including chlorine)~~ agent that is added to water in any part of the treatment ~~or distribution~~ process for the purpose of ~~killing or deactivating~~ inactivating or destroying pathogenic organisms.

"Disinfectant contact time ("T" in CT calculations)" means the time in minutes that it takes for water to move from the point of disinfectant application to the point where residual disinfectant concentration ("C") is measured.

"Disinfection" means a process that inactivates or destroys pathogenic organisms in water by ~~chemical oxidants or equivalent agents~~ use of a disinfectant.

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

"Distribution main" means a water main whose primary purpose is to provide treated water to service connections.

~~"District engineer" means the employee assigned by the Commonwealth of Virginia, Department of Health, Office of Drinking Water to manage its regulatory activities in a geographical area of the state consisting of a state planning district or subunit of a state planning district.~~

~~"Domestic or other nondistribution system plumbing problem" means a coliform contamination problem in a waterworks with more than one service connection that is limited to the specific service connection from which the coliform positive sample was taken.~~

"Double gate-double check valve assembly" means an approved assembly composed of two single independently acting check valves including tightly closing shutoff valves located at each end of the assembly and petcocks and test gauges for testing the watertightness of each check valve.

"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. ~~Dual sample sets are collected for the purposes of conducting an initial distribution system evaluation (IDSE) under 12VAC5-590-370 B 3 e (2) and determining compliance with the TTHM and HAA5 MCLs under 12VAC5-590-370 B 3 e (3)."Effective corrosion inhibitor residual" means, for the purpose of 12VAC5-590-405 A 1 only, a concentration sufficient to form a passivating film on the interior walls of a pipe.~~

"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.

~~"Equivalent residential connection"~~ or "ERC" ~~means a volume of water used equal to a residential connection that is 400 gallons per day unless supportive data indicates otherwise.~~

"Exception" means an approved deviation from a ~~"shall" criteria~~ mandatory criterion contained in Part III ~~(12VAC5-590-640 et seq.)~~ of this chapter.

~~"Exemption" means a conditional waiver of a specific PMCL or treatment technique requirement that is granted to a specific 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 startup 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~~ produced for human consumption without further treatment, except as treatment necessary to maintain water quality in the distribution system ~~(e.g. booster disinfection, addition of corrosion control chemicals)~~.

~~"First draw sample" means a one-liter sample of tap water, collected in accordance with 12VAC5-590-375 B 2, that has been standing in plumbing pipes at least six hours and is collected without flushing the tap.~~

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

~~"GAC10" means granular activated carbon filter beds with an empty-bed contact time of 10 minutes based on average daily flow and a carbon reactivation frequency of every 180 days, except that the reactivation frequency for GAC10 used as a best available technology for compliance with 12VAC5-590-410 C 2 b (1) (b) 12VAC5-590-384 B 1 b shall be 120 days.~~

~~"GAC20" means granular activated carbon filter beds with an empty-bed contact time of 20 minutes based on average daily flow and a carbon reactivation frequency of every 240 days."Governmental entity" means the Commonwealth, a town, city, county, service authority, sanitary district or any other governmental body established under the Code of Virginia, including departments, divisions, boards or commissions.~~

"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 ~~(or surface water sources)~~.

"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 prior to treatment is not a groundwater system. Groundwater systems include consecutive waterworks that receive finished groundwater from a wholesale waterworks.

"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~~. It also means~~ 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. ~~The~~ GUDI source determinations shall be made by the commissioner in accordance with 12VAC5-590-430 ~~will determine direct influence of surface water~~.

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

"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.

~~"Health regulations" means regulations that include all primary maximum contaminant levels, treatment technique requirements, and all operational regulations, the violation of which would jeopardize the public health.~~

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

"Hypochlorite" means a solution of water and some form of chlorine~~, usually sodium hypochlorite~~.

"Initial compliance period" means ~~for all regulated contaminants, the initial compliance period is the first full three-year compliance period beginning at least 18 months after promulgation with the exception of waterworks with 150 or more service connections for contaminants listed at Table 2.3, VOC 19-21; Table 2.3, SOC 19-33; and antimony, beryllium, cyanide (as free cyanide), nickel, and thallium that shall begin January 1993~~ the compliance period in which chemical monitoring begins.

"Interchangeable connection" means an arrangement or device that will allow alternate but not simultaneous use of two sources of water.

"Isolation" means the safeguard against backflow into a waterworks from a consumer's water supply 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 supply 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. ~~Such~~ These areas often feature sinkholes, caverns, and sinking or disappearing creeks. ~~In Virginia, this generally includes all that area west of the Blue Ridge and, in Southwest Virginia, east of the Cumberland Plateau.~~

"Lake/reservoir" means a natural or ~~manmade~~ 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.

~~"Large waterworks" means, for the purposes of 12VAC5-590-375, 12VAC5-590-405,12VAC5-590-530-F, and 12VAC5-590-550-D only, a waterworks that serves more than 50,000 persons.~~

"Lead free" means the following:

1. When used with respect to solders and flux refers to solders and flux containing not more than 0.2% lead;

2. When used with respect to pipes, ~~and~~ pipe fittings, plumbing fittings, and plumbing fixtures refers to the weighted average of wetted surfaces of pipes, ~~and~~ pipe fittings, plumbing fittings, and plumbing fixtures containing not more than ~~8.0%~~ 0.25% lead;

~~3. When used with respect to plumbing fittings and fixtures intended by the plumbing manufacturer to dispense water for human ingestion, it refers to fittings and fixtures that are in compliance with standards established in accordance with 42 USC § 300g-6(e).~~

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

"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 have caused 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.

"Liquid chlorine" means a liquefied, compressed chlorine gas ~~as shipped in commerce~~.

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

"Log inactivation" ~~(log removal)"~~ means ~~that a 99% reduction is a 2-log~~ the inactivation~~; a 99.9% reduction is a 3-log inactivation; a 99.99% reduction is a 4-log inactivation~~ of organisms expressed on a logarithmic scale. For example, a 99.9% inactivation is a 3-log inactivation; 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; a 99.99% removal is a 4-log removal.

~~"Manmade beta particle and photon emitters" means all radionuclides emitting beta particles and/or photons listed in the most current edition of "Maximum Permissible Body Burdens and Maximum Permissible Concentration of Radionuclides in Air or Water for Occupational Exposure," National Bureau of Standards Handbook 69, except the daughter products of thorium-232, uranium-235 and uranium-238.~~

"Maximum contaminant level" or "MCL" means the maximum permissible level of a contaminant in ~~pure~~ potable water that is delivered to any user customer of a waterworks. MCLs are set as close to the MCLGs as feasible using the ~~best available treatment technology~~ 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~~ effects on the health of persons would occur and that allows an adequate margin of safety. Maximum contaminant level goals are nonenforceable health goals.

~~"Maximum daily water demand" means the rate of water usage during the day of maximum water use.~~

"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. ~~For chlorine and chloramines, a waterworks is in compliance with the MRDL when the running annual average of monthly averages of samples taken in the distribution system, computed quarterly, is less than or equal to the MRDL. For chlorine dioxide, a waterworks is in compliance with the MRDL when daily samples are taken at the entrance to the distribution system and no two consecutive daily samples exceed the MRDL. MRDLs are enforceable in the same manner as maximum contaminant levels MCLs. There is convincing evidence that addition of a disinfectant is necessary for control of waterborne microbial contaminants. Notwithstanding the MRDLs listed in Table 2.12 340.7, operators may increase residual disinfectant levels of chlorine or chloramines (but not chlorine dioxide) 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 distribution line breaks, storm runoff events, source water contamination, or cross-connections.~~

"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 produced in a given water containing a disinfectant residual after seven days at a temperature of 25°C or above.

~~"Medium waterworks" means, for the purpose of 12VAC5-590-375 and 12VAC5-590-405 only, a waterworks that serves greater than 3,300 and less than or equal to 50,000 persons.~~

"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. ~~This definition includes the common membrane technologies of microfiltration, ultrafiltration, nanofiltration, and reverse osmosis.~~ Included in this definition are the common membrane classifications of microfiltration (MF), and 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 technologies" means those processes that use 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 process that separates particles, based on the pore-size rating of the membrane, from a feed stream by using a sieving mechanism. Typically, microfiltration can remove particles down to approximately 0.1 micrometer in size.

"Most probable number" or "MPN" means ~~that~~ the number of organisms per unit volume that, in accordance with statistical theory, would be more likely than any other number to yield the observed test result or that would yield the observed test result with the greatest frequency, expressed as density of organisms per 100 milliliters. Results are computed from the number of positive findings of coliform-group organisms resulting from multiple-portion decimal-dilution plantings.

“Nanofiltration” or “NF”, sometimes referred to as “low-pressure reverse osmosis” or “membrane softening”, means a membrane technology designed to remove multivalent ions (“softening”) and other constituents up to 1 nm (nanometer = 0.001 micrometer) in size.

"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~~ potable 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 context to a NTNC, regularly serves means four or more

hours per day, for four or more days per week, for 26 or more weeks per year, in accordance with EPA Water Supply Guidance 61A, dated August 21, 1991.

~~"Office" or "ODW" means the Commonwealth of Virginia, Department of Health, Office of Drinking Water.~~

"One hundred year flood level" means the flood ~~elevation that will, over a long period of time, be equaled or exceeded on the average once every 100 years~~ that has a 1% probability of occurring in any given year.

"Operate" means any act of an individual that may impact the finished water quality at a waterworks.

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

"Operator" means any individual employed or appointed by any owner, and who is designated by such owner to be the person in responsible charge, such as a supervisor, a shift operator, or a substitute in charge, and whose duties include 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 ~~users'~~ customers' taps while ensuring that the treatment does not cause the waterworks to violate any other section of this chapter.

"Owner" ~~or "water purveyor"~~ 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 this state from or by means of any waterworks. ~~(see Article 2 (§ 32.1-167 et seq.) of Chapter 6 of Title 32.1 of the Code of Virginia).~~

"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 withdrawal, treatment facilities, finished water storage, delivery and distribution system.

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

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

~~"Plant intake" means the works or structures at the head of a conduit through which water is diverted from a source (e.g., river or lake) into the treatment plant.~~

"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 water runoff.

"Point-of-entry treatment 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 treatment 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 or impair the usefulness of the water.

"Pollution hazard" means a condition through which an aesthetically objectionable or degrading material may enter the waterworks or a consumer's water system.

~~"Postchlorination" means the application of chlorine to water subsequent to treatment.~~

"Potable water" – ~~see~~ See "Pure water".

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

"Prechlorination" means the application of chlorine to water prior to 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 treatment plant.

"Pressure vacuum breaker assembly" means an assembly designed to prevent backsiphonage backflow and used for high or low hazard situations, composed of an independently operating, spring-loaded check valve: an independently operating , spring-loaded air-inlet valve; and tightly closing shut-off valves located at each end of the assembly; and fitted with properly located test cocks.

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

"Process fluids" means any fluid or solution that may be chemically, biologically, or otherwise contaminated or polluted that would constitute a health, ~~pollutional~~ pollution, or system hazard if introduced into the waterworks. This includes, but is not limited to:

1. Polluted or contaminated water;
2. Process waters;
3. Used waters~~, originating from the waterworks that may have deteriorated in sanitary quality~~;
4. Cooling waters;
5. Contaminated natural waters taken from wells, lakes, streams, or irrigation systems;
6. Chemicals in solution or suspension; ~~and~~ or
7. Oils, gases, acids, alkalis, and other liquid and gaseous fluid used in industrial or other processes~~, or for firefighting purposes~~.

"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 ~~(see Article 2 (§ 32.1-167 et seq.) of Chapter 6 of Title 32.1 of the Code of Virginia).~~.

~~"Raw water main" means a water main that conveys untreated water from a source to a treatment facility.~~

"Reduced pressure principle backflow prevention device" or "RPZ device" means ~~a device containing a minimum of two independently acting check valves together with an automatically operated pressure differential relief valve located between the two check valves.~~ an assembly designed to prevent backsiphonage or backpressure backflow 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. ~~In case of leakage of either check valve, the differential relief valve, by discharging to the atmosphere, shall operate to maintain the pressure between the check valves at less than the supply pressure.~~ The ~~unit~~ assembly shall include tightly closing shutoff valves located at each end of the ~~device~~ assembly, and ~~each device shall~~ be fitted with properly located test cocks. ~~These devices shall be of the approved type.~~

"Regulations" means the Waterworks Regulations (12VAC5-590 et seq.).

"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 a REM.

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

"Residual disinfectant concentration ("C" in CT Calculations)" means the concentration "C" 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.

~~"Responsible charge" means designation by the owner of any individual to have duty and authority to operate or modify the operation of waterworks processes.~~

~~"Sanitary facilities" means piping and fixtures, such as sinks, lavatories, showers, and toilets, supplied with potable water and drained by wastewater piping.~~

"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 ~~ODW~~ the Department of a waterworks' water supply, facilities, equipment, operation, maintenance, monitoring records, and overall management of a waterworks to ensure the provision of ~~pure~~ potable water.

"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 water source" means any approved water source, other than a waterworks' primary source, connected to or available to that waterworks for emergency or other nonregular use.~~

"Secondary disinfection" means disinfection by chemical oxidants or equivalent agents applied at the entry point or in the distribution system to provide a disinfectant residual 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 water to a ~~customer's building service line as follows: 1. If a meter is installed, the service connection is the downstream side of the meter; 2. If a meter is not installed, the service connection is the point of connection to the waterworks;~~ consumer's water supply system, fire protection system, or irrigation system and to all temporary or emergency water service connections.

~~3.~~ When the ~~water purveyor~~ waterworks owner is also the building owner, the service connection is the entry point to the building.

~~"Service line sample" means a one-liter sample of water, collected in accordance with 12VAC5-590-375 B 2 c, that has been standing for at least six hours in a service line.~~

"Sewer" means any pipe or conduit used to convey sewage or industrial waste streams.

"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 ~~pure~~ 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.

"Slow sand filtration" means a process involving passage of ~~raw~~ 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.

~~"Small waterworks" means, for the purpose of 12VAC5-590-375, 12VAC5-590-405, and 12VAC5-590-530 F and 12VAC5-590-550 D only, a waterworks that serves 3,300 persons or fewer.~~

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

~~"Standard sample" means that portion of finished drinking water that is examined for the presence of coliform bacteria.~~

"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)~~ (in m^{-1}) by its concentration of dissolved organic carbon (DOC) (in mg/L).

"Synthetic organic chemicals" or "SOC" means one of the ~~family~~ families of organic manmade compounds generally utilized for agriculture or industrial purposes.

"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.

"Terminal reservoir" ~~means an impoundment providing end storage of water prior to treatment~~ a water reservoir providing end storage of source water for the sole use as a drinking water supply.

"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 effective storage volume" means the volume available to store water in distribution reservoirs measured as the difference between the reservoir's overflow elevation, and the minimum storage elevation. The minimum storage elevation is that elevation of water in the reservoir that can provide a minimum pressure of 20 psi at a flow as determined in 12VAC5-590-690 C to the highest elevation served within that reservoir's service area under systemwide maximum daily water demand.~~

"Total organic carbon" or "TOC" means total organic carbon in 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 expressed in milligrams per liter (mg/L) and rounded to two significant figures. For the purpose of ~~these regulations~~ this chapter, ~~the TTHMs~~ 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. ~~A TNC serves~~ These waterworks serve at least 25 persons daily for at least 60 days out of the year.

"Transmission main" means a water main ~~whose primary purpose is to move significant quantities of treated water among service areas.~~ that transports potable water from the main supply to a distant area where the water is distributed through smaller pipelines.

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

"Treatment technique requirement" means a requirement that specifies for a contaminant a specific ~~treatment technique(s)~~ technology demonstrated to the satisfaction of the ~~division~~ commissioner to lead to a reduction in the level of ~~such~~ the contaminant sufficient to comply with ~~these regulations~~ 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~~ families of organic compounds, named as derivatives of methane, wherein three of the four hydrogen atoms in methane are each substituted by a ~~halogen~~ chlorine or bromine atom in the molecular structure.

~~"Two-stage lime softening" means a process in which chemical addition and hardness precipitation occur in each of two distinct unit clarification processes in series prior to filtration.~~

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

"Unconsolidated formation" means loose, soft sediment that has not been compacted, cemented or lithified into rock, derived from a sedimentary-, igneous-, 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.

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

~~"Variance" means a conditional waiver of a specific regulation that is granted to a specific waterworks. 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 secondary maximum contaminant level. Variances for monitoring, reporting and public notification requirements will not be granted.~~

"Virus" means a microbe that is infectious to humans by waterborne transmission.

"Volatile ~~synthetic~~ organic chemical" or "VOC" means one of the ~~family~~ families of manmade organic compounds generally characterized by low molecular weight and rapid vaporization at relatively low temperatures or pressures.

"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 purveyor" (same as owner).~~

"Waiver" means official permission from the commissioner for the waterworks to deviate from the monitoring and reporting requirements set forth in this chapter.

"Water supply" means the source of water ~~that shall have been~~ taken into a waterworks ~~from all~~ including wells, streams, springs, lakes, and other bodies of surface waters (natural or impounded), and the tributaries thereto, and all impounded ~~groundwater, but the~~ groundwater. The term "water supply" shall not include any waters above the point of intake of ~~such~~ the waterworks ~~(see Article 2 (§ 32.1-167 et seq.) of Chapter 6 of Title 32.1 of the Code of Virginia)~~.

~~"Water supply main" or "main" means any water supply pipeline that is part of a waterworks distribution system.~~

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

~~"Water Well Completion Report" means a report form published by the State Water Control Board entitled "Water Well Completion Report" which requests specific information pertaining to the ownership, driller, location, geological formations penetrated, water quantity and quality encountered as well as construction of water wells. The form is to be completed by the well driller.~~

"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 pure water except the piping and fixtures inside the building where such water is delivered ~~(see Article 2 (§ 32.1-167 et seq.) of Chapter 6 of Title 32.1 of the Code of Virginia)~~.

~~"Waterworks with a single service connection" means a waterworks that supplies drinking water to consumers via a single service line.~~

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

B. Frequently used abbreviations.

°C– degrees Celsius

°F – degrees Fahrenheit

AL – action level

ANSI – American National Standards Institute

ASSE – American Society of Sanitary Engineers

AWWA – American Water Works Association

BAT – best available treatment technology

C – residual disinfectant concentration, in milligrams per liter

CCCBPP – Cross Connection Control and Backflow Prevention Program

CT – the product of the residual disinfectant concentration (C) in milligrams per liter and the corresponding disinfectant contact time (T) in minutes; C x T

CU – color units
DCLS – Virginia Department of General Services, Division of Consolidated Laboratory Services
DEQ – Virginia Department of Environmental Quality
EPA – United States Environmental Protection Agency
ft^2 – square foot (feet) of area
ft/min – foot (feet) per minute
ft/sec – foot (feet) per second
GAC – granular activated carbon
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
GUDI – groundwater under the direct influence of surface water
HAA5 – haloacetic acids
HPC – heterotrophic plate count; a specific procedure for biological water quality examination
IDSE – initial distribution system evaluation
in – inch(es)
lb – pounds
lb/ft^2 – pounds per square foot
LRAA – locational running annual average
MCL – maximum contaminant level
MCLG – maximum contaminant level goal
MGD – million gallons per day
mg/L – milligrams per liter
min – minutes
MOU – memorandum of understanding
MPA – microscopic particulate analysis
MPN – most probable number of organisms; a specific procedure for biological water quality examination
MRDL – maximum residual disinfection level
NSF – National Sanitation Foundation (a.k.a. NSF Inspectional)
NTU – nephelometric turbidity units
pCi – picocurie(s)
pH – the negative logarithm of the hydrogen ion concentration of an aqueous solution using a scale of 1 (very acid) to 14 (very alkaline)
PMCL – primary maximum contaminant level
POE – point of entry treatment device
POU – point of use treatment device
psi – pound(s) per square inch
PTA – packed tower aeration

SCADA – supervisory control and data acquisition
SDWA – Safe Drinking Water Act and its amendments
SMCL – secondary maximum contaminant level
SOC – synthetic organic chemicals
THM – trihalomethanes
TTHM – total trihalomethanes
µm – micrometers (or microns)
µg/L – micrograms per liter
USBC – Uniform Statewide Building Code (as adopted in Virginia, 13VAC5-63)
VOC – volatile organic chemical
VOSH – Virginia Occupational Safety and Health

~~Article 2~~
~~General Information~~

12VAC5-590-20. Authority for regulations.

~~Article 2 (§ 32.1-5 et seq.) of Chapter 1 of Title 32.1 of the Code of Virginia provides that the~~ The State Board of Health has the duty to protect the public health and to ensure that all water supplies destined for public consumption be pure water. In order to discharge that duty, the board is empowered to supervise and regulate all waterworks and water supplies within the Commonwealth~~(see Article 2 of Chapter 1 of Title 32.1 of the Code of Virginia)~~.

12VAC5-590-30. Purpose of regulations.

~~These regulations have~~ This chapter has been promulgated by the board to~~: 1. Ensure~~ ensure that all water supplies destined for public consumption be ~~pure~~ potable water; ~~2. Guide~~ guide the commissioner in ~~his determination of~~ determining whether a permit for a waterworks ~~should~~ shall be issued; and ~~3. Assist~~ assist ~~the owner~~ owners ~~or his authorized engineer~~ in the preparation of ~~an application~~ waterworks applications, plans, specifications, reports and other data.

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 ~~regulations~~ this chapter.

~~These regulations are administered by the following parties:~~

~~1. State Board of Health, which has responsibility~~ A. The board is responsible for promulgating, amending, and repealing regulations ~~which~~ to ensure a supply of ~~pure~~ potable water.

~~2. State Health Commissioner, who is the executive officer~~ B. The commissioner is vested with all the authority of the ~~State Board of Health with the authority of the~~ board when it is not in session, ~~and~~ subject to such rules and regulations as may be prescribed by the board.

~~3.Division of Water Supply Engineering, which~~ C. The Department is designated as the primary ~~reviewing~~ evaluation agent of the board for the purpose of administering this chapter. It examines ~~and passes upon~~ the technical aspects of all applications and plans for waterworks projects prior to the drafting of a permit for final approval by the ~~State Health Commissioner~~ commissioner. It also has primary responsibility for monitoring waterworks operations to ensure that water supplied to the public is ~~pure~~ potable water.

~~4. Central and field offices, which are maintained by the division, the central office is located in Richmond, Virginia. The Office of Water Programs maintains six field offices which are responsible for activities of the division within their service areas. Applications for waterworks permits should be submitted to the appropriate field office. The addresses of the field offices and a description of the areas that they serve are listed in Appendix C.~~

~~5. Waterworks Advisory Committee, which shall be appointed by the commissioner, shall consist of thirteen appointed members and three ex officio members specified below. The commissioner shall appoint to the Waterworks Advisory Committee one individual each from the following: a member of the Virginia Section American Water Works Association; a member of the Virginia Society of Professional Engineers; a member of the Virginia Water Well Association, Inc.; a member of the Consulting Engineers Council; a water treatment plant operator having a valid license of the highest classification in waterworks issued by the State Board for Waterworks and Wastewater Works Operators; a faculty member of a state university or college whose principal field of teaching is Environmental Engineering; a community waterworks owner; a nontransient noncommunity (NTNC) representative; a representative from Virginia Rural Water Association; a representative from Virginia Water Projects, Inc.; a representative from the Virginia Municipal League; a representative from the Virginia Association of Counties; and a citizen representative. Ex officio members shall consist of the Director, Office of Water Programs, who shall act as chairman; Director, Division of Water Supply Engineering; and Director, Division of Consolidated Laboratory Services or their designees.~~

~~Appointed members shall serve at the discretion of the commissioner with staggered terms being of three years in duration. The Waterworks Advisory Committee shall make recommendations to the commissioner regarding waterworks and water supply policies, procedures and programs of the division.~~

12VAC5-590-45. Waterworks Advisory Committee (WAC).

A. A WAC shall be formed by the commissioner to provide peer review of the regulatory, policy, and legislative aspects of the Department's authorities. Committee 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 seven working days prior to 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 Department staff member serve as secretary.

12VAC5-590-50. Application of regulations to waterworks ~~and water supplies~~ in operation or planned prior to the effective date of the regulations.

~~Waterworks and water supplies which were in operation prior to the effective date of the regulations may continue operation if they comply with the operational regulations set forth in Part II. Operation permits, which will be in addition to all permits previously received, will be issued to such waterworks as soon as practicable after the effective date of these regulations.~~

A. ~~Waterworks and water supplies unable to comply with Part II of this chapter may be issued the appropriate variances and/or exemptions in conjunction with the operation permit to allow continued operation during the period of adjustment. Any variances and/or exemptions will be issued in accordance with the procedures contained in Article 3 of Part I of this chapter~~ Owners shall comply with Part II of this chapter unless a variance or exemption is issued by the commissioner.

B. Compliance with design criteria set forth in ~~Parts~~ Part III ~~and IV~~ of this chapter is ~~necessary for waterworks modification~~ limited to modifications to existing waterworks and for all construction of new waterworks commenced after the effective date of ~~these revised regulations~~ this chapter. Portions of waterworks not being modified are not required to comply with the design criteria of Part III. Waterworks construction or modification is deemed to be commenced for purposes of this section upon ~~receipt of final plans and specifications by the field office~~ issuance of the construction permit.

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

~~D. Volatile Synthetic Organic Chemicals (VOCs) and Unregulated Contaminants (UCs) Regulations are effective immediately for those community and NTNC waterworks which serve more than 10,000 persons. The VOC and UC regulations are effective immediately for community and NTNC waterworks serving 3,300 to 10,000 persons. The VOC and UC regulations become effective on January 1, 1991, for community and NTNC waterworks serving less than 3,300 persons. (See Table 2.7.)~~

~~E. The Lead and Copper Regulations establish a treatment technique that includes requirements for corrosion control treatment, water supply (source water) treatment, lead service line replacement, and public education. These requirements are triggered, in some cases, by lead and copper action levels measured in samples collected at consumers' taps. Unless otherwise indicated, each of the provisions of 12VAC5-590-375, 12VAC5-590-405, 12VAC5-590-530 D and 12VAC5-590-550 D applies to community waterworks and nontransient~~

~~noncommunity waterworks. The requirements set forth in 12VAC5-590-375, 12VAC5-590-530 D and 12VAC5-590-550 D shall take effect on July 7, 1991.~~

12VAC5-590-55. Relationship of this chapter to the USBC.

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

B. In accordance with § 36-98 of the Code of Virginia and the USBC, the USBC (13VAC5-63) governs the construction of buildings and structures, including plumbing systems and backflow prevention methods. 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.

~~Article 3~~

~~Procedures~~

12VAC5-590-60. Compliance with the Administrative Process Act (APA).

The provisions of the ~~Administrative Process Act (Chapter 1.1:1 of Title 9) and~~ APA (§ 2.2-4000 et seq.) of Title 2.2 of the Code of Virginia and Title 32.1 of the Code of Virginia govern this chapter. All procedures ~~outlined below~~ contained in this chapter are in addition to, or in compliance with, the requirements of that Act.

12VAC5-590-70. Powers and procedures.

The board reserves the right to ~~authorize~~ utilize any lawful procedure for the enforcement of this chapter ~~that is consistent with the provisions set forth herein and the provisions of Title 32.1 of the Code of Virginia~~.

12VAC5-590-80. ~~Procedure.~~ (Repealed).

~~Regulations for the operations, construction, or modification of a waterworks or water supply are established, amended, or repealed only in accordance with the Administrative Process Act.~~

12VAC5-590-90. ~~[Reserved]~~ Effective date of regulations.

~~These regulations~~This chapter shall become effective on _____.

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

If the establishment of a regulation is necessary for the preservation of public health, safety, or welfare, the board or commissioner 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.

~~All waterworks must be operated in compliance with the requirements as set forth in this chapter as follows:~~

~~1.~~ A. Notice. Whenever the commissioner~~, his appointed representative, or the division~~ has reason to believe that a violation of Title 32.1 ~~or~~ of the Code of Virginia or of any section of this chapter ~~has~~ may have occurred or ~~is~~ may be occurring, the ~~division~~ commissioner shall ~~so~~ notify the alleged violator. ~~Such~~ The notice shall: (i) be in writing; (ii) ~~shall~~ cite the statute, regulation or regulations that are allegedly being ~~violated,~~ violated; and ~~shall~~ (iii) state the facts ~~which~~ that form the basis for believing that the violation ~~has~~ may have occurred or ~~is~~ may be occurring. ~~A notice of violation~~ This notification is not an official finding, case decision, or adjudication, but may ~~be accompanied by~~ include a request ~~that certain~~ to the owner to respond timely and to take specific corrective action ~~be taken~~ by a stated deadline.

~~2.~~ B. Orders. Pursuant to § 32.1-26 of the Code of Virginia, the commissioner may issue orders to require any owner to comply with the provisions of Title 32.1 of the Code of Virginia or any section of this chapter. The order shall be signed by the commissioner and may require:

~~a.~~ 1. The immediate cessation or correction of the violation;

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

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

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

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

~~f. Division review~~ 6. Evaluation and approval~~, if appropriate,~~ of the required submissions, if appropriate.

~~3.~~ 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:

~~a.~~ 1. Institute ~~a~~ 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;

~~b. Apply to an appropriate court for an injunction or other legal process to prevent or stop any practice in violation of the order;~~

~~c.~~ 2. Request ~~attorney for~~ the ~~Commonwealth~~ criminal prosecution by a Commonwealth's Attorney with the appropriate jurisdiction in accordance with § 32.1-27 of the Code of Virginia ~~to bring a criminal action~~;

~~d.~~ 3. Request civil action by the Attorney General to ~~bring an action for~~ impose a civil penalty, ~~injunction~~ seek injunctive relief, or other appropriate ~~remedy~~ legal remedies; or

~~e.~~ 4. Do any combination of ~~the above~~subdivision C 1, C 2, or C 3 of this section.

~~4.~~ D. Graduated enforcement actions. Nothing in this section shall prevent the commissioner~~, or the division from taking action prior to issuing an order~~ from making efforts to obtain voluntary compliance through conference, warning, or other appropriate means before issuance of an order.

~~5. Hearing as a matter of right (see 12VAC5-590-180).~~

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 staff 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, its agents, or deputies in the administration of this chapter, shall have 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~~ 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~~ a waterworks or ~~the source of a water supply~~ waterworks source.

B. An emergency order may be communicated by the best practical notice under all the circumstances and is effective immediately upon receipt. The order may state any requirements necessary to remove the danger to the public health, including the immediate cessation of the construction or operation of the waterworks or the use of ~~any~~ the water supply.

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 ~~Administrative Process Act~~ APA.

12VAC5-590-125. Chronically noncompliant waterworks.

A. ~~The commissioner may identify a waterworks as chronically noncompliant (CNC) whenever he determines that:~~

~~1. The waterworks has a documented performance record that demonstrates the waterworks is not a dependable supplier of potable water;~~

~~2. The owner has shown inadequate technical, financial, or managerial capabilities to provide potable water;~~

~~3. The owner has failed to comply with an order issued by the commissioner;~~

~~4. The owner has abandoned the waterworks and has discontinued providing potable water to the consumers; or~~

~~5. The owner is subject to a forfeiture order pursuant to § 32.1-174.1 of the Code of Virginia.~~

~~B. Once~~ If the commissioner determines that a waterworks is ~~CNC~~ chronically noncompliant as defined in § 32.1-167 of the Code of Virginia, ~~he~~ 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 comprehensive business plan pursuant to § 32.1-172 B of the Code of Virginia. 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 ~~such~~ the improvements are complete and operational. The owner shall provide a copy of the order to each consumer ~~with a copy of the compliance schedule~~ within 10 calendar days of issuance of the order.

~~C.~~ B. The owner shall ~~provide~~ certify in writing to the commissioner that a copy of the ~~notice~~ order was distributed ~~and a signed certification of the distribution completion date~~ to each consumer within ~~five~~ 15 calendar days of ~~completing the notification required in subsection B of this section~~ issuance of the order.

~~D.~~ 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.

~~E.~~ 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 ~~§§ 32.1-167 through 32.1-176~~ 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 manmade or natural disaster, the commissioner ~~finds~~ determines that certain regulations cannot be complied with ~~and that the public health is better served by access to semiregulated or nonregulated water supplies than by the closing of those affected supplies he may suspend~~, the ~~application~~ enforcement of ~~the chapter~~ those regulations may be suspended for ~~specific affected localities~~ designated waterworks and ~~institute~~ a provisional regulatory scheme instituted until ~~the disaster is abated~~ the conditions that brought about the suspension have abated.

12VAC5-590-140. Variances.

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

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

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

b. The characteristics of the ~~raw water sources which~~ water supply that are reasonably available to the waterworks prevent the waterworks from meeting the PMCL or SMCL requirements and on condition that the waterworks installs the best

available technology, treatment techniques, or other means, which the commissioner 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~~3. The commissioner may grant ~~a~~ one or more treatment technique ~~variance~~ 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 ~~such~~ the treatment technique is not necessary to protect the health of persons because of the nature of the ~~raw water source of such~~ water supply of the waterworks.

~~3~~4. The commissioner may grant a variance to a waterworks from an operational regulation ~~or a SMCL~~ if a thorough investigation reveals that the hardship imposed outweighs the benefits that may be received by the public and that the granting of ~~such~~ the variance does not subject the public to unreasonable health risks. ~~An operational variance may not be issued from monitoring, reporting, or public notification requirements.~~

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

B. Application for a variance. Any owner may apply in writing for a variance. The ~~application should~~ request shall be sent to the ~~appropriate field office~~ Department for evaluation. All ~~applications~~ 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 applicant to be pertinent to the ~~application~~ request; and

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

8. For any ~~application~~ request made for a PMCL variance, the applicant shall also include~~;~~:

a. Explanation in full and evidence of the best available treatment technology and techniques;

b. Economic and legal factors relevant to ability to comply;

c. Analytical results of ~~raw water~~source water quality relevant to the variance request;

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

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

(2) Date of initiation of the connection of the alternative ~~raw water~~ source ~~water supply~~ source water or improvement of existing ~~raw water source~~ source water; and

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

e. A plan for the provision of safe drinking water in the case of an excessive rise in the contaminant level for which the variance is requested; ~~and~~

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

g. 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 condition of a variance.

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

C. Consideration of a variance ~~application~~ request.

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

~~2~~3. In the commissioner's consideration of whether the waterworks is unable to comply with a contaminant level required by this chapter ~~(PMCL variance)~~ because of the nature of the ~~raw water~~ source water, the commissioner shall consider such factors as the following:

a. The availability and effectiveness of best available treatment technology and treatment methods for which the variance is requested~~.~~ ; and

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

~~3~~4. In the commissioner's consideration of whether a waterworks should be granted a variance to a required treatment technique because ~~such~~ the treatment is unnecessary to protect the public health ~~(treatment technique variance)~~, the commissioner shall consider such factors as the following:

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

b. Source protection measures employed by the waterworks.

~~4~~5. In the commissioner's consideration of whether waterworks should be granted a variance to a required operational procedure ~~or SMCL (operational variance)~~, 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 ~~Virginia Occupational Safety and Health~~ VOSH laws)~~.~~ ;

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.

D. Disposition of a variance ~~application~~ request.

1. The commissioner may reject any ~~application~~ 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. ~~The applicant has the right to petition for a hearing within 60 days of the date of the rejection to challenge the rejection pursuant to 12VAC5-590-160 and 12VAC5-590-180.~~ 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. ~~Such~~ 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~~2 of this section, ~~such~~ 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 D 3 of this section.

b. For a treatment technique variance as specified in subdivision A ~~2~~3 of this section, ~~such~~ the notice shall provide that the variance may be terminated at any time upon a finding by the commissioner that the nature of the ~~raw water source~~ water supply 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~~4 of this section, ~~such~~ 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 towards compliance are to be taken, including where applicable:

(1) Date by which arrangement for an alternative ~~water source~~ water supply or improvement of existing ~~raw water source~~ water supply will be completed~~.~~ ;

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

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

b. If the waterworks has no access to an alternative ~~raw water source~~ water supply and can effect or anticipate no adequate improvement of the existing ~~raw water source~~ water supply, 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.

E. 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 D of this section may take effect. A notice given pursuant to the preceding sentence 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 an application 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, the rationale for the extended compliance schedule shall be discussed in the notice.

F. 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, the commissioner shall document the rationale for the extended compliance schedule.

2. Such 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. Such schedule shall provide the shortest practicable time schedule under the circumstances.

G. 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.

H. No variances shall be granted to 12VAC5-590-380, ~~12VAC5-590-400, or 12VAC5-590-420,~~ 12VAC5-590-388, 12VAC5-590-395 or 12VAC5-590-411.

12VAC5-590-150. Exemptions.

A. The commissioner may grant an exemption to any primary maximum contaminant level (PMCL) or treatment technique requirement by following the procedures set forth in this ~~subsection~~section. An exemption may be granted to a waterworks ~~from any requirement with respect to a PMCL or treatment technique requirement~~ upon a finding that:

1. The waterworks must be unable to implement measures to develop an alternative ~~source of~~ 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 such contaminant level or treatment technique requirement;

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 requirement; and

6. The waterworks has not been granted a variance.

B. Application for exemption. ~~A waterworks~~ An owner may request an exemption for a waterworks by submitting a written ~~application~~ request to the ~~appropriate field office~~Department for evaluation. All ~~applications~~ requests for an exemption shall include the following information:

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

2. Nature and duration of the exemption 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. Explanation of the compelling factors such as time or economic factors which prevent such waterworks from achieving compliance;

5. Other information believed by the applicant to be pertinent to the application;

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

7. Such 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 ~~application~~ request submitted pursuant to subsection B of this section within 90 days of receipt of the application.

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. Construction, installation, or modification of treatment equipment or systems;

b. The time needed to put into operation a new treatment facility to replace an existing waterworks which 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 ~~application~~ request.

1. The commissioner may reject any request for an exemption 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. The applicant has the~~

~~right to petition for a hearing within 60 days of the date of the rejection to challenge the rejection pursuant to 12VAC5-590-160 and 12VAC5-590-180.~~ 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, the applicant shall be notified in writing of this decision. ~~Such~~The notice shall identify the exemption and the waterworks covered and shall specify the termination date of the exemption. ~~Such notice shall provide that 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 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. A notice given pursuant to the preceding sentence may cover the granting of more than one exemption and a public hearing held pursuant to ~~such~~ the notice shall include each of the exemptions covered by the notice.

2. Notice of a public hearing on an application 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 such hearing, revise the proposed exemption as necessary and prescribe the final schedule for compliance and interim measures for the waterworks granted an exemption.

2. ~~Such~~ The schedule shall establish the timetable by which the waterworks shall comply with each contaminant level and treatment technique requirement prescribed by this chapter. If the schedule for compliance exceeds five years from the date of issuance of the exemption, 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, ~~12VAC5-590-400, or 12VAC5-590-420 B 1 b 12VAC5-590-384 or~~ 12VAC5-590-388 or 12VAC5-590-395.

12VAC5-590-160. ~~Types of hearings.~~ (Repealed.)

~~Hearings before the board, the commissioner, or their designees shall include any of the following forms depending upon the nature of the controversy and the interests of the parties involved.~~

~~1. An informal hearing is a meeting with the district engineer and field director and held in accordance with § 9-6.14:11 of the Code of Virginia. The field director may consider all evidence presented at the meeting which is relevant to the issue in controversy. Presentation of evidence, however, is entirely voluntary. The field office has no subpoena power. No verbatim record will be taken at the informal hearing, but the field director may make preliminary findings of fact, and may submit a copy of those preliminary findings, with recommendations, to the commissioner and or division director for review. A copy of the findings shall be mailed to the appellant.~~

~~2. The adjudicatory hearing is a formal, public, adjudicatory proceeding before the commissioner or a designated hearing officer held in conformance with § 9-6.14:12. Pursuant to the hearings process:~~

~~a. A Notice which states the time, place, and issues involved in the prospective hearing shall be sent to parties requesting the hearing by certified mail at least 15 calendar days before the hearing is to take place;~~

~~b. A record of the hearing will be made by a court reporter or other approved means. A copy of the transcript of the hearing, if transcribed, will be provided within a reasonable time to any person upon written request and payment of the cost. If the record is not transcribed, then the cost of preparation of the transcript will be borne by the party requesting the transcript;~~

~~c. All interested parties may attend the hearing and present evidence, expert or otherwise, that is material and relevant to the issues in controversy. The admissibility of evidence shall be in accordance with the Administrative Process Act. All parties may be represented by counsel;~~

~~d. The commissioner or hearing officer, pursuant to § 9-9.14:13 of the Code of Virginia, may issue subpoenas for the attendance of witnesses and the production of books, papers, maps, and records. The failure of a witness without legal excuse to appear or to testify or to produce documents may be reported by the commissioner to the appropriate circuit court; and~~

~~e. The commissioner may designate a hearing officer or subordinate to conduct the hearing, as provided in § 9-6.14:12 of the Code of Virginia, and to make written recommended findings of fact and conclusions of law to be submitted for review and final decision by the commissioner. The final decision of the commissioner shall be~~

~~reduced to writing and will contain the explicit findings of fact upon which his decision is based. Copies of the decision shall be delivered to the owner affected by it. Notice of a decision will be served upon the parties and become a part of the record. Service may be by personal service or certified mail, return receipt requested.~~

~~3. A regulatory hearing is a public meeting of the board which is held for the purpose of adopting, amending, or repealing rules and regulations. A regulatory hearing requires that:~~

~~a. A notice shall be published, in at least one newspaper of general circulation in the commonwealth, not less than 60 days prior to the day on which the regulatory hearing is to be held. Such notice shall state the time, place, and nature of the hearing and the express terms or an informative survey of the rules that are to be adopted, amended, or repealed;~~

~~b. All interested persons may be present at the hearing and may present comments, arguments, objections, and evidence which concern the proposed rules; and~~

~~c. The board may adopt, repeal, or amend any rule or regulation which was included in the general notice published prior to the meeting. Rules and regulations may be adopted in the form in which they were described in the notice, or as amended at the hearing, provided the amendments do not alter the main purpose of the rule or regulation.~~

12VAC5-590-170. ~~Request for hearing.~~ (Repealed.)

~~Any person may request a hearing by sending a request, in writing, to the appropriate field office or the central office.~~

12VAC5-590-180. Hearing as a matter of right. (Repealed.)

~~Any person whose rights, duties or privileges have been or may be affected by any action or inaction of the board, its agents, or deputies in the administration of this chapter, shall have a right to both an informal and an adjudicatory hearing; however, the commissioner reserves the right to require participation in an informal hearing before granting the request for a full adjudicatory hearing.~~

12VAC5-590-190. ~~Permits~~Construction permits.

A. 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 or water supply without a written construction permit or a general permit for distribution mains from the commissioner.

B. Construction permits may not be required for the extension of water distribution piping provided that the projects meet the requirements in § 32.1-172 A of the Code of Virginia.

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

~~Furthermore, no~~ D. No owner or other person shall cause or ~~permit~~ allow any waterworks ~~or water supply~~ to be operated without a written operation permit issued by the commissioner ~~which authorizes the operation of the waterworks or water supply~~.

E. Conditions may be imposed on the issuance of any permit, and no waterworks ~~or water supply~~ 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~~ commissioner, but all requests for a construction permit are directed initially to the ~~Field Office~~ Department. The procedure for obtaining the permit includes the following steps:

~~(i) the submission of an application, (ii) a preliminary engineering conference, (iii) the submission of an engineer's report (optional at the discretion of the Field Director), and, (iv) the submission of plans, specifications, design criteria and other data in the number requested by the Division.~~

~~A. An application for a permit shall be submitted by the owner or authorized agent requesting permission to establish, construct, expand, modify, and/or operate a waterworks or water supply. The application shall clearly indicate whether the affected water supply is a community, nontransient noncommunity, or noncommunity waterworks.~~

~~B. A preliminary conference with the Division's appropriate District Engineer will be held. The applicant's engineer shall be prepared to set forth the water supply problems and the proposed solution in such a manner as to support his conclusions and recommendations.~~

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

2. At the discretion of the Department, a preliminary engineering conference with the Department personnel may be required prior to submission of design plans and specifications. 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. Conferences shall be required for projects proposed using alternative delivery methods authorized under the § 2.2-4308 of the Code of Virginia;

3. The submission of a Waterworks Permit Application to the Department on a form approved by the Department;

4. The submission of a comprehensive business plan pursuant to § 32.1-172 B of the Code of Virginia;

5. The submission of a Preliminary Engineering Report (PER), if required by the Department. The need for, and scope of, the PER shall be established during the preliminary engineering conference; and

6. The submission of plans, specifications, 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 the well or 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. The engineer's report and preliminary plans for waterworks shall present the following information where applicable:~~

~~1. General information - The report shall include:~~

~~a. A description of any existing waterworks and sewerage facilities.~~

~~b. Identification of the municipality or area served.~~

~~c. The name and mailing address of the owner.~~

~~2. Extent of waterworks system - The report shall include:~~

~~a. A description of the nature and extent of the area to be served.;~~

~~b. Provisions for extending the waterworks system to include additional areas.~~

~~c. An appraisal of the future requirements for service, including existing and potential industrial, commercial, institutional and other water supply needs.~~

~~3. Alternate plans - Where two or more solutions exist for providing public water supply facilities, each of which is feasible and practicable, the report shall discuss the alternate plans and give reasons for selecting the one recommended, including financial considerations.~~

~~4. Soil, groundwater conditions, and foundation problems - The report shall include:~~

~~a. A description of the character of the soil through which water mains are to be laid.~~

~~b. A description of foundation conditions prevailing at sites of proposed structures.~~

~~c. A description of the approximate elevation of ground water in relation to subsurface structures.~~

~~5. Water consumption - The report shall include:~~

~~a. A description of the population trends as indicated by available records, and the estimated population which will be served by the proposed water supply system or expanded system.~~

~~b. Present and estimated future water consumption values used as the basis of design.~~

~~c. Present and estimated future yield of the sources of supply.~~

~~6. Fire flow requirements: - if fire flows are to be provided, the quantity of fire flow which will be made available by the proposed or enlarged system shall be given.~~

~~7. Sewerage system available: - Describe the existing system and sewage treatment works, with special reference to its relationship to the existing or proposed waterworks which may affect the operation of the water supply system, or which may affect the quality of the water supply.~~

~~8. Source of water supply: - Describe the proposed source or sources of water supply to be developed and the reasons for their selection by supplying the following data:~~

~~a. Surface water sources~~

~~(1) Hydrological data, stream flow, and weather records;~~

~~(2) Safe yield, including all factors that may affect it;~~

~~(3) Maximum flood flow, together with approval for safety features of spillway and dam from appropriate reviewing authority;~~

~~(4) Summarized quality of raw water with special references to fluctuation in quality, changing meteorological conditions, sources of contamination, measures to protect the watershed, etc.~~

~~b. Groundwater sources~~

~~(1) Sites considered,~~

~~(2) Advantages of site selected,~~

~~(3) Elevation with respect to surroundings and 100-year flood,~~

~~(4) Probable character of geological formations through which source is to be developed,~~

~~(5) Unusual geological conditions affecting site,~~

~~(6) Summary of source exploration, test well depth and method of construction, placement of liners or screens; pumping test, hours, capacity; water level and specified yield, water quality,~~

~~(7) Possible sources of contamination.~~

~~9. Proposed treatment processes - Summarize and establish the adequacy of proposed processes for the treatment of the specified water under consideration (pilot studies may be required).~~

~~10. Waste disposal - Discuss the various wastes from the water treatment plant, their volume, proposed treatment and points for discharge.~~

~~11. Automatic equipment - Provide supporting data justifying automatic equipment, including servicing.~~

~~12. Project sites - The report shall include:~~

~~a. A discussion on various sites considered and advantages of the recommended one,~~;

~~b. A description of the proximity of residences, industries, and other establishments,~~

~~c. The location of potential sources of pollution that may influence the quality of the supply or interfere with the effective operation of the waterworks system, such as sewage absorption systems, septic tanks, privies, cesspools, sink holes, sanitary landfills, petroleum storage tanks, etc.~~

~~13. Financing - The report shall state:~~

~~a. The estimated cost of integral parts of the system,~~

~~b. The detailed estimated annual cost of operation,~~

~~c. The proposed method of financing, both capital charges and operating expenses.~~

~~14. Future extensions - Summarize planning for future needs and service.~~

~~D.~~ C. Plans for waterworks improvements shall provide the following information, where applicable:

1. A general layout ~~which~~ 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~~, in feet,~~;

e. North Point~~,~~;

f. Datum used~~,~~;

~~g. Boundaries of the municipality or area to be served,~~

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

~~i. Imprint of professional engineer's seal (see 12VAC5-590-220),~~

~~j. Legible prints suitable for microfilming, with size not to exceed 30 inches by 42 inches,~~

~~k.~~ h. Location and size of existing water mains~~,~~; and

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

2. Detailed plans ~~which~~ that include where applicable:

a. Stream crossings, providing profiles with elevations of the stream bed and the normal ~~and extreme high and low water levels,~~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 ~~the~~ property to be used for ~~the~~ 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 level, 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. ~~Schematic drawing~~ A completed Uniform Water Well Completion Report, Form GW-2, and schematic drawings of well construction, showing diameter and depth of ~~drillholes~~ 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. ~~Location~~ If not previously submitted in the PER: location of all potential sources of pollution within ~~250~~ 1000 feet ~~(or further, depending upon aquifer type and recharge area)~~ 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 or sewers, drains, water mains, 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 water mains ~~and/or~~ 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.

~~E.~~ D. Specifications for waterworks improvements shall provide the following information, where applicable: ~~Complete, detailed, technical specifications shall be supplied for the proposed project which include 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. Laboratory facilities and equipment, as well as sampling taps and their locations~~,~~;

3. Number and design of treatment process components~~,~~;

4. Materials or proprietary equipment for sanitary or other facilities including any necessary backflow or backsiphonage protection~~,~~;

5. Workmanship~~,~~; and

6. Other equipment.

~~F.~~ 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. ~~Yield of source of supply,~~ Source withdrawal capacity;

~~2. Reservoir surface area,~~

~~3. Area of watershed,~~

~~4.~~ 2. Estimated water consumption, including average day, maximum day, and peak hour flows;

~~5.~~ 3. Number and type of proposed services~~,~~;

~~6.~~ 4. Fire-fighting requirements~~,~~;

~~7.~~ 5. Basin capacities~~,~~;

~~8.~~ 6. Retention times~~,~~;

~~9.~~ 7. Unit loadings~~,~~;

~~10.~~ 8. Filter area and proposed filtration rate~~,~~;

~~11.~~ 9. Backwash rate~~,~~; and,

~~12.~~ 10. Feeder capacities and ranges.

11. A copy of the plat plan of the well lot showing that it has been duly recorded or a copy of the recorded subdivision plan showing the well lot.

12. A dedication document duly recorded with the clerk of the circuit court stating that the well lot shall be used only for waterworks appurtenances as long as this lot is utilized as part of a waterworks.

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

A. In accordance with ~~Article 1 (§ 54.1-400 et seq.) of Chapter 4 of Title 54.1~~ the provisions of 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 ~~legally~~ 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 front cover of each set of drawings, of each copy of the engineer's report, and of each copy of the specifications submitted for review shall bear the signed imprint of the seal of the licensed professional engineer who prepared or supervised the preparation and be signed with an original signature. In addition, each drawing submitted shall bear an imprint or a legible facsimile of such seal.~~ The quantity, format, and method of submission shall meet the ~~review~~evaluation needs of the Department and shall be consistent with 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 ~~field office~~ Department at least 60 days prior to the date upon which action by the ~~division~~ 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 ~~detailed review~~ evaluation, the plans and specifications will be returned to the submitting party. If revisions to the plans or specifications or both are necessitated, ~~a letter will be sent to~~ the engineer who prepared them ~~outlining the~~ will be notified in writing of the necessary revisions. Revised plans or specifications or both constitute a ~~resubmittal; however, the division will make every~~ resubmission. Every effort will be made to complete the ~~review of such~~ evaluation of these revisions promptly. ~~Preliminary plans and the engineer's report should be submitted for review prior to preparation of final plans.~~

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

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

B. Designs submitted for waterworks must demonstrate that the waterworks will adequately safeguard public health. Submissions ~~which~~ that are in substantial compliance with the Manual of Practice or additional requirements of the ~~department~~ commissioner, as noted ~~above~~in subdivision A of this section, will be approved. Justification for a design may be required for those portions of the submitted design ~~which~~ that differ from the criteria of the ~~division,~~ commissioner or the Manual of Practice~~, or accepted engineering practices~~. Deviations from ~~"shall"~~ mandatory criteria contained in the Manual of Practice ~~which the design engineer, in his judgment, believes to be substantial in nature~~ shall be identified and justified. For each deviation, ~~The division~~ the commissioner may ~~require changes in designs which are not in substantial compliance with the manual and which are not adequately justified by the engineer~~ ~~owner~~ 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 ~~reviewed~~ evaluated by the ~~division~~ commissioner as soon as practicable upon receipt. ~~Such plans~~ Plans and specifications will be approved if they demonstrate substantial compliance with the design criteria set forth in the Manual of Practice and if the waterworks as constructed or modified, will be able to function in compliance with ~~the operating regulations set forth in~~ Part II of this chapter. ~~One set of the approved plans and specifications will be stamped by the division and returned to the owner.~~

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

1. The design of a transient noncommunity waterworks is exempted from 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 source, small pressure tank, and 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 well of a transient noncommunity waterworks is required to use a water well system provider certified by the Virginia Department of Professional and Occupational Regulation 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 system provider, as defined in § 54.1-1129.1 of the Code of Virginia.

E. The conditions for exemptions of 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 commissioner.

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 ~~his~~ the waterworks or water supply 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, the owner shall reapply for a 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 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 ~~division~~ commissioner before any ~~such changes~~ of these deviations are made.

B. Revised plans and specifications shall be submitted in time to ~~permit~~ allow the ~~review~~ evaluation and approval of ~~such~~ plans or specifications before any construction work ~~which~~ that will be affected by ~~such~~ the changes is begun.

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 ~~field office~~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, that are adequate to insure the truth of the statement of completion of construction.

B. The project documents may require a performance verification 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 verification report and a certification of successful operator training, as applicable.

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

A. Upon receipt of the ~~12VAC5-590-250~~ statement of completion of construction and inspection by the Department to insure that the project has been satisfactorily completed, and satisfactory bacteriological test results are received, as appropriate, the commissioner will issue an ~~operating~~ operation permit. ~~However, the commissioner may delay the granting of the permit pending inspection by the field office to insure that the work has been satisfactorily completed.~~

B. When a waterworks changes ownership, the new owner shall submit a completed Waterworks Permit Application to the Department within 30 days of the purchase date.

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

D. An owner shall not operate a substantially modified waterworks without first obtaining an amended operation permit.

E. The commissioner shall establish the type (community, nontransient noncommunity, or transient noncommunity), 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. ~~Inspection and correction.~~ Startup testing and inspections.

A. ~~Within 30 days after~~ Before placing a new or modified waterworks or water supply into operation following construction, the owner shall test the water produced in a manner acceptable to the ~~division~~ commissioner. The ~~field office will be notified~~ owner shall notify the Department of the time and place of the tests. ~~Results~~ The owner shall send the results of the tests ~~will be sent~~ to the ~~field office~~Department.

B. The commissioner~~, a member of the board, or a member of the division~~ has a right to inspect any waterworks or water supply and to be present for any testing in accordance with Title 32.1 of the Code of Virginia.

12VAC5-590-280. Procedure for obtaining a construction permit for well sources. (Repealed.)

~~Since the quantity and quality of water from proposed wells cannot be anticipated, the following procedure shall be used:~~

~~1. Submittal of application--see 12VAC5-590-200 A.~~

~~2. Preliminary engineering conference--see 12VAC5-590-200 B.~~

~~3. When, upon inspection by the division's engineer, one or more well lots are found suitable for well sites, then tentative approval in writing will be furnished to the owner authorizing him to proceed with the drilling of the well or wells and this letter will specify~~

~~the exact location on the lot where each well is to be drilled. Also, the letter will specify that the well shall be Class I or Class II, meeting the specifications set forth in Part III Article 2, Source Development. This tentative approval will become void after a 12-month period and the site must be reinspected before construction when so voided.~~

~~4. Submittal of engineer's report and preliminary plans--see 12VAC5-590-200 C.~~

~~5. Submittal of plans, specifications, and other data--see subsections D, E, and F of 12VAC5-590-200; 12VAC5-590-210 and 12VAC5-590-840. One of the following must also be submitted:~~

~~a. A copy of the plat plan showing that it has been duly recorded and signed by the clerk of the court, giving the deed book and page number and date of recording, will be required before a construction permit can be issued, or~~

~~b. If the well lot is identified on a recorded plan of the subdivision as a well lot, then this is acceptable, if recorded as required by this subsection.~~

~~In addition, a dedication document duly recorded with the clerk of the circuit court must be furnished stating that the well lot shall be used only for waterworks appurtenances as long as this lot is utilized as part of a waterworks.~~

~~6. Compliance with 12VAC5-590-220 through 12VAC5-590-270 is required.~~

12VAC5-590-290. Procedure for issuance of special permits for new or nonconventional methods, processes, and equipment Issuance of a temporary operation permit.

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

B. ~~The policy of the board is to encourage~~ Submission of data on new or nonconventional methods, processes, and equipment. The Department encourages the development of any new or nonconventional methods, processes and equipment which~~,~~ by virtue of treatability studies, appear to have application for ~~the purification of raw~~ water treatment. However, these new or nonconventional developments shall have been thoroughly tested in a full scale or representative pilot plant installation before ~~approval of a plant utilizing this process~~ these processes and equipment ~~can be employed~~ are approved and an operation permit issued. The ~~result of this testing must~~ results shall be submitted to the ~~field office~~Department. The testing required on new or nonconventional developments will generally follow these guidelines:

1. All procedures used in validating the process shall be conducted under the supervision of a licensed professional engineer experienced in the field of environmental engineering, the owner's engineering staff, or a testing firm acceptable to the ~~division~~ commissioner;

2. Samples shall be collected and analyzed in a manner ~~which~~ that would 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 continuous operation of a full scale or pilot plant treating the type of water to be handled;

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

~~5. At installations treating surface waters, employing coagulation, flocculation, sedimentation, filtration, and disinfection, automatic indicating and recording equipment shall be provided for continuously monitoring the turbidity of the raw water, settled water, and each filter effluent, as well as pH monitoring of the treated water (flash mix effluent);~~

~~6.~~ 5. If the ~~raw water source~~ source water receives upstream discharges of treated industrial wastes or ~~sewage effluents~~ treated wastewater, automatic indicating and recording equipment shall be provided for continuously monitoring the pH of raw and finished water and chlorine residual of finished water;

~~7.~~ 6. The minimum sampling and analysis program will be established by the ~~division~~ commissioner in accordance with the process under investigation; and.

~~8.~~ 7. All analyses shall ~~be made in accordance with the most current edition of Standard Methods for the Examination of Water and Wastewater, published by the American Public Health Association, the American Water Works Association, and the Water Pollution Control Federation or analytical methods approved in advance by the~~ ~~division~~ utilize methods that are consistent with 12VAC5-590-440.

C. Submission of plans. Detailed plans shall be submitted where possible showing how, in case of nonacceptance, the water treatment plant or treatment unit 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. Issuance of a construction permit. After ~~review~~ evaluation of the plans and testing data, the commissioner will issue a construction permit if ~~he is satisfied~~ the performance data verifies that the method, process, or equipment ~~will~~ may efficiently produce water ~~that will meet~~ in accordance with design specifications and the operation standards of Part II of this chapter, and that the method, process, or equipment may be ~~converted to a conventional technique, if necessary~~ installed as conventional for similar site specific operation.

E. Issuance of temporary operation permit - Upon completion of construction or modification, a ~~provisional~~ 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 ~~provisional~~ temporary permit will be granted for a similar installation during the evaluation period. The ~~provisional~~ 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 ~~provisional~~ temporary operation permit ~~must~~ shall submit reports on operation during the evaluation period as required by the ~~division~~ commissioner. The reports shall be prepared by a licensed professional engineer experienced in the field of environmental engineering, the owner's operating or engineering staff, or a testing ~~firm acceptable to the division~~ organization.

~~F. The commissioner will issue an operation permit upon lapse of the provisional permit, if, on the basis of testing during that period, he finds that the new or nonconventional method, process, or equipment efficiently meets the operation standards of Part II. If the standards are not met, then the commissioner will issue an order which will require the alteration of the waterworks or water supply in a manner that will enable those standards to be met.~~

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

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

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

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

1. The owner shall develop, adopt, and have ~~division~~ the commissioner's approval of general specifications and plan details covering water 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)~~ a Memorandum of Understanding (MOU) with the ~~division which outlines the following~~ commissioner. The commissioner will outline the waterworks-specific requirements, and the owner's method of compliance with ~~such requirements:~~ the requirements. The waterworks-specific requirements include, but are not limited to the following:

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

b. The means for modifying the ~~division~~ Department approved general specifications and plan details;

c. The maintenance of engineering capabilities satisfactory to the ~~division~~ commissioner, 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 division~~ Department of appropriate reports, including an annual report and summary, concerning all projects constructed under the terms of the ~~general permit~~ MOU and information concerning changes to the distribution system.

C. Once the general specifications are approved and the MOU is agreed to by the commissioner, a general permit for distribution mains may be issued with the MOU attached.

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

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

The commissioner may amend or reissue ~~a~~ an operation permit where there is a change in the manner of storage, the treatment, or the ~~source of supply of the~~ water supply at the permitted location, or for any other cause incident to the protection of the public health, or for the supplying of ~~pure~~ potable water, provided notice is given to the owner, and, if one is required, a hearing held in accordance with the provisions of ~~subdivisions 1 and 2 of 12VAC5-590-160~~ 12VAC5-590-115.

12VAC5-590-320. Revocation ~~or suspension of a~~ of an operation permit.

A. The commissioner may ~~suspend or~~ revoke ~~a~~ an operation permit in accordance with ~~Administrative Process Act~~ the APA. Reasons for revocation ~~of permits~~ are as follows:

1. Failure to comply with the conditions of the operation permit;

~~2. Violation of Title 32.1 of the Code of Virginia or of any of this chapter from which no variance or exemption has been granted;.~~

~~3.~~ 2. Change in ownership of the waterworks; or

~~4. Abandonment of the waterworks and discontinuing the supplying of pure water; and~~

~~5.~~ 3. Any of the grounds specified in § 32.1-174 of the Code of Virginia.

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

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

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

~~C. An owner who is given notice of intent to revoke or suspend his permit has a right to a hearing as specified in 12VAC5-590-160 and 12VAC5-590-180.~~

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

A. The commissioner or ~~the division~~ Department may require the owner ~~or operator of any waterworks or water supply~~ 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 ~~division~~ commissioner. Test results shall be recorded, compiled, and reported to ~~the field office~~ Department in a format ~~approved by~~ acceptable to the ~~division~~ commissioner.

DEPARTMENT OF HEALTH

Proposed Amended Waterworks Regulations

Part II

Operation Regulations for Waterworks

~~Article 1~~

~~General~~

Contents

12VAC5-590-340. ~~General~~ Compliance standards.

A. All physical, chemical, bacteriological, or radiological analyses for the purpose of demonstrating compliance with ~~primary and secondary maximum contaminant levels action levels or contaminants that do not have PMCLs but for which compliance samples must be analyzed by certified laboratories~~ the requirements of this chapter shall be performed by the ~~Commonwealth of Virginia, Department of General Services, Division of Consolidated Laboratory Services (DCLS)~~ DCLS or ~~in~~ by laboratories certified by the ~~Division of Consolidated Laboratory Services~~ DCLS for such purposes unless listed in 12VAC5-590-440 C. The owner is responsible for the collection and submission of all samples. The commissioner may require sampling and testing that exceeds the minimal requirements specified in this chapter. A sample is deemed to have been collected only ~~if and~~ when its results are made known to the ~~Office of Drinking Water~~ODWDepartment.

B. Specific limits. No attempt has been made to prescribe specific limits for every contaminant that might occur in a water supply or 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 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 averages, where applicable, 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 um)
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
Sulfate	250[c]
Zinc	5
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] For artificially fluoridated waterworks, the optimum control limit is 0.7 mg/L.
[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. Owners are encouraged to maintain as low an aluminum concentration as possible. If the aluminum concentration in the finished water causes discoloration, the owner is urged to contact

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

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
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
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[1b]

[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.

Parameter	
Combined radium-226 and radium-228.	
Gross alpha particle activity (excluding Radon and uranium)	
Beta particle and photon radioactivity.	
Uranium	
Radionuclide	**Critical Organ**
Tritium	Total Body
Strontium-90	Bone Marrow

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/inactivation.
Viruses	TT 99.99% (4-log) removal/inactivation
Legionella	TT No limit, but if Giardia lamblia and viruses are removed/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)**
Total trihalomethanes (TTHM) ■ Bromodichloromethane ■Bromoform ■Chloroform ■Dibromochloromethane	0.080[a]
Haloacetic Acids (five) (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.

Disinfectant residual	**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, owners may increase residual disinfectant levels ~~in the distribution system~~ 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, but not limited to, distribution line breaks, storm run-off events, water supply contamination events, or cross-connection events.

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

A. Frequent assessments shall be made by the owner of the water supply ~~source~~ 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 ~~supply sources~~ supplies.

B. ~~The commissioner may perform sanitary surveys.~~ The Department is required to perform sanitary surveys and site visits to assess the condition of waterworks and water supplies. Pursuant to §32.1-25 of the Code of Virginia, the Department personnel have the right, with the owner's consent, of entry onto the waterworks property and 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. Owners shall provide any existing information requested by the commissioner that will enable ~~the commissioner~~ the Department personnel to conduct the sanitary survey or site visit.

C. A sanitary survey includes, but is not limited to, an ~~onsite~~ 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 ~~licensed operator(s)~~ operator or operators ~~required in 12VAC5-590-460~~. ~~Licensed 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, Department of Professional and Occupational Regulation.

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

1. The commissioner 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 commissioner regarding the appropriate corrective action with a schedule for implementing corrective action. Any waterworks with significant deficiencies must have a Corrective Action Plan (CAP) as described in 12VAC5-590-421 A.

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

12VAC5-590-360. ~~Responsibility;~~Responsibilities of the owner.

A. The ~~water utility~~ owner ~~or owner of the property served, to the extent of their respective jurisdictions,~~ shall provide and maintain conditions throughout the entirety of the ~~water supply system~~ waterworks in a manner ~~which~~ that will assure a high degree of capability and reliability to ~~effect compliance with these standards~~ comply with Part II of this chapter. This requirement shall pertain to the ~~source of supply~~ water supply, treatment, transmission, storage, and distribution facilities and the operation thereof. ~~In addition, this requirement shall include specific and continuing assessment of the capability, effectiveness, and reliability of the treatment process in relation to potential contaminants in the source of supply. Finally, this requirement shall include the identification and evaluation of~~ The owner shall identify and evaluate ~~all~~ factors ~~having~~ with the potential for impairing the quality of the water ~~as~~ delivered to ~~customers and appropriate preventive and control~~ 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 application of this chapter, responsibility for the conditions in the water supply system shall be considered to be held by:~~

~~1. The owner from the source of supply to the customer's service connection; and~~

~~2. The owner of the property served and the municipal, county, or other authority having legal jurisdiction from the customer's service connection to the free-flowing outlet.~~ For the purpose of achieving compliance with this chapter, the owner shall exercise control of the waterworks from the water supply 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.

~~Article 2~~
~~General Information~~

The following sections are adopted from the federal regulations. Detailed text is not included.

12VAC5-590-370. ~~Sampling frequency~~ Monitoring requirements.

12VAC5-590-372. Inorganic chemicals monitoring.

12VAC5-590-373. Organic chemicals monitoring.

12VAC5-590-374. Disinfectant residuals, disinfection byproducts, and disinfection byproduct precursors monitoring.

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

12VAC5-590-376. Surface water and GUDI sources treatment monitoring.

12VAC5-590-377. Physical constituent monitoring.

12VAC5-590-378. Radiological monitoring.

12VAC5-590-379. Groundwater ~~system~~waterworks monitoring.

12VAC5-590-380. Bacteriological ~~quality~~ compliance.

12VAC5-590-382. Inorganic chemicals compliance.

12VAC5-590-383. Organic chemicals compliance.

12VAC5-590-384. Disinfectant residuals, disinfection byproducts, and disinfection byproduct precursor compliance.

12VAC5-590-385. Lead and copper action level compliance.

12VAC5-590-388. Radiological compliance.

12VAC5-590-390. ~~Chemical and physical quality~~Physical contaminant compliance.

12VAC5-590-391. Treatment technique requirements.

12VAC5-590-392. Coliform treatment technique triggers and assessment requirements.

12VAC5-590-395. Surface water and GUDI source, polymer, and recycle treatment techniques.

12VAC5-590-400. ~~Radiological quality.~~ (Repealed)

12VAC5-590-401. Enhanced filtration and disinfection for Cryptosporidium treatment techniques.

12VAC5-590-405. Lead and copper treatment techniques.

12VAC5-590-410. ~~Determination of compliance.~~ (Repealed.)

12VAC5-590-411. Disinfection byproduct precursor, disinfection byproducts, and maximum residual disinfectant level treatment techniques.

12VAC5-590-415. Uncovered finished water storage.

12VAC5-590-420. ~~Treatment technique requirement.~~ (Repealed).

12VAC5-590-421. Groundwater ~~system~~ source treatment techniques.

12VAC5-590-425. ~~Raw water monitoring requirements for groundwater sources.~~ (Repealed.)

12VAC5-590-430. Determination of surface water influence of groundwater sources.

12VAC5-590-440. Analytical methods.

~~Article 3~~
~~Operation of Waterworks~~

12VAC5-590-450. ~~General.~~ Facility and personnel management.

Waterworks operation comprises the constant ~~operation~~ oversight and management of facilities and personnel. Consideration ~~must~~ shall be given to such factors as the ~~competent~~ competency of personnel, ~~standards of~~ water quality including drinking water standards, water treatment plant maintenance and cleanliness, analytical laboratory control, operation and maintenance of ~~plant equipment, plant records and safety~~ facilities, including water treatment plant equipment and distribution system equipment and piping. As the ~~degree of~~ complexity of ~~water treatment~~ the waterworks increases, so does the expertise and skill required ~~to produce a high quality water also increases~~ of the operating staff.

12VAC5-590-460. ~~Personnel.~~ (Repealed.)

~~The operation of waterworks, both small and large, must rest in the hands of qualified persons. The number of such employees in a waterworks system depends principally upon the size, the quality of the raw water, and the type of treatment processes used.~~

~~A. Waterworks operators designated by the waterworks owner to be in responsible charge must possess a valid waterworks operator license issued by the Board for Waterworks and Wastewater Works Operators and Onsite Sewage Professionals, Department of Professional and Occupational Regulation, in accordance with that board's regulations (18VAC160-20-10 et seq.) and Chapters 1, 2, 3, and 23 of Title 54.1 of the Code of Virginia. The license must be of a classification equal to or higher than that of the waterworks. Additional operating personnel at the waterworks must also be licensed as specified below.~~

~~B. The number and class of operators in attendance and additional operating personnel are a minimum to meet the requirements of protection of the public health of the consumer and safety of the operating personnel. The classification of operators and additional operating personnel in attendance must conform with Table 2.9.~~

~~1. The owner shall designate one or more properly licensed operators to be in responsible charge of the waterworks at all times. When no designated operator is on duty or in communication with the operating personnel in attendance at the waterworks, a substitute operator shall be designated by the owner. The substitute operator shall possess a valid operator license of a classification equal to or greater than that of the waterworks.~~

2. All waterworks having design capacity of 2.0 mgd or higher and employing filtration must have a minimum of two operating personnel on duty whenever the plant is in operation. All other waterworks employing filtration must have a minimum of one operating person on duty whenever the plant is in operation.

3. Waterworks designed for softening only and utilizing chemical precipitation:

a. Waterworks having a design capacity of 2.0 mgd or higher must have a minimum of two operating personnel in attendance at all times the plant is in operation; and

b. All other waterworks must have a minimum of one operator operating person in attendance at all times the treatment plant is in operation.

4. Waterworks utilizing iron and manganese removal by precipitation and having a design capacity of 0.5 mgd or higher must have a minimum of one operating person on duty at all times the treatment plant is in operation.

5. Waterworks providing treatment or no treatment and serving 400 or more persons and not previously covered will require daily attendance at each treatment facility by an operating person for sufficient time to insure proper operation of the facility and protection of the public health, as determined by the division.

TABLE 2.9
MINIMUM CLASSIFICATION FOR WATERWORKS OPERATIONS
ADDITIONAL OPERATING PERSONNEL

PLANT CLASSI-FICATION	PLANT CAPACITY (MGC)	EQUIVALENT POPULATION SERVED	TREATMENT	OPERATOR IN RESPONSIBLE CHARGE (CLASS)	SHIFT SUPERVISOR (CLASS)	OTHERS
CLASS I	15.0 or more	150,000	Conventional filtration or filter rate more than 2 gpm/ft^2	I	I	II,III,IV Trainee*
CLASS I	5.0 but less than 15.0	50,000 but less than 150,000	Conventional filtration filter rate more than 2 gpm/ft^2	I	II	II,III,IV Trainee*
CLASS II	Less than 5.0	Less than 50,000	Filtering rater greater than 2 gpm/ft^2	II	II	III, IV Trainee*
CLASS II	0.5 but less than 5.0	5,000 but less than 50,000	Conventional filtration	II	III	III, IV Trainee*

~~CLASS III~~	~~Less than 0.5~~	~~Less than 5,000~~	~~Conventional filtration~~	~~III~~	~~III~~	~~IV or Trainee*~~
~~CLASS III~~	~~5,000 or more~~	-	~~Approved treatment other than conventional filtration and fluoridation~~	~~III~~	~~IV~~	~~IV or Trainee*~~
~~CLASS III~~	~~Sufficient persons or connections to be classified as a Public Water supply~~	-	~~Not under higher classifications but using fluoridation~~	~~III~~	~~IV~~	~~Trainee*~~
~~CLASS IV~~	~~Less than 5,000~~	-	~~Approved treatment other than conventional filtration and fluoridation or no treatment serving 400 or more persons~~	~~IV~~	~~IV~~	~~Trainee*~~

~~* Trainees should meet basic prerequisites for operators with the exception of experience and have potential for licensing wherever listed in these guidelines. Owner must provide a qualified substitute operator when only one operator is normally employed. The substitute must have the same class license as the operator.~~

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 commissioner 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 below shall be designated an unclassified waterworks unless specified otherwise by the commissioner. Normally a TNC waterworks shall

not be classified and shall not be required to have an operator, unless the commissioner determines that it is necessary to ensure satisfactory operation of the treatment installed. If a waterworks consists of multiple treatment facilities, these facilities may be individually classified for the purpose of determining operator requirements.

1. Class 1 shall mean:

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. The waterworks is designated by the commissioner to be Class 1 waterworks.

2. Class 2 shall mean:

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 C), chemical coagulation in combination with membrane filtration; or

b. 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 employing high rate conventional filtration (see 12VAC5-590-874 C); or

c. The waterworks is designated by the commissioner to be a Class 2 waterworks.

3. Class 3 shall mean:

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; or

b. 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; re-chlorination other than with hypochlorination; activated carbon contactors; membrane or other filtration technologies without chemical coagulation; fluoridation with a saturator or acid feed; or

c. Waterworks or a water treatment plant employing fluoridation with other than a saturator not considered a Class 1 or Class 2 waterworks; or

d. The waterworks is designated by the commissioner to be a Class 3 waterworks.

4. Class 4 shall mean:

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; re-chlorination other than with hypochlorination; activated carbon contactors; membrane or other filtration technologies without chemical coagulation ; fluoridation with a saturator; or

b. The waterworks is designated by the commissioner to be a Class 4 waterworks.

5. Class 5 shall mean:

a. Waterworks serving 400 or more persons that:

(1) Provides no treatment; or

(2) Employs one or more of the following treatment processes; or

(a) Hypochlorination for disinfection; or

(b) Corrosion control with calcite or magnesium oxide contactors or solution feed except with caustic; or

(c) Sequestration by solution feed.

b. The waterworks is designated by the commissioner to be Class 5 waterworks.

6. Class 6 shall mean:

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; or

(b) Corrosion control with calcite or magnesium oxide contactors or solution feed except with caustic; or

(c) Sequestration by solution feed.

b. The waterworks is designated by the commissioner 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.

1. If a classified waterworks or water treatment plant is without a required operator, the owner shall notify the Department as soon as reasonably practical but no later than 24 hours of such an occurrence.

2. 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 commissioner may increase the required operating attendance when appropriate to protect human health.

3. All classified waterworks shall be operated by an operator having a valid license issued by the Commonwealth of Virginia 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).

4. 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. Waterworks shall have a minimum of two operating staff on duty whenever the water treatment plant is in operation; at least one of the operating staff must be an operator.

2. Class 2. Waterworks shall have a minimum of one operator on duty whenever the water treatment plant is in operation.

3. Class 3. Waterworks employing conventional filtration or chemical coagulation in combination with membrane filtration shall have a minimum of one operator on duty whenever the water treatment plant is in operation. All other treatment facilities may have operator attendance similar to Class 4 waterworks.

4. Class 4. Waterworks shall be attended by an operator at least three days per week except membrane filters treating surface waters 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, waterworks shall be attended by an operator at least twice a month.

b. When treatment is provided, 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 commissioner on a case-by-case basis in order to protect public health and may include, but are not limited to, the following:

a. Operational history;

b. Facilities employing treatment for compliance with PMCLs or treatment technique requirement;

c. Complexity of the treatment; and

d. Non-conventional treatment methods.

2. Reduced staffing attendance may be considered by the commissioner on a case-by-case basis. Evaluation criteria may include, but are not limited to, the following:

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. Staffing availability;

g. Frequency of operating staff attendance;

h. Remote monitoring;

i. Reliable staff communications; and

j. Emergency response plans and procedures.

12VAC5-590-470. Waterworks ~~appearance~~ condition.

~~The general appearance and state of cleanliness of a waterworks can greatly influence the attitude of the public toward a utility and can actually promote public health. A community without confidence in its public water supply with often resort to the use of water from questionable or polluted sources; therefore, the~~ The waterworks ~~must~~ shall be maintained in a clean and orderly condition~~to achieve this goal~~.

12VAC5-590-475. Removal of wells from service.

A. Temporary inactivation.

1. Any water well temporarily inactivated shall be sealed with a watertight cap or well-head seal.

2. The well shall be maintained so that it will not be a source or channel of contamination during temporary inactivation.

3. The well head shall be visually inspected and 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. Sufficient 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 prior to 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 which 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 which is mounded a minimum of one foot above the surrounding ground surface.

9. Wells constructed in consolidated rock formations or which 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 which is mounded a minimum of one foot above the surrounding ground surface.

10. The location of the well shall be permanently documented for future location.

12VAC5-590-476. Reactivation of wells.

A. The owner shall notify the Department of the intent to reactivate a well.

B. Prior to bringing the well into service, it shall be pumped to waste (purged) for a minimum of five well volumes, and no less than 30 minutes. The purged well water shall be discharged in a manner 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, the well shall be tested for total coliform density (MPN), nitrate, and if determined by the commissioner, inorganics, VOCs, SOCs, and radionuclides. Satisfactory test results shall be obtained prior to placing the well in service.

D. A well yield and drawdown test may be required by the commissioner prior to 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 prior to receipt of satisfactory monitoring results, if public health and safety are at risk, as determined by the commissioner. In these circumstances, a special water advisory shall be approved by the commissioner and issued by the waterworks at the same time the well is activated.

12VAC5-590-480. ~~Analytical laboratory control~~ Operational control testing and monitoring.

A. ~~Analyses~~ Water analyses and tests performed at waterworks are made for four main purposes: to ensure compliance; to control water treatment plant operation~~,~~; to record water treatment plant performance~~,~~; and to ~~improve plant performance, and to undertake fundamental research of value to the plant and to the profession in general~~ provide information for improving water treatment plant performance. Tests designed to control operation ~~should~~ shall present evidence that:

1. ~~The water has been properly prepared for each major key step in the treatment process;2.~~ Each key process, such as mixing, coagulation, sedimentation, filtration, softening, iron and manganese removal, disinfection, and taste and odor control ~~has proceeded according to plan~~ is effective; and

~~3~~2. The finished product is clean, is free from objectionable taste ~~or~~ and odor, is free from undesirable chemical characteristics, and is safe for human consumption.

B. ~~Laboratory analyses shall conform with the most current edition available of Standard Methods for the Examination of Water and Wastewater published by the American Public Health Association, the American Water Works Association, and the Water Pollution Control Federation, or analytical methods approved by the division.~~ 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's instructions. Calibrations shall be documented in a manner acceptable to the commissioner.

C. Ample laboratory space shall be provided for all required laboratory analyses as specified in 12VAC5-590-760.

~~1. Chemical. The analyses listed below are the minimum required. Additional testing may be required by the division.~~

~~a. Waterworks utilizing treatment for turbidity removal shall provide equipment for the analysis of pH, alkalinity, hardness, turbidity, water temperature and coagulation dosage. An electric pH meter must be provided; however, a color comparator may be used as a back-up unit. Turbidities must be determined by the use of a nephelometer. Minimum equipment for coagulation control shall be a multiple jar stirring machine.~~

~~b. Waterworks providing softening only and utilizing chemical precipitation shall provide equipment for analysis of pH utilizing an electric pH meter, alkalinity, hardness, water temperature, and chemical dosage for precipitation utilizing a multiple jar stirring machine.~~

~~c. Waterworks providing iron and manganese removal by chemical precipitation shall provide equipment for analysis of pH, alkalinity, iron, manganese, and water temperature.~~

~~d. Waterworks providing fluoridation shall provide equipment for analysis of the fluoride ion concentration and water temperature.~~

~~e. Waterworks providing chlorination or rechlorination shall provide equipment for the analysis of chlorine residual and temperature.~~

~~f. Waterworks providing iron and manganese removal by ion exchange and or softening by ion exchange shall provide equipment for the analysis of iron and manganese, or hardness.~~

~~2. Bacteriological. Only results of bacteriological analyses performed by the Division of Consolidated Laboratory Services, or by laboratories and laboratory personnel certified by the Division of Consolidated Laboratory Services will be acceptable.~~

~~a. The number and frequency of bacteriological sampling shall comply with Article 1 of Part II. Additional analyses may be necessary when deemed so by the division.~~

~~b. Waterworks having a rated capacity of 3.0 mgd or more or serving an equivalent of 30,000 persons or more shall provide laboratory space and equipment for routine bacteriological analysis.~~

~~c. Bacteriological sampling in accordance with Article 1 of Part II is required by all waterworks.~~

D. Required waterworks on-site laboratory analyses. The analyses listed below are the minimum required. Additional testing may be required by the commissioner.

1. Owners of 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 back-up unit. Turbidities must be determined by the use of a calibrated turbidimeter. ~~Minimum equipment for coagulation control shall be a multiple jar stirring machine.~~

2. Owners of waterworks employing membrane filtration without chemical coagulation or lime softening shall provide equipment for analysis of turbidity and temperature. Turbidities shall be determined by the use of a calibrated turbidimeter.

3. Owners of waterworks employing softening only and utilizing chemical precipitation shall provide equipment for 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. Owners of waterworks employing iron and manganese removal by chemical precipitation shall provide equipment for analysis of pH, alkalinity, iron, manganese, and water temperature.

5. Owners of waterworks employing fluoridation shall provide equipment for analysis of the fluoride ion concentration and water temperature.

6. Owners of waterworks employing chlorination, rechlorination, chloramination, or re-chloramination shall provide equipment for the analysis of the appropriate chlorine residual measurement and temperature.

7. Owners of 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, shall be maintained fully operational and calibrated in accordance with the manufacturer's instruction.

1. Owners of 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 commissioner. All UV sensors shall be verified with a reference UV sensor at least monthly. It is also recommended that off-line/standby sensors be calibrated at the same time. At least one reference sensor for calibration of on-line 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 on-line measurements to a bench top spectrophotometer that is calibrated in accordance with manufacturer's instructions.

2. Owners of waterworks employing ozone for inactivation credit shall perform calibration checks on continuous, on-line ozone residual monitors at least weekly, during peak hourly flow. Inactivation credits for a multiple chamber contactor shall be based on only the chambers that have a measured ozone residual > 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 ~~a~~ water consistently meeting the requirements of this chapter. The concept of adequate treatment also includes processes that are appropriate to the source of supply; 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 conscientious operation by well-trained and competent personnel whose qualifications are commensurate with the responsibilities of the position and acceptable to the ~~division~~ commissioner.

B. All waterworks shall provide adequate treatment and ~~pure~~ potable water.

The following sections are adopted from the federal regulations. Detailed text is not included.

12VAC5-590-500. Disinfection ~~by chlorination~~.

12VAC5-590-501. Determination of CT, disinfection profiles, and disinfection benchmarks for Giardia lamblia and virus inactivation.

12VAC5-590-505. Emergency management plan for extended power outages.

A. ~~Each~~ The owner of each community waterworks (including consecutive waterworks) shall develop and maintain an emergency management plan for extended power outages.

B. Each plan shall be kept current and shall be ~~kept~~ retained at a location that is readily accessible to the owner in the event of an extended power outage.

C. ~~Each~~ The owner of each community waterworks shall certify in writing to the ~~appropriate field office of the Office of Drinking Water in the Department of Health~~Department that the ~~waterworks~~ plan has been completed ~~such plan~~.

D. Each 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 ~~community waterworks~~ owner will respond to an extended power outage ~~for~~ lasting a minimum of five days.

3. Procedures for obtaining and distributing potable water in the event that the primary ~~source(s) becomes~~ source or 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(s)~~system and storage ~~tank(s)~~ tank or tanks.

6. The ~~telephone number of~~ point of contact for the ~~appropriate ODW field office of the Office of Drinking Water in the Virginia Department of Health~~Department.

7. The ~~names and telephone numbers of~~ points of contact for the waterworks personnel who should be notified.

8. The ~~name and telephone number of~~ point of contact for the Local Emergency Coordinator designated by the Virginia Department of Emergency Management.

9. The ~~names and telephone numbers of~~ 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 ~~treatment plant~~ waterworks operation.

~~B. Waterworks designed for bacteria and turbidity removal shall not be operated without adequate chemical coagulation as determined by the division.~~

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 commissioner.

2. 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 commissioner.

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 micro- and ultra-filtration technologies employed for pathogen removal shall demonstrate removal efficiency equal to the removal (log inactivation) credit given. A direct integrity test acceptable to the commissioner 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. Waterworks utilizing filtration in the treatment process shall not vary the rate of filtration through any single filtering unit above its design capacity unless approved by the division.~~

~~D. Filtering units equipped with rewash facilities shall not be returned to service after backwashing until being thoroughly rewashed.~~

~~E.~~ C. All waterworks shall provide a minimum working pressure of 20 psi-gauge (psig) at all service connections.

12VAC5-590-511. Maintenance of waterworks' integrity.

A. All chemicals, components, materials, and products used to replace, maintain, or repair any portion of a waterworks shall comply with 12VAC5-590-515.

B. Before returning the waterworks to service, the current applicable AWWA standards including cleaning, disinfecting and testing, shall be applied to, but not limited to, the following situations:

1. All existing water treatment units, piping and appurtenances located downstream of the point of application of the secondary disinfectant that are taken out of service for cleaning, inspection, maintenance, painting, repair, or any other activity that may lead to contamination of the processed water.

2. All existing wells removed from service for maintenance or pump repair or replacement.

3. All existing water storage tanks removed from service for repair or painting, or that have been entered for inspection or construction.

4. All existing water mains taken out of service for inspection, repair, or any other activity that may lead to contamination of the processed water.

C. Federal, state, or local environmental regulations may require special provisions or permits before disposal of chlorinated water.

12VAC5-590-515. Use of chemicals, components, materials, and products.

A. Chemicals, components, materials and products in contact with raw, partially treated, or potable water and used in pipes, tanks, or equipment that convey or store these waters shall be compliant with NSF/ANSI Standard 60, Standard 61, or Standard 372, as appropriate, unless otherwise approved by the commissioner. Products certified by 3rd party certification agencies accredited by ANSI for meeting NSF/ANSI Standards shall be accepted.

B. These chemicals, components, materials and products shall bear a proper certification mark or the owner shall have documentation of their certification.

C. Only chemicals authorized in the construction permit or subsequently authorized by the commissioner and in compliance with subsection A of this section shall be used to treat drinking water or added to drinking water.

D. Chemical containers shall be fully labeled to include chemical name, purity and concentration, supplier name and address, precautions in handling, expiration date if available, and requirements of VOSH.

12VAC5-590-520. Waterworks capacity ~~expansion~~.

~~A. At such time as the water production of a community waterworks reaches 80% of the rated capacity of the waterworks for any consecutive three-month period, the owner shall cause plans and specifications to be developed for expansion of the waterworks to include a schedule for construction; however, if it can be shown by the owner that growth within the service area is limited and will not exceed the rated capacity of the waterworks or if unusual transient conditions caused production to reach the 80% level, preparation of plans and specifications for expansion will no longer be required.~~

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 a written plan within 30 days to address capacity needs. This plan shall be evaluated by the Department and corrective actions shall be approved by the commissioner.

~~B. All waterworks shall provide metering of total water production.~~

B. The commissioner may require the owner to reevaluate a well source capacity by conducting a yield and drawdown test in accordance with 12VAC5-590-840 H when the well has demonstrated declining yield.

The following sections are adopted from the federal regulations. Detailed text is not included.

12VAC5-590-530. Reporting.

12VAC5-590-531. Reporting requirements for filtration treatment and disinfection treatment.

12VAC5-590-532. Reporting requirements for lead and copper.

12VAC5-590-540. Public notices.

12VAC5-590-545. Consumer confidence reports.

12VAC5-590-546. Regulated contaminants for the consumer confidence reports and public notification.

12VAC5-590-550. Recordkeeping.

12VAC5-590-560. Safety.

~~Since its trained personnel is the waterworks' most important asset, an important phase of waterworks operation is the protection of personnel through an active safety program; therefore, it is strongly recommended that every waterworks institute a safety program.~~ The owner shall institute a safety program to inform personnel of the known hazards, preventive measures, and emergency procedures from the operation of the waterworks in accordance with VOSH requirements.

12VAC5-590-565. Source Water Protection.

A. Counties, cities, and towns that are waterworks owners may exercise their authority pursuant to §15.2-2109 of the Code of Virginia to protect their waterworks from pollution or injury.

B. Any 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 waterworks owner and the commissioner.

C. Waterworks owners should develop source water protection plans for all their sources and report ongoing or completed protection initiatives to the commissioner.

12VAC5-590-570. Operational ~~report forms.~~ reporting requirements.

~~All waterworks required to report information to the department shall use the forms approved by the division.~~

A. Monthly operational reports.

1. All classified waterworks are 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. All classified waterworks using conventional filtration shall report using the Monthly Operating Report form approved by the Department. All other classified waterworks shall report the required information specified in Tables 570.1 to 570.13, based on the treatment processes employed. Monitoring data shall be collected for each day operating staff attended the facilities, unless otherwise specified.

3. All unclassified waterworks are required to quarterly report the following information to the department no later than the 10th of the month following the calendar quarter which the monitoring period occurred.

4. All unclassified waterworks that are using any of the treatment processes described in Tables 570.2-570.13 are 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 to 570.13 based on the treatment processes employed. The monitoring data shall be collected at a minimum frequency as established by the Department.

5. The commissioner may vary the reporting requirements on a case-by-case basis.

Table 570.1.
Baseline Data - All Waterworks.

PWSID 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, gallons
Total source water treated, gallons
Total finished water produced, gallons (monthly for each Entry Point) and/or Total water purchased, gallons (monthly at each consecutive connection)
Operator Name (printed and signature)
Operator Classification (Class 1 – 6)

Operator DPOR Certification No.
Name and contact information of the emergency contact person (text, voice phone number)

[a]Required for unclassified waterworks.

Table 570.2.
Chlorine Disinfection.

Chlorine compound used (chlorine gas, calcium hypochlorite or sodium hypochlorite)
Amount of chlorine compound used at each application point, pounds
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.
Re-Chlorination in Distribution System.

Chlorine compound used (chlorine gas, calcium hypochlorite or sodium hypochlorite)
Amount of chlorine compound used at each application point, pounds
Free chlorine residual concentration before re-chlorination, mg/L
Free chlorine residual concentration after re-chlorination, 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
Finished water iron and manganese concentrations, mg/L (each filter)
Finished water pH, S.U. (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, S.U. (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, Lbs/gal/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, Lbs/gal/day (average)
Source water pH, S.U.
Finished water (Entry Point) pH, S.U.
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 CaCO3 (each source)
Softener effluent hardness, mg/L as CaCO3 (each unit)
Stabilization chemical type, weight, daily dosage
Finished water (Entry Point) pH, S.U.
Finished water (Entry Point) alkalinity, mg/L
Finished water (Entry Point) hardness, as CaCO3

Table 570.10.
Fluoridation.

Chemical used (manufacturer and product name)
Fluoride used, lbs
Fluoride dosage, mg/L
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, gallons
Filtrate volume, gallons
Recirculated during suspension mode (volume or % of feed flow)
Waste volume, gallons
Maximum stabilized flux, gdf
Source water turbidity, NTU bench test
Source water turbidity, NTU in line (collected at same time as bench test)
Source water turbidity, NTU in-line (maximum)

Source water alkalinity, mg/L
Source water hardness, mg/L
Source water temperature, ^{o}C
Source water pH , S.U.
Filtered water turbidity, NTU bench test
Filtered water turbidity, NTU in line (collected at same time as bench test)
Filtered water turbidity, NTU in-line (maximum)
Pressure loss across pre-filter (psi)
Number of membrane modules in use
Direct integrity test time
Direct integrity test starting pressure, psi (each module)
Direct integrity test final pressure, psi
Direct integrity test duration, minutes
Direct integrity test pressure decay rate, psi/minute
Direct integrity test log removal value (LRV)
Trans-membrane pressure prior to 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 with dates completed)
Module repairs/replacements (Itemized with dates repairs/replacements)

Table 570.12.
Reverse Osmosis.

Hours unit in operation
Pre-filter inlet pressure, psi
Pre-filter outlet pressure, psi
RO Inlet pressure, psi
RO outlet pressure, psi
Total permeate flow, gallons

Total monthly permeate flow, gallons
Concentrate flow (bypass), gallons
Finished water flow, gallons
Total finished water (Entry Point) flow, gallons
Pre RO TDS, mg/L
Post RO TDS, mg/L
Pre RO turbidity, NTU
Post RO turbidity, NTU
Pre RO conductivity, uS/cm
Post RO conductivity, uS/cm
Finished water conductivity, uS/cm
Source water pH, S.U.
Permeate pH, S.U.
Finished water (Entry Point) pH, S.U.
Module repairs/replacements (Itemized with dates repairs/replacements)

Table 570.13.
UV Disinfection.

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
UV Intensity setpoint, W/m^2 (if using intensity setpoint approach)
UV Intensity for each reactor, minimum, W/m^2 (if using intensity setpoint approach)
UV intensity sensor calibration date(s) for each reactor (if using intensity setpoint approach)

To receive disinfection credit, the following shall also be reported:

Number of off-specification events
Total off-specification volume, gallons
Percent off-specification volume, gallons

Required dose, mJ/cm^2 (if using calculated dose approach)
UV Transmittance (UVT) for each reactor, percentage (if using calculated dose approach)
Calculated dose for each reactor, minimum, mJ/cm^2 (if using calculated dose approach)
Validated dose for each reactor, minimum, mJ/cm^2 (if using calculated dose approach)
UVT analyzer calibration date(s) (if using calculated dose approach)
Sensor correction factor

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 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.

~~Article 4~~
~~Cross Connection Control and Backflow Prevention in Waterworks~~

12VAC5-590-580. General requirements for cross-connection control and backflow prevention.

A. ~~The purpose of this article is to require as a condition for the issuance and continued use of the operation permit for the waterworks that each owner of a waterworks~~ Every owner shall establish and enforce a ~~program of cross connection control and backflow prevention for each waterworks~~ cross connection control program (CCCP) in accordance with 12VAC5-590-360 with the goal of preventing the intrusion of contamination into the distribution system via cross connections and backflow. ~~The cross connection control and backflow prevention program shall be approved by the division prior to issuance of the operation permit (see Appendix I).~~

B. The owner shall not install or allow to be installed a water service connection to any premises where cross connections to a waterworks or a consumer's water supply system is known to exist, unless the cross connections are adequately safeguarded to the satisfaction of the owner and the commissioner.

C. The owner shall not install or allow to be installed any water service connection whereby water from an auxiliary water system may enter a waterworks or consumer's water supply system, unless the auxiliary water system is a permitted waterworks or permitted source for use during an emergency.

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.

12VAC5-590-590. ~~Cross connections.~~ (Repealed.)

~~A. The purveyor shall not install, maintain, or allow to be installed a water service connection to any premises where cross connections to a waterworks or a consumer's water system may exist unless such cross connections are abated or controlled to the satisfaction of the water purveyor or the division.~~

~~B. The purveyor shall not install, maintain, or allow to be installed any connection whereby water from an auxiliary water system may enter a waterworks or consumer's water system unless the auxiliary water system and the method of connection and use of such system shall have been approved by the water purveyor and by the division.~~

12VAC5-590-600. CCCP Responsibilities.

A. ~~General. Effective cross connection control requires the cooperation of the water purveyor, the building official, the consumer, the Virginia Department of Health, and the backflow prevention device tester. B. Water purveyor. 1. The purveyor shall establish or cause to be established and operate a cross connection control and backflow prevention program.~~ The owner shall establish and operate a (CCCP) consistent with the extent of the distribution system and the type of consumer served. This program shall include at least one designated individual ~~who shall be responsible for the inspection of the waterworks for cross connection and backflow prevention control~~ to be in charge of the CCCP. Requirements for this position shall include training and experience in cross connection control programs. ~~This program shall be carried out in accordance with the Uniform Statewide Building Code and shall be a continuing program.~~

~~2. Suggested elements of this program are contained in Appendix I. The purveyor has full responsibility for water quality and for the construction, maintenance, and operation of the waterworks beginning at the water source and ending at the service connection.~~

~~3. The purveyor shall have thorough inspections and operational tests made at least annually of backflow prevention devices which are required and installed at the service connection.~~

B. The owner shall establish appropriate procedures to complete annual assessments of consumers' water supply systems, and shall determine both the degree of hazard and the appropriateness of existing safeguards.

C. The owner shall establish procedures for completing operational tests for testable backflow prevention assemblies, devices, and methods installed at least annually and after installation, relocation, or repairs.

D. In lieu of annual assessments and operational tests, the owner may provide a public education program to residential customers, and commercial customers whose water supply system is similar in use, size, and complexity to a residential system, where there are no known or suspected high hazards as identified in Table 630.1.

1. The public education program shall be designed to prompt consumer self-assessments, increase the awareness of cross connections, and inform the consumer of the public health hazards of backflow.

2. The CCCP public education program shall describe:

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 reduce the hazards at the point-of-use; and

e. Sources for additional information.

~~4. In the event of backflow of pollution or contamination into the waterworks, the purveyor~~

E. The owner shall promptly take or cause corrective action, to confine and eliminate the pollution or contamination. The purveyor shall immediately notify the division when backflow occurs. 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. A required backflow prevention assembly is not installed, tested, and maintained in accordance with the applicable sections of this chapter;

2. A required backflow prevention assembly has been removed or bypassed;

3. An unprotected or inadequately protected cross connection is known to exist on the premises and the owner has determined that there is inadequate backflow prevention at the service connection.

F. The owner shall maintain an inventory of all assemblies, methods, and devices required and installed under 12VAC5-590-610.

G. The owner shall maintain records related to the CCCP implementation, and any other records required by the commissioner in accordance with 12VAC5-590-550.

H. 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 to the Department in the most expeditious manner, and 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.

~~5. The purveyor shall take positive action to ensure that the waterworks is adequately protected at all times. If a cross connection exists or backflow occurs into a consumer's water system or if the pressure in the waterworks is lowered below 10 psi gauge, the purveyor may discontinue the water service to the consumer and water service shall not be restored until the deficiencies have been corrected or eliminated to the satisfaction of the purveyor.~~

12VAC5-590-610. Containment ~~policy~~ of backflow.

A. ~~An approved backflow prevention device~~ Backflow prevention assemblies or backflow elimination methods shall be installed (i) at ~~each~~ the service connection to a consumer's water supply system ~~where, in the judgment of the water purveyor or the division, a health, pollution, or system hazard to the waterworks exists. B. When, as a matter of practicality, the backflow prevention device cannot be installed at the service connection, the device may be~~ or (ii) located downstream of the service connection but prior to any unprotected takeoffs.

B. Where the consumer's water supply system is not intricate or complex and where actual or potential cross connection hazards can be eliminated or reduced, point-of-use isolation protection by application of appropriate backflow prevention assemblies or devices or backflow elimination methods, complying with the USBC, may be applied in lieu of containment.

C. A backflow prevention ~~device~~ assembly or backflow prevention method shall be installed ~~at each service connection to a consumer's water system serving premises~~ where the following conditions exist:

1. ~~Premises on which any~~ 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~~ including process fluids or used waters ~~originating from a~~

~~waterworks which are no longer under the control of the water purveyor)~~ connected to the consumer's water supply system;

2. ~~Premises having~~ There exists internal cross connections that, in the judgment of the ~~water purveyor~~ owner or the ~~division~~ commissioner, may not be easily correctable or have intricate plumbing arrangements ~~which~~ that make it impracticable to determine whether or not cross connections exist;

3. ~~Premises where, because of~~ There are security requirements or other prohibitions or restrictions~~, it is impossible or impractical to make a complete cross connection survey~~ that prevent the assessment of all potential cross connections that may impair the quality of the water delivered;

4. ~~Premises having~~ There is a repeated history of cross connections being established or reestablished;

5. There are fire protection systems, lawn sprinkler systems, or irrigation systems that are connected directly to the waterworks with a separate service connection;

6. There are frost-free yard hydrants, outdoor drinking fountains or other appurtenances with below-grade weep holes subject to contamination that are connected directlt to the waterworks with a separate service connection.

~~5. Premises having fire protection systems utilizing combinations of sprinklers, fire loops, storage tanks, pumps, antifreeze protection, or auxiliary water sources including siamese connections (fire loops and sprinkler systems with openings not subject to flooding, and containing no antifreeze or other chemicals, no separate fire protection storage, or auxiliary sources, will not normally require backflow prevention); and~~

~~6. Other premises specified by the division or the purveyor when cause can be shown that a potential cross connection hazard not enumerated above exists.~~ 7. Cause can be shown by the commissioner or owner that a potential cross connection hazard exists.

D. ~~Premises~~ The owner shall ensure that premises having booster pumps or fire pumps connected directly to the waterworks or indirectly through the service connection shall be equipped with ~~a low pressure regulating or cutoff device to shut off the booster pump when the pressure in the waterworks drops to a minimum of 10 psi gauge~~ control devices to prevent a reduction of pump suction line pressure to less than 20 psig.

E. ~~An approved~~ A backflow prevention ~~device~~ assembly or backflow elimination method shall be installed at ~~each service connection to a consumer's water system serving~~, but not necessarily limited to, the following types of facilities:

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. Lawn sprinkler systems, and irrigation systems;~~

~~12. Fire service systems;~~

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 products plants and printing plants;

18. Pesticide or exterminating companies and their vehicles with storage or mixing tanks;

19. Lawn care companies and their vehicles with storage or mixing tanks;

~~19.~~ 20. Schools or colleges with laboratory facilities;

~~20. Highrise buildings~~ 21. Buildings with four or more stories ~~(four or more stories)~~;

~~21. Multiuse commercial, office, or warehouse facilities; and~~

22. Others specified by the ~~purveyor~~ owner or the ~~division~~ commissioner 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. Devices used shall be appropriately certified or approved to match the requirements of this section.

12VAC5-590-620. Type of protection required. (Repealed.)

~~The type of protection required shall depend on the degree of hazard which exists or may exist and on the method of potential backflow. Backflow occurs either by back pressure or by back siphonage.~~

~~The degree of hazard, either high, moderate, or low, is based on the nature of the contaminant; the potential of the health hazard; the probability of the backflow occurrence; and the effect on waterworks structures, equipment, and appurtenances used in the storage, collection, purification, treatment, and distribution of pure water.~~

~~Table 2.10 shall be used as a guide to determine the degree of hazard for any situation.~~

~~A. Air gaps give the highest degree of protection and shall be used whenever practical to do so in high hazard situations subject to back pressure.~~

~~B. An air gap separation and a reduced pressure principle backflow prevention device will protect against back pressure when operating properly. Vacuum breakers will not protect against back pressure, but will protect against back-siphonage when operating properly.~~

~~C. Backflow prevention devices consisting of dual independent check valves with or without an intermediate atmospheric vent shall only be used in low hazard situations.~~

~~D. Barometric loops are not acceptable.~~

~~E. An interchangeable connection or change-over device has limitations which prevent its use where back pressure is present or may occur, the auxiliary supply is not an approved source, or the waterworks line pressure is less than 20 psi. Since this type connection is one of the easiest to bypass, the use of this type device will be approved only as a temporary and continuously supervised arrangement. In most instances, an approved device or method must be included and approved by the purveyor and division.~~

~~F. Reduced pressure principle type backflow preventers shall not be installed in pits or areas subject to flooding.~~

12VAC5-590-630. Backflow prevention assemblies, devices, and methods for containment.

A. Any backflow prevention device shall be of the approved type and shall comply with the Uniform Statewide Building Code.

~~B. Any backflow prevention device shall be installed in a manner approved by the water purveyor and in accordance with the Uniform Statewide Building Code.~~

B. General Safeguards

1. The type of safeguard required, either an assembly device or cross connection elimination method, 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 the nature of the contaminant; the potential of the health hazard; the potential method of backflow (either by backpressure or by backsiphonage); and 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 or unhealthy of questionable 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.	The contaminant would not disrupt service of piped water for human consumption.
Examples - sewage, used water, nonpotable water, auxiliary water systems, and mixtures of water and other liquids, gases, or other toxic or hazardous chemicals.	Examples - food residuals, nontoxic chemicals, and nonhazardous chemicals.

3. Table 608.1 of the plumbing code referenced in §13VAC5-63-320 A of the USBC shall be used to determine appropriateness of assembly and device application for containment.

C. Backflow prevention assemblies used for containment shall be listed by the ASSE.

~~C. Existing backflow prevention devices approved by the purveyor and the division prior to the effective date of this chapter shall, except for inspection, testing, and maintenance requirements, be excluded from the requirements of 12VAC5-590-600 A and B if the water purveyor and the division are assured that the devices will protect the waterworks.~~

D. Backflow prevention devices or assemblies with openings, outlets, or vents that are designed to operate or open during backflow prevention shall not be installed in areas subject to flooding or in pits and shall be installed in a free atmosphere. They shall not be installed in such a manner as to be able to be bypassed.

E. Persons testing and repairing backflow prevention assemblies may be required to be certified by the Virginia Department of Professional and Occupational Regulation, Virginia Board for Contractors, under the Tradesman Regulations, to test and repair assemblies.

F. Backflow prevention assemblies and devices shall be installed, maintained, and repaired in accordance with the ASSE listing and the manufacturer's specifications.

~~TABLE 2.10. DETERMINATION OF DEGREE OF HAZARD~~	
~~Premises with one or more of the following conditions shall be rated at the corresponding degree of hazard.~~	
~~High Hazard~~	~~The contaminant would be toxic, poisonous, noxious or unhealthy.~~
~~-~~	~~A health hazard would exist.~~
~~-~~	~~A high probability exists of a backflow occurrence either by back pressure or by back siphonage.~~
~~-~~	~~The contaminant would disrupt the service of piped water for human consumption.~~
~~-~~	~~Examples - sewage, used water, nonpotable water, auxiliary water systems, toxic or hazardous chemicals, etc.~~
~~Moderate Hazard~~	~~The contaminant would only degrade the quality of the water aesthetically or impair the usefulness of the water.~~
~~-~~	~~A health hazard would not exist.~~
~~-~~	~~A moderate probability exists of a backflow occurrence either by back pressure or by back siphonage.~~
~~-~~	~~The contaminant would not seriously disrupt service of piped water for human consumption.~~
~~-~~	~~Examples - food stuff, nontoxic chemicals, nonhazardous chemicals, etc.~~
~~Low Hazard~~	~~The contaminant would only degrade the quality of the water aesthetically.~~
~~-~~	~~A health hazard would not exist.~~
~~-~~	~~A low probability exists of the occurrence of backflow primarily by back siphonage.~~

-	~~The contaminant would not disrupt service of piped water.~~
-	~~Examples - food stuff, nontoxic chemicals, nonhazardous, chemicals, etc.~~

DEPARTMENT OF HEALTH

Proposed Amended Waterworks Regulations

Part III

Manual of Practice for Waterworks Design

~~Article 1~~

~~General~~

Contents

12VAC5-590-640. General design considerations.

A. Waterworks shall conform ~~with~~ to the Public Water Supply Law, Article 2 of Chapter 6 of Title 32.1 of the Code of Virginia. ~~The engineer shall confer with the division before proceeding with the detailed designs. The engineering report and preliminary plan shall include plant site selection. Ordinarily,~~ Community waterworks shall be designed to provide for the estimated ~~population~~ water demand 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. ~~Operation and maintenance manuals are required for treatment facilities and pumping facilities.~~

B. Waterworks design shall be based on sound engineering practice substantiated in the engineer's design and approved by the commissioner. 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. Pump capacity and/or storage capacity 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 psi 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 Standard 61, or an approved equivalent.

12VAC5-590-650. Objectives of a waterworks. (Repealed.)

~~A. The objectives of a waterworks are:~~

~~1. The production of pure water; and~~

~~2. The production of water appealing to the consumer.~~

~~B. To reach the objectives of a waterworks, finished water quality shall conform with Article 1 of Part II of this chapter.~~

12VAC5-590-660. Site location.

A. Wells and water treatment plants shall be located above the projected 100 year flood-plain elevation. Lower elevations 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. ~~Consideration should be given to~~ Functional aspects of the site shall be considered in design, including the convenience of transportation facilities to the ~~plant~~ site and ~~to~~ the availability of electric power from more than one source ~~of outside power~~.

12VAC5-590-670. Site size.

A. The area reserved around a well or spring site shall conform ~~with 12VAC5-590-820, 12VAC5-590-830, and~~ 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 disposal of treatment plant ~~wastes~~ residuals.

C. The disposal of water treatment plant ~~wastes~~ 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 best available technology.

A. The following shall be considered when selecting treatment processes ~~to achieve treatment goals~~: (i) The quality and variability of the source water, and (ii) Possible future changes in the quality and quantity of the source water.

~~A. The quality and variability of the source water.~~

~~B. Possible future changes in the quality of the source.~~

~~C. Water quality goals, including the growing desire of the public for better water.~~

~~D. When removal of contaminants for which BAT has been specified is necessary, processes classified as BAT shall be employed.~~

~~E. When treatment technique requirements have been established in lieu of MCLs, processes specified by such requirements shall be employed.~~

~~F. POE or POU devices shall not be utilized for long-term compliance with PMCLs. Such devices may be considered for short-term, interim use, as a condition of a variance or exemption issued by the commissioner.~~

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 commissioner.

E. When treatment technique requirements have been established in lieu of PMCLs or Action Levels, 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.

12VAC5-590-690. ~~Capacity of waterworks.~~ (Repealed.)

~~The design capacity of the waterworks shall exceed the maximum daily water demand of the system. Waterworks shall normally be designed on the following basis of water consumption. If deviations are made, they shall be based on sound engineering knowledge substantiated in the designer's report and approved by the division.~~

~~A. Daily water consumption rates (annual daily water demand):~~

~~Dwellings, per person~~	~~100 gpd~~
~~High schools with showers, per person~~	~~16 gpd~~
~~Elementary schools without showers, per person~~	~~10 gpd~~
~~Boarding schools, per person~~	~~75 gpd~~
~~Motels at 65 gallons per person, minimum per room~~	~~130 gpd~~
~~Trailer courts at three persons per trailer, per trailer~~	~~300 gpd~~
~~Restaurants, per seat~~	~~50 gpd~~
~~Interstate or through highway restaurants, per seat~~	~~180 gpd~~
~~Interstate rest areas, per person~~	~~5 gpd~~
~~Service stations, per vehicle served~~	~~10 gpd~~
~~Factories, per person, per eight-hour shift~~	~~15-35 gpd~~
~~Shopping centers, per 1,000 sq.ft. of ultimate floor space~~	~~200-300 gpd~~
~~Hospitals, per bed~~	~~300 gpd~~
~~Nursing homes, per bed~~	~~200 gpd~~
~~Home for the aged, per bed~~	~~100 gpd~~
~~Doctor's office in medical center~~	~~500 gpd~~
~~Laundromats, 9 to 12# machines, per machine~~	~~500 gpd~~
~~Community colleges per student and faculty member~~	~~15 gpd~~
~~Swimming pools, per swimmer~~	~~10 gpd~~
~~Theaters, drive-in type, per car~~	~~5 gpd~~
~~Theaters, auditorium type, per seat~~	~~5 gpd~~
~~Picnic areas, per person~~	~~5 gpd~~
~~Camps, resort, day and night with limited plumbing, per camp site~~	~~50 gpd~~
~~Picnic areas, per person~~	~~5 gpd~~
~~Luxury Camps with flush toilets, per camp site~~	~~100 gpd~~

~~B. Minimum acceptable effective finished water storage for human consumption shall not be less than 200 gallons per equivalent residential connection at minimum pressure.~~

~~C. All waterworks shall provide at least a minimum working (under flow) pressure of 20 psi at the service connection based on the greater of maximum hour or maximum day plus applicable~~

~~fire flows. Applicable fire flows shall be selected by coordination between the water supply owner, design consultant, local officials and local fire marshal. When the number of residential units is less than 1,000, the formula $Q=11.4N^{0.544}$; is acceptable for estimating maximum hour domestic demand flow, where Q=total gallons per minute and N=total number of residential units. The division can require a higher design pressure if indicated by site conditions.~~

~~D. A waterworks utilizing wells as the sole source of supply shall provide source capacity of a minimum of 0.5 gallons per minute per equivalent residential connection.~~

~~E. Waterworks serving 50 or more residential connections with wells as the source of supply shall provide at least two water sources that do not hydraulically interfere with another source of public water supply. Consideration shall be given to requiring each source to be of a minimum yield so its reliability is realistic. The secondary well should be rated at 20% of the waterworks capacity as a minimum.~~

~~F. Waterworks serving less than 50 residential connections with wells as the source of supply shall provide or have access to an auxiliary pump stored or stocked locally or they shall provide 48 hours of total effective storage volume based on water usage.~~

12VAC5-590-700. Metering total water production.

~~A. Waterworks providing chlorination only shall meter the water prior to treatment~~ The design of all waterworks shall provide metering of total source water withdrawn and finished water produced.

~~B. Waterworks providing iron or manganese removal, or both, shall meter the water prior to treatment.~~

~~C. Waterworks providing softening by ion exchange, shall meter all water treated and total water delivered to the distribution system. D. Waterworks providing turbidity removal or softening by precipitation, or both, shall meter the water prior to and subsequent to treatment.~~

~~E. All waterworks shall provide metering of total water production.~~

12VAC5-590-710. ~~Site layout.~~ (Repealed.)

~~A. Functional aspects of site layout shall be considered.~~

~~B. Site grading shall be provided.~~

~~C. Adequate site drainage shall be provided.~~

~~D. Walks shall be provided.~~

~~E. Access roads shall be provided.~~

~~F. Driveways shall be provided.~~

12VAC5-590-720. Building design and layout.

~~A. Adequate ventilation shall be provided.~~

~~B. Adequate lighting shall be provided.~~

~~C. Adequate heating shall be provided.~~

~~D. Adequate drainage shall be provided.~~

~~E. Adequate dehumidification equipment shall be provided.~~

~~F. Accessibility of equipment for operation, servicing, and removal shall be provided.~~

~~G. Flexibility of operation shall be provided.~~

~~H. Safety precautions shall be considered. Reference the applicable health and safety standards of the Virginia Department of Labor and Industry for the appropriate requirements.~~

~~I. Convenience of operation shall be considered.~~

~~J. Separate rooms for chemical storage and feed equipment to reduce dust problems shall be considered.~~

~~K. Sanitary facilities shall be provided at all waterworks installations requiring an operator in attendance at all times during operation.~~

~~L.~~ A. In accordance with Chapter 6 of Title 36 of the Code of Virginia, waterworks building design is subject to all applicable requirements of the USBC. Building design and layouts shall include, but not be limited to, adequate ventilation, lighting, heating, drainage, dehumidification, accessibility to equipment for operation, servicing, and removal.

B. In accordance with VOSH requirements, waterworks building design and layout shall incorporate safety provisions to protect waterworks personnel and visitors, including 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 ~~should~~ 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.

~~M. No conduit or basin containing filtered water shall have a common division walls with another conduit or basin~~ 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 requirements shall be considered.

F. Wherever pipes pass through walls of concrete structures, extra wall castings to facilitate expansion and future uses shall be considered.

12VAC5-590-725. Automated monitoring and control systems.

The design of computers, including 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 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 or panels 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 should be considered.

12VAC5-590-730. ~~Standby power capability~~ Alternate power sources.

~~Standby power capability may be required by the division so that water may be treated or pumped, or both, to the distribution system in order to maintain a minimum level of service during an emergency.~~

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 design, in order to maintain a minimum level of service during an electrical power outage.

12VAC5-590-740. Maintenance and servicing of equipment. (Repealed.)

~~Adequate facilities must be provided for the maintenance and servicing of automatic equipment.~~

12VAC5-590-750. ~~Shop space and storage.~~ (Repealed.)

~~Adequate facilities should be included for shop space and storage consistent with the designed facilities.~~

12VAC5-590-760. Laboratory facilities.

~~Laboratory equipment and facilities shall be compatible with the raw water source, intended design of the water treatment plant, and the complexity of the water treatment involved.~~

A. ~~Testing equipment provided shall be adequate for the purpose intended and recognized procedures must be utilized.~~ 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. ~~Sufficient~~ The design of community and nontransient noncommunity waterworks shall provide for adequate floor and bench space, adequate ventilation, adequate light, ~~storage room, laboratory sink, and auxiliary facilities shall be provided. Office space is not included in the following specified laboratory sizes:~~ adequate separation of incompatible activities, adequate environmental control and auxiliary facilities sufficient to carry out reliable testing.

~~1. Waterworks providing iron or manganese removal, or softening by ion exchange should provide a laboratory with a minimum of 64 square feet of floor area and 20 square feet of bench area.~~

~~2. Waterworks providing turbidity removal or softening by precipitation, or both, should provide a laboratory with a minimum of 200 square feet of floor area and 65 square feet of bench area.~~

~~3. Waterworks providing turbidity removal or softening by precipitation, or both, and in-plant bacteriological analysis should provide a laboratory with a minimum of 300 square feet of floor area and 100 square feet of bench area.~~

C. ~~When a bacteriological laboratory is required a separate room of adequate space shall be provided~~. Certified analytical laboratory facilities analyzing drinking water shall comply with 1VAC30-41.

12VAC5-590-770. ~~Sample taps~~ Sampling and monitoring equipment.

A. Sample taps shall be provided so that water samples can be obtained from each ~~water~~ source water and each entry point to the distribution system. At waterworks providing treatment, sample taps shall be provided from each unit ~~operation of treatment, with the taps being located at the master control sink in the laboratory. Taps shall be consistent with sampling needs and shall not be of the petcock type~~ treatment process and from the finished water.

1. For surface water treatment plants, a master control sink shall monitor source water, chemically treated water, settled water, combined filter water, and finished water.

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 fifteen minutes. Each data point shall be a single result at that time, and not an average of previous data points. The recording equipment shall be capable of producing a paper copy (or equivalent electronic file) showing daily trends, including maximum, minimum, and average values.

12VAC5-590-780. ~~Wall castings.~~ (Repealed.)

~~Consideration shall be given to providing extra wall castings built into the structure to facilitate expansion and future uses wherever pipes pass through walls of concrete structures.~~

12VAC5-590-790. ~~Water supply service~~ Process water.

~~The water supply service for treatment facilities shall be taken from a point after there has been thorough mixing of all chemicals added to the water.~~ Process water is defined as water used for dissolving dry chemicals, diluting liquid chemicals, operating chemical feeders,

treatment facilities or equipment. The process water shall be taken from the finished water after thorough mixing of all chemicals added. An approved backflow or backsiphonage prevention device shall be installed on the process water supply pipe prior to connection to the treatment process or equipment.

12VAC5-590-800. ~~Disinfection.~~ (Repealed.)

~~All pipes, tanks, and equipment which can convey or store potable water shall be disinfected prior to being placed in service. Plans and specifications shall outline the procedures and include the disinfectant dosage, contact time, and method of testing the results of the procedure.~~

~~1. Forms of chlorine for disinfection.~~

~~a. Liquid chlorine. The use of liquid chlorine shall be acceptable only when suitable equipment is available and only under the direction of a person trained to handle liquid chlorine. Emergency handling equipment shall be provided.~~

~~It will normally require 4.2 lbs. of liquid chlorine (supplied under pressure in steel containers) to produce a concentration of 50 mg/L of available chlorine in 10,000 gallons of water.~~

~~b. Calcium hypochlorite. Granular and tablet forms are available (both with 65% available chlorine). It will normally require 6.5 lbs. of calcium hypochlorite to produce a concentration of 50 mg/L of available chlorine in 10,000 gallons of water.~~

~~c. Sodium hypochlorite. This is supplied in strengths of 5.25% to 16% available chlorine. The required amount of sodium hypochlorite to produce a 50 mg/L concentration of available chlorine in 10,000 gallons of water can be calculated from the following formula:~~

$$\frac{50}{\text{\% available chlorine}}$$

~~2. Methods of disinfection other than chlorination may be considered by the division on a case-by-case basis.~~

~~3. Testing of water following disinfection:~~

~~a. All chlorine residual determinations shall be made using only those methods approved by the division; and~~

~~b. Two water samples for bacteriological analysis must be collected at least 24 hours apart and analyzed by a certified laboratory. The results of these samples must indicate no coliform contamination before the pipe, tanks, or equipment can be utilized as part of the waterworks. If contamination is indicated, then the disinfection procedure must be repeated.~~

12VAC5-590-810. ~~Paints, coatings, sealers, or liners~~ Chemicals, components, materials, and products.

~~Paints, coatings, sealers or liners which contact raw, partially treated, or potable water and are used in pipes, tanks, or equipment which can convey or store these waters shall be approved by the division before application.~~ All chemicals, components, materials and products that will be in contact with raw, partially treated, or potable water shall comply with 12VAC5-590-515.

~~Article 2~~
~~Source Development~~

12VAC5-590-820. ~~General~~ New water source selection and sampling.

A. Preference shall be given to the best available sources of supply ~~which~~ that present minimal risks of contamination from ~~wastewaters~~ point and nonpoint pollution sources, ~~which~~ that contain a minimum of impurities that may be hazardous to health, and that give the greatest chance of ensuring a sufficient quantity of potable water.

B. In all cases, sources shall be selected and maintained on a basis ~~which~~ that will assure that the water is continuously amenable to available treatment processes. In selecting the source of water to be developed, the ~~designing engineer must~~ owner shall prove to the satisfaction of the commissioner that the water ~~which is to be delivered to the consumers shall comply with all applicable PMCLs of the board with respect to bacteriological, physical, chemical and radiological qualities~~ to be delivered to the consumers will comply with 12VAC5-590-340.

C. All water samples for bacteriological, chemical, physical and radiological analyses ~~must~~ shall be submitted to the ~~Commonwealth of Virginia, Department of General Services, Division of Consolidated Laboratory Services~~ DCLS or to a testing laboratory certified by the ~~Division of Consolidated Laboratory Services~~ DCLS. ~~All bacteriological analyses must be performed at laboratories in accordance with analysis 12VAC5-590-370 A and 12VAC5-590-480 B 2~~ 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~~ an assessment of the factors, both natural and man-made, ~~which~~ that will affect the quality ~~of the water at the source~~ and quantity of the water supply. The results of the ~~sanitary survey~~ assessment shall be submitted to the ~~division~~ Department with the design. ~~Such survey and study~~ The assessment shall include, but shall not be limited to:

1. Obtaining samples over a ~~sufficient~~ period of time acceptable to the commissioner, to assess the bacteriological, physical, chemical, and radiological characteristics of the water supply;

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. Locating all potential sources of pollution within 5 miles upstream from the surface water intake; and

~~4~~5. Assessing the degree of hazard to the ~~source by possible spillage~~ surface water supply resulting from a potential release of materials that may be toxic, harmful, or detrimental to treatment processes.

C. ~~Intake~~ Surface water 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 at impoundments or reservoirs;

3. Screens on intake ports with provisions for adequate cleaning. Screen opening size and velocity may be restricted by federal or state permit;

4. Prevention of flooding of access walkways and control valves of intakes on multiple purpose reservoirs; and

5. ~~Velocity of flow through~~ Flow velocity through the inlet structure ~~such~~ so 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 ~~should~~ shall be protected from contamination during construction. All ~~public water supply~~ wells intended to serve a waterworks shall be constructed by ~~registered Virginia contractors~~ 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 ~~potable water~~ 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 that screen multiple aquifers.

2. Geophysical logging and formation sampling shall be required for all wells during construction, in addition to submitting a completed Form GW-2.

3. Observation and production wells shall be constructed with gravel packs and grout in a manner that prevents leakage 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.

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.

C. All groundwater sources must be analyzed for chemical, physical, radiological and bacteriological quality ~~in order to determine treatment requirements~~ as described in 12VAC5-590-840 K. ~~Groundwater containing total coliform concentrations of less than 100 and more than three organisms per 100 milliliters based on the geometric mean of 20 or more samples shall be disinfected. Groundwater containing total coliform concentrations of 100 or more organisms per 100 milliliters based on the geometric mean of 20 or more samples constitutes unacceptable contamination for disinfection only. Groundwater with widely fluctuating or increasing bacteriological results may be determined by the division to be unsuitable for disinfection treatment alone.~~

~~The class of well to be constructed shall be determined by the division. All well lot, well location, and well construction requirements contained in this section may be varied by the division as specific geologic and site conditions dictate.~~

~~1.~~ D. Minimum well lot requirements:

~~a.~~ 1. The well lot shall provide a distance of at least 50 feet from the well to all property lines ~~of the well lot. Larger well lots may be required under certain conditions. Fencing of the well lot may be required under certain conditions;~~, unless the well serves a noncommunity waterworks and the setback distances are approved by the commissioner;

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 establishing additional well lots for future use.

~~b.~~ 3. If the well lot does not adjoin a public road, an ~~all-weather~~ access road shall be provided and an access easement recorded as part of the well lot;

~~c.~~ 4. The well lot shall be graded to divert surface runoff away from the well and to prevent ponding on the well lot;

~~d.~~ 5. The well lot or lots ~~must~~ and access to the lots shall be located by a survey, and a final plat plan and dedication document prepared and recorded as described in 12VAC5-590-200. ~~The final plat plan must agree with the preliminary plat plan with respect to size~~

~~and boundaries of the lot or lots selected for well or wells. One of the following must be submitted:~~

~~(1) A copy of the plat plan showing that it has been duly recorded and signed by the clerk of the circuit court for the jurisdiction where the well is located and giving the deed book and page number and date of recording will be required before a construction permit can be issued or~~

~~(2) If the well lot is identified on a recorded plan of the subdivision as a well lot, then this is acceptable, if recorded as indicated in subdivision A 1 d (1) above; and~~

~~e. In addition, a dedication document duly recorded with the clerk of the circuit court must be furnished stating that the well lot shall be used only for waterworks appurtenances as long as this lot is utilized as part of a waterworks.~~

~~2.~~ E. Minimum well location requirements:

~~a.~~ 1. The horizontal distance from the well to any septic tank, purification field, pit privy, cesspool, barnyard, ~~hog~~ animal feed lot, cemetery, geothermal well or source of similar contamination, as well as all surface runoff from ~~such~~ actual or potential sources of contamination, shall be at least 50 feet~~;~~.

~~b.~~ 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~~; and~~.

~~c. The horizontal distance from the well to any petroleum or chemical storage tank or pipe line or similar source of contamination shall be at least 50 feet, except that where plastic type well casing is used, the separation distance shall be at least 100 feet. This 100-foot separation may be obtained by an enlarged well lot, easements, deed restrictions, or other equivalent legal means.~~

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 storage fuel is propane or natural gas, or 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 full capacity containment system constructed of compatible material.

c. The liquid fuel line shall be located above grade, or enclosed in a protective casing if below grade, and the liquid fuel tank shall be provided with a paved and curbed parking pad at the tank filling location.

4. The commissioner may require a spill response plan if fuel is stored on the well lot.

F. The class of well to be constructed shall be determined by the commissioner. A Form GW-2 shall be completed and submitted to the Department with the project documents, in accordance with procedures in 12VAC5-590-200.

~~3~~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 ~~the casing~~ this depth be less than 100 feet ~~in depth;~~ below finished grade.

b. The diameter of the drill hole ~~to the depth required above~~ shall be at least three inches greater than the outside diameter of the couplings of the casing to be used~~; and~~.

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.

~~c.~~ d. The annular space around the casing shall be grouted to a depth of at least 100 feet in a manner satisfactory to the ~~division~~ commissioner. 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 ~~division~~ commissioner.

~~4.~~ 2. Minimum construction requirements for Class II wells. ~~This classification includes two types of construction, either of which is acceptable:~~

~~a. Type A wells in which the annular space around the casing is grouted a minimum of 20 feet from the surface:~~

~~(1) The well shall be drilled and cased to a depth of at least 100 feet; and~~

~~(2) The cased drill hole shall pass through at least the first 50 feet of unconsolidated formation such as caving sand, gravel or other material that will collapse against the casing;~~

~~b. Type B wells in which the annular space around the casing is grouted:~~

~~(1)~~ a. The well shall be drilled and cased to a depth sufficient to exclude undesirable groundwater, but in no case shall ~~the casing be less than 50 feet in length;~~ this depth be less than 50 feet below finished grade.

~~(2)~~ b. The diameter of the drill hole ~~to the depth required above~~ shall be at least three inches greater than the outside diameter of the couplings of the casing to be used~~;~~.

~~(3) The~~ 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~~; and~~.

~~(4)~~ d. The annular space around the casing shall be grouted to a depth of at least 50 feet in a manner satisfactory to the ~~division~~ commissioner. 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 ~~division~~ commissioner.

~~B. General well development requirements~~ G. Well construction materials and development:

1. Water used in well construction shall be from a ~~satisfactory~~ potable water source or from the well under construction.

2. Casing and liner pipe~~:~~.

a. ~~Shall be metallic pipe meeting ASTM, ANSI, AWWA or API specifications and standards applicable to wells.~~ Steel pipe meeting the requirements of ASTM A589/A589M, NSF/ANSI Standard 61, or AWWA Standard A100 shall be used. Dimensions shall conform to ~~the following table:~~ 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 ~~id~~	4.5	4.026	0.237	10.79	11.0 ÷

6 ~~id~~	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 ~~od~~	14.000	13.250	0.375	54.57	57.00
16	16.000	15.250	0.375	62.58	~~65.30~~
18	18.000	17.250	0.375	70.59	~~73.00~~
20	20.000	19.250	0.375	78.60	~~81.00 :~~
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 pipes may be approved following investigation by the division. The casing shall be PVC type 1120 (cell identification 12454), NSF approved for well casings meeting appropriate ASTM, ANSI, AWWA or API specifications and used to depths in conformance with the information contained in the following tables:~~ Plastic well casing shall be PVC meeting ASTM F480, NSF/ANSI Standard 61, or AWWA Standard A100. 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.

~~Maximum Allowable Depths of Installation~~
~~of~~
~~Polyvinyl Chloride (PVC) Thermoplastic~~
~~Water Well Casing~~

~~Type 1120 (12454)~~

~~Schedule Number~~	~~Nominal Diameter of PVC 1120~~								
	~~2~~	~~2.5~~	~~3~~	~~3.5~~	~~4~~	~~5~~	~~6~~	~~8~~	~~10~~
~~40-~~	~~560'~~	~~740'~~	~~485'~~	~~265'~~	~~291'~~	~~19-~~	~~143'~~	~~99'~~	~~74'~~
~~80-~~	~~1750'~~	~~2040'~~	~~1380'~~	~~1085'~~	~~912'~~	~~64-~~	~~395'~~	~~400'~~	~~340'~~

~~SDR No.~~	~~All Diameters of PVC 1120~~
~~SDR 41~~	~~25~~
~~SDR 32.5~~	~~50'~~
~~SDR 26~~	~~108'~~
~~SDR 21~~	~~212'~~
~~SDR 17~~	~~413~~
~~SDR 13.5~~	~~868'~~

c. Heavy weight casing pipe may be required under certain geologic and hydrostatic conditions~~; and~~.

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 ~~division~~ commissioner, and meeting the requirements of NSF/ANSI Standard 61, as applicable.

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 ~~which~~ 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 ~~should~~ shall be adequate to pass flows at a velocity of 0.1 ~~foot per second~~ ft/sec or less; and

c. Be installed so that exposure above the pumping level will not occur.

~~5. A water well completion report shall:~~

~~a. Be submitted to the division, the State Water Control Board and the owner; and~~

~~b. Provide all data requested on the most recent well completion form.~~

~~6. The yield and drawdown test data over a 48-hour minimum period shall be provided; however, in those areas where geologic conditions warrant, the required test period may be varied by the division.~~

~~7. Chemical conditioning shall be included in specifications as to method, equipment, chemicals, testing for residual chemicals, disposal of waste, and inhibitors used.~~

~~8.~~ 5. Grouting requirements.

a. Neat cement grout ~~is normally required and shall consist of cement (API Spec. 10, Class G cement or Class B similar to ASTM C150 TYPE II)~~ 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. ~~NOTE: When exceptional conditions require the use of a less fluid grout to bridge voids, a mixture of cement (ASTM C150 TYPE II), sand and water in the proportion of not more than two parts by weight of sand to one part of cement with not more than six gallons of clean water per 94 pound sack of cement may be used if approved by the division;~~ Other grout mixes may be approved by the commissioner 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 1-½ inches of grout around the protective casing, including couplings, if used.

(3) Prior to grouting~~, bentonite, Aquagel, or similar approved materials may be added to the annular opening, in the manner indicated for grouting; and~~ wells, suitable fill material such as bentonite, low strength cement/sand mix, or similar materials that have been approved by the commissioner shall be added to the annular opening below the grout zone to seal and stabilize these areas. In lieu of this requirement, the casing may be grouted for its entire depth.

c. ~~Protective casing~~ Casing shall be provided with sufficient centralizers attached to the casing to ~~permit~~ allow unobstructed flow and uniform thickness of the grout.

d. Where plastic well casing is used, the heat of hydration of cement mixtures and collapse of the casing shall be taken into consideration when choosing grout composition and placement.

~~9. Plumbness and alignment:~~

~~a. Every well shall be tested for plumbness and alignment;~~

~~b. The test method shall be clearly stated in specifications; and~~

~~c. Excessive kinks and bends shall not be acceptable.~~

~~10.~~ 6. To prevent tampering and contamination of the water source, 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 commissioner 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 supply 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 commissioner prior to 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 used, the location and geology of each well in the vicinity shall be evaluated. The commissioner my require that:

a. The yield and drawdown test be performed simultaneously on 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 may be required by a Professional Engineer or a Professional Geologist with experience in groundwater source evaluations.

4. The commissioner 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 a individual basis by the commissioner.

5. When a pumping test is required by the Department of Environmental Quality (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 commissioner prior to 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 6 ft by 6 ft.

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 commissioner.

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.

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.

~~11.~~ 1. Bacteriological quality~~:~~.

~~a. Every new, modified, or reconditioned groundwater source shall be disinfected after placement of the final pumping equipment; and~~

~~b. A series of nine consecutive negative samples for bacteriological examination or a series of 20 or more samples for most probable number (MPN) examination is required.~~

a. Bacteriological samples for new 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 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. These samples shall be analyzed for both total coliform density and E. coli density. More samples may be required by the commissioner, depending on the work performed.

~~12. Samples for chemical, physical and radiological analyses shall be submitted on every new, modified, or reconditioned well. The sample must be collected near the end of the pumping test and after the well water has cleared.~~

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 commissioner if supported by the source water assessment of vulnerability to contamination. Chemical sampling analysis for transient noncommunity waterworks 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 cleared. Chemical, physical, and radiological constituent testing for modified or reconditioned wells shall be determined on a individual basis by the commissioner.

~~13.~~ L. Observation wells:

~~a.~~ 1. Shall be constructed in accordance with the requirements ~~for permanent wells if they are to remain in service after completion of the groundwater study; and~~ of DEQ if they are constructed in a GWMA~~.~~. Otherwise, they shall be constructed in accordance with 12VAC5-590-630 if they are to remain in service as observation wells after completion of the groundwater study.

~~b.~~ 2. Shall be protected ~~at the upper terminal~~ to preclude entrance of contamination.

~~14. Well abandonment:~~

~~a. Observation wells and groundwater sources which are not in use shall be sealed by methods which will restore the controlling geological conditions which existed before they were constructed;~~

~~b. Temporary abandonment.~~

~~(1) Any water well temporarily removed from service, or completed but not put into service, shall be sealed with a watertight cap or well-head seal.~~

~~(2) Such well shall be so maintained that it will not be a source or channel of contamination during temporary abandonment; and~~

~~c. Permanent abandonment.~~

~~(1) All casing and screen materials may be salvaged.~~

~~(2) The well shall be checked from land surface to the entire depth of the well before it is plugged to ascertain freedom from obstructions that may interfere with plugging (sealing) operations.~~

~~(3) The well shall be thoroughly chlorinated prior to plugging (sealing).~~

~~(4) Bored wells shall be completely filled with cement grout or dry clay compacted in place.~~

~~(5) Wells constructed in unconsolidated formations shall be completely filled with cement grout or clay slurry by introduction through a pipe initially extending to the bottom of the well. Such pipe shall be raised, but remain submerged in grout, as the well is filled.~~

~~(6) Wells constructed in consolidated rock formations or which 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. The remainder of the well shall be filled with sand-cement grout only.~~

~~15.~~ 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.

~~C. Special requirements for various groundwater sources~~:

~~1.~~ N. Gravel packed wells:

~~a.~~ 1. The gravel utilized shall be free of foreign material, properly sized, washed, and then disinfected prior to or during placement~~;~~.

~~b.~~ 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 ~~pumphouse~~ pump house floor or concrete apron~~;~~.

~~c.~~ 3. ~~Gravel~~ The gravel refill pipes in the grouted annular opening shall be surrounded by a minimum of 1-½ inches of grout~~.~~;

~~d.~~ 4. ~~Means~~ A means for the prevention of leakage of grout into the gravel pack of the screen shall be provided~~; and~~.

~~e.~~ 5. The minimum protective casing and grouted depth shall be acceptable to the ~~division.~~ commissioner.

6. Wells located in GWMA shall have gravel packing installed in accordance with 12 VAC5-590-840 B 3.

~~2.~~ O. Radial water ~~collectors will~~ collector systems shall be considered on an individual basis by the ~~division~~ commissioner.

~~3. Multiple aquifer wells. The annular space between producing aquifers should be grouted to prevent the mixing of waters of different qualities (see subdivision B 15). An approved bentonite material specifically manufactured as a grout may be considered.~~

~~4.~~ P. Flowing artesian wells located outside a GWMA will be considered on ~~an individual basis by the division~~ a individual basis by the commissioner.

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.

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 as a water supply 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 less than 50 residential connections with a single well as the water supply shall provide or have ready access to a replacement pump and other components and materials needed for pump replacement. In lieu of this requirement, the owner may provide 48 hours of total finished water storage volume based on the maximum daily water demand.

~~5. Springs:~~

~~a. Springs may be considered only when it is not possible to develop an acceptable well or other source;~~

~~b. Springs may be approved only after an extensive sanitary survey and bacteriological, turbidity, chemical, and flow data over a time period sufficient to establish year-round quality and quantity. The amount of land required for protection of the spring shall be determined by the division on a case-by-case basis;~~

~~c. Springs shall be considered as surface water sources if they are influenced by surface conditions. Indicators of such influence include turbidity, bacteriological, and chemical quality that varies with surface conditions;~~

~~d. Springs shall be protected from entry of surface water;~~

~~e. Springs shall be housed in a permanent structure; and~~

~~f. Springs shall be continuously chlorinated.~~

T. Springs.

1. The water quality of spring sources shall be established by obtaining samples over a period of time, agreeable to the commissioner, 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 commissioner.

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 (30 year 1-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 1000 daily flow measurements.

c. If sufficient data is not available to conduct the analysis specified in this subsection, 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 commissioner.

~~Article 3~~
~~Processes and Devices~~

12VAC5-590-850. ~~General~~ Appropriate treatment.

A. The design of water treatment ~~processes and devices~~ facilities shall depend upon the evaluation of the nature and quality of the particular water to be treated and the ~~desired~~ required quality of the finished water ~~as set forth in Article 1 of Part II, Drinking Water Standards, and Article 2 of Part III, Source Development. All surface water shall receive treatment by chemical addition, for coagulation, flocculation, clarification, filtration, and disinfection unless otherwise approved by the division. Some types of treatment processes may require presedimentation. Operation and maintenance manuals are required.~~ Treatment process selection shall follow the requirements of 12VAC5-590-680 and 12VAC5-590-685.

B. The design of water treatment facilities shall address safety considerations as required in 12VAC5-590-560.

12VAC5-590-860. Chemical application.

~~Only chemicals authorized in the construction permit or subsequently authorized by the division and in compliance with National Sanitation Foundation Standards 60 and 61 shall be used to treat drinking water or as an additive to drinking water.~~

A. Plans and specifications shall be submitted for ~~review~~ evaluation and approval, as ~~provided for~~ required in Part I, 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. ~~Storage~~ Chemical storage and handling facilities;
4. Specifications for chemicals to be used;
5. Operating and control ~~procedures~~ 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 ~~back-siphonage~~ backsiphonage between multiple points of feed through common manifolds; and
7. Provide for the application of pH-affecting chemicals to the ~~raw~~ water prior to the addition of the coagulant in turbidity removal processes.

C. Feed equipment.

1. Where chemical feed is necessary for the treatment of the water supply, such as chlorination, coagulation or other essential processes~~: a. A minimum of two feeders shall be provided; and b. A standby unit or combination of units of sufficient capacity~~, a standby feeder or combination of feeders shall be available to ~~replace~~ provide the required chemical dose with the largest ~~unit during shutdowns~~ 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 ~~at all times~~ 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 commissioner.

c. Positive displacement type solution feed pumps, or gravity feed through ~~rotometers~~ rotameters, shall be used to feed liquid chemicals, but should not normally be used to feed chemical slurries~~; and~~.

~~d. Chemical solutions shall be prevented from being siphoned into the water supply by:~~

~~(1) Providing vacuum relief,~~

~~(2) Providing a suitable air gap, or~~

~~(3) Other approved devices or piping arrangements;~~

~~e. The service water supply shall be protected from contamination by chemical solutions by:~~

~~(1) Equipping the supply line with backflow or back-siphonage prevention devices or~~

~~(2) Providing an air gap between supply line and solution tank;~~

~~f~~d. Chemical contact materials and surfaces shall be resistant to the aggressiveness of the chemical solution~~;~~.

~~g~~e. Dry chemical feeders shall:

(1) Measure chemicals volumetrically or gravimetrically;

(2) Provide effective solution of the chemical in the solution pot;

(3) ~~Preferably provide~~ Provide gravity feed from solution pots; and

(4) Completely enclose chemicals to prevent emission of dust to the ~~operation~~ room~~;~~.

~~h~~f. No direct connection ~~may~~shall exist between any sewer and a drain or overflow from the feeder or solution chamber or tank~~; and~~.

~~i~~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 and protective ~~curbings~~ curbing provided so that chemicals from equipment failure, spillage or accidental drainage shall not enter the water in conduits or treatment or storage basins.

4. Control:

a. Feeders ~~may~~ shall be manually or automatically controlled with the automatic control reverting to manual control as necessary;

b. ~~The feeders~~ Feeders shall be manually started following shutdown, unless otherwise approved by the ~~division~~ commissioner; and

c. Automatic chemical dose ~~or~~ controls with residual analyzers ~~may be approved for use and~~ shall provide alarms for critical values, and shall include indicating and recording ~~charts~~ equipment.

5. Solution tanks. All solution tanks shall be manufactured of materials suitable ~~as a~~for food contact ~~surface:~~ 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 ~~is necessary~~ shall be provided to maintain slurries in suspension~~;~~.

b. ~~Two solution tanks of specific capacity may be required for a chemical to assure continuity of chemical application during servicing;~~ 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) ~~No direct~~ Direct connection between any tank or drain and a sewer ~~shall be permitted~~ 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. Make-up 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.

~~(1) Polyphosphate solutions shall be disinfected by carrying a chlorine residual when added to unchlorinated water.~~

~~(2) Large tanks with access openings shall have such openings curbed and fitted with tight covers;~~

g. ~~Subsurface locations for~~ Buried or subsurface chemical storage or solution tanks ~~shall:~~ are prohibited.

~~(1) Be free from sources of possible contamination;~~

~~(2) Assure positive drainage for groundwaters, accumulated water, chemical spills, and overflows; and~~

h. Overflow pipes, when provided, shall:

(1) Be turned downward, ~~with end screened~~ and when located outside, be provided with a screened end.

(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 ~~required for fluoride solution~~ provided for fluorosilicic acid feed systems in conjunction with a loss of weight recorder;

c. ~~Should be required~~ 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 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 ~~such~~ 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; and

f. Shall be designed so that liquid alum does not mix with water prior to the point of application.

8. ~~Service water supply:~~ Process water.

a. Water used for dissolving dry chemicals, diluting liquid chemicals, or operating chemical feeders shall be:

(1) Only 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, ~~duplicate equipment~~ a spare pump shall be provided ~~and, when necessary, standby power~~.

c. Backflow prevention shall be achieved by appropriate means such as:

(1) An air gap between fill pipe and overflow rim of solution or dissolving tank 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. Quality.a. Chemical containers shall be fully labeled to include:~~

~~(1) Chemical name, purity and concentration;~~

~~(2) Supplier name and address;~~

~~(3) Precautions in handling; and~~

~~(4) Requirements of Virginia Department of Labor and Industry, Virginia Occupational Safety and Health Standards for General Industry, section 1910.1200(f).~~

~~b. Chemicals shall meet American Water Works Association standards, where applicable, and be stamped or certified accordingly.~~

~~c. Provisions may be required for assay of the chemicals delivered where the quality is in doubt.~~

~~d. Chemicals having a distinguishing color may be used, providing the coloring material is not toxic in concentrations used and will not impart taste, odor, or color to the water supply.~~

~~2~~1. Storage.

a. Space shall be provided where at least 30 days of chemical supply can be stored ~~in dry storage conditions~~ based on average dose and average annual water treatment plant flow rate. Storage shall be at a location that is convenient for efficient handling ~~unless local suppliers~~ and safety. Lesser storage capacity may be approved if the owner can demonstrate that the local suppliers or other conditions ~~indicate lesser storage is adequate~~ 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~~: (1) Sodium~~ sodium chlorite, to eliminate any danger of explosion~~; and~~.

~~(2)~~e. Activated carbon~~, which is a potentially combustible material, requiring isolated, fireproof storage and explosion proof electrical outlets, lights, and motors in areas of dry handling~~. Special precautions shall be taken in areas where activated carbon is stored 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 local codes.

(3) Ventilation in these hazardous areas shall be local so as not to cause dust or material to be drawn into other nonhazardous areas.

(4) Activated carbon shall not be stored with strong oxidants such as ozone, liquid chlorine, and permanganate. Liquid chlorine means liquefied, compressed chlorine gas.

~~e~~f. Chemicals shall be stored in covered or unopened shipping containers, unless the chemical is transferred into an approved covered storage unit.

~~f~~g. Solution storage or day tanks supplying feeders directly should have sufficient capacity for one day of operation.

~~g~~h. Acid storage tanks shall be vented to the outside atmosphere, but not through vents in common with day tanks.

~~3~~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 in ~~such~~ a way ~~as~~ to minimize the quantity of dust ~~which~~ 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 ~~which~~ that put the hoppers or bins under negative pressure.

e. Precautions shall be taken with electrical equipment to prevent explosions~~, particularly in the use of sodium chlorite and activated carbon~~ 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 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 minimize excessive lifting by operators.

h. Provisions shall be made for disposing of empty containers by an approved procedure ~~which~~ that will minimize 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 ~~with a slope of ⅛ inch per foot, minimum~~.

3. Open basins, tanks, and conduits shall be protected from chemical spills or accidental drainage.

F. Operator safety. Safety provisions should protect operators and visitors at the waterworks from chemical exposures in accordance with VOSH requirements.

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 ~~approved by the Virginia Occupational Safety and Health Standards for General Industry, Section 1910.134~~ that meets the VOSH Standards 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. Rubber gloves, clothing protection, and goggles shall be provided for each operator preparing chemical solutions.~~

~~6~~5. Facilities such as emergency eye wash and showers shall be provided for washing of the face, gloves, and protective equipment.

~~7. See 12VAC5-590-1000 E.~~

12VAC5-590-865. Conventional filtration treatment.

A. Conventional filtration treatment is generally used for surface water supplies. 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 commissioner may require presedimentation of waters containing high turbidity or organics (as measured by total organic carbon).

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 commissioner 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 commissioner 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.

12VAC5-590-870. ~~Mixing and sedimentation[~~ Repealed].

~~A. Plants designed for processing surface waters shall:~~

~~1. Provide multiple units for coagulation, flocculation, and sedimentation at plants having a rated capacity greater than 100 gallons per minute;~~

~~2. Permit operation of flocculation basins in series or parallel;~~

~~3. Be constructed to permit units to be taken out of service without disrupting operation; and~~

~~4. Provide multiple stage treatment facilities when required by the division.~~

~~B. Water containing high turbidity or coliform organisms may require pretreatment, usually sedimentation, either with or without the addition of chemicals. When pretreatment is used, the following requirements must be met:~~

~~1. Presedimentation basins utilizing a coagulant shall have hoppered bottoms or shall be equipped with continuous sludge removal apparatus;~~

~~2. Incoming water shall be dispersed across the full width of the line of travel as quickly as possible; short circuiting must be prevented;~~

~~3. Provisions for bypassing sedimentation basins shall be included; and~~

~~4. Three hours detention is the minimum period required. Greater detention may be required depending on raw water quality.~~

~~C. Flash mixing is the rapid dispersion of chemicals throughout the water to be treated, usually by violent agitation, to enhance coagulation.~~

~~1. Turbidity removal plants other than those of the solids contact type shall provide flash mixing facilities.~~

~~2. Basins shall be equipped with mechanical mixing devices; other arrangements, such as baffling, may be acceptable only under special conditions. Where mechanical mixing devices are utilized, duplicate units or spare mixing equipment shall be provided.~~

~~3. Design parameters:~~

~~a. The detention period shall not be less than 10 seconds;~~

~~b. The design of the flash mixing unit should be based upon the mean temporal velocity gradient G (expressed as units of seconds^{-1}). Typical values for G and T are:~~

~~T (seconds)~~	~~G (seconds^{-1})~~
~~20~~	~~1,000~~

30	900
40	700
Longer time	790

For optimization, the engineer should determine the appropriate G value and detention time through experimentation;

c. The point of application of the coagulant shall be at the point of maximum mixing intensity;

d. The physical configuration of the mixing basin shall be designed to eliminate vortexing; and

e. Flash mix units should be designed to allow speed variation throughout at a range of one to three.

4. Properly designed static mixers may be utilized.

D. 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.

2. Design parameters:

a. The minimum detention time shall be 30 minutes;

b. The design of the flocculation units shall be based upon the value of GT (mean temporal velocity gradient in seconds^{1}) X (detention time in seconds) which is ordinarily in the range of 20,000 to 200,000. The engineer should establish the value of GT through experimentation;

c. Variable speed drive units shall be designed to provide speed variations throughout a range of four to one;

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; and

g. The flocculation basins must be so designed that individual basins may be isolated without disrupting plant operation.

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 feet per second. Allowances must be made to minimize turbulence at bends and changes in direction.

4. Baffling may be used to provide for flocculation in small plants only after consultation with the division. The design should be such that the velocity gradients noted above may be maintained. Turbidity removal plants other than solids contact shall provide flocculation basins.

~~5. Safety. Guard rails and adequate lighting shall be provided.~~

~~E. Sedimentation shall follow flocculation/mixing. The detention time for effective clarification is dependent upon a number of factors relating to basin design and the nature of the raw water. The number of basins required is dependent upon the plant size, turbidity, color, colloidal matter, and taste and odor causing compounds to be removed.~~

~~1. Plants utilizing rapid rate gravity filters in conjunction with conventional sedimentation shall provide a minimum of four hours effective settling (detention) time. Effective settling time shall be calculated using the volume of the basins from the stilling wall to the submerged effluent orifice or weir.~~

~~2. 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. 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.~~

~~3. Outlet devices shall be designed to maintain velocities suitable for settling in the basin and to minimize short circuiting. The use of submerged orifices or submerged weirs is required. The maximum velocity gradient in pipes and conduits from the settling basins to the filters shall not exceed that used in flocculation. Where velocity gradient is not used as a parameter the linear velocity in pipes and conduits from settling basins shall not exceed 1.0 foot per second.~~

~~4. Rectangular sedimentation basins should be designed with a length to width ratio of at least four to one. Surface overflow rates should be within the range of 0.25 to 0.38 gallons per minute per square foot in processes utilizing flocculation, the lower limit being utilized for cold waters and the higher limit being applied to warm waters.~~

~~5. The circular clarifiers of the center feed, peripheral feed, and spiral flow type will be considered on an individual basis.~~

~~6. Basins shall be provided with a means for dewatering. Basin bottoms shall slope toward the drain not less than one foot in twelve feet unless mechanical sludge collection equipment is provided.~~

~~7. Superstructures are acceptable at specific plant locations where necessary. In areas where settling basins are subject to high and frequent cross winds, consideration should be given to the provision of windbreaks.~~

~~8. The velocity through settling basins shall not exceed 1.0 foot per minute. The basins shall be designed to minimize short circuiting. Baffles shall be provided as necessary to minimize short circuiting.~~

~~9. An overflow weir (or pipe) shall be installed which will establish the maximum water level desired on top of the filters. It shall discharge with a free fall at a location where the discharge will be noted.~~

~~10. Permanent ladders or handholds shall be provided for safety on the inside walls of basins above the water level. Guard rails shall be included. Flushing lines or hydrants shall not include interconnection of the potable water with nonpotable water.~~

~~11. For plants having a capacity of 100 gallons per minute or more, multiple basins are required and shall be so designed that individual basins may be isolated without disrupting plant operation.~~

~~12. Mechanical sludge collecting equipment shall be considered for all plants with a capacity of 100 gallons per minute or more.~~

13. Facilities are required by the State Water Control Board for disposal of sludge (see 12VAC5-590-990). Provision shall be made for the operator to observe or sample sludge being withdrawn from unit.

F. Units that combine softening and clarification are acceptable where water characteristics are not variable and flow rates are uniform. Before solids contact units are considered as clarifiers without softening, specific approval of the division shall be obtained. Clarifiers shall be designed for the maximum uniform rate and shall be adjustable to changes in flow which are less than the design rate and for changes in water characteristics. A minimum of two units is required.

1. A representative of the manufacturer shall supervise the installation and initial operation of each unit.

2. The following equipment shall be provided for plant operation.

a. Complete outfit of tools and accessories; and

b. Adequate piping with suitable sampling taps so located as to permit the collection of samples of water from critical portions of the units.

3. Chemical feed requirements are those listed in 12VAC5-590-860.

4. Mixing devices shall be constructed to:

a. Provide good mixing of the raw water with previously formed sludge particles; and

b. Prevent deposition of solids in the mixing zone.

5. Flocculation equipment:

a. Shall be adjustable;

b. Shall insure that coagulation occurs in a separate chamber or baffled zone within the unit; and

c. Shall provide a flocculation and mixing period of at least 30 minutes.

6. The sludge equipment shall provide either internal or external sludge concentrators in order to obtain a concentrated sludge with a minimum of waste water.

7. Sludge removal design shall provide that:

a. Sludge pipes shall be not less than three inches in diameter and so arranged as to facilitate cleaning;

b. Entrance to sludge withdrawal piping will prevent clogging;

c. Valves are located outside the tank for accessibility;

d. The operator may observe or sample sludge being withdrawn from the unit; and

e. A timeclock with proportional timer shall be provided for automatic blowoff.

8. Cross connections:

a. Blowoff outlets and drains shall terminate and discharge at a place satisfactory to the division; and

b. Cross connection control shall be included for the potable water mains used to backflush sludge lines.

9. The detention time shall be established on basis of the raw water characteristics and other local conditions that affect the operation of the unit. Based on design flow rates, the minimum detention time shall be:

a. Two hours for suspended solids contact clarifiers; and

b. One hour for the suspended solids contact softeners.

~~10. Softening units should be designed so that continuous slurry concentrates of 1.0% or more, by weight, can be satisfactorily maintained.~~

~~11. Water losses:~~

~~a. Solids contact units shall be provided with suitable controls for sludge withdrawal;~~

~~b. Total water losses should not exceed:~~

~~(1) Five percent for clarifiers; and~~

~~(2) Three percent for softening units; and~~

~~c. The solids concentration of sludges bled to waste should be:~~

~~(1) Three percent by weight for clarifiers,~~

~~(2) Five percent by weight for softeners.~~

~~12. Units used as clarifiers should be equipped with orifices. Units used for softening should be equipped with either overflow weirs or orifices. Weirs shall be:~~

~~a. Adjustable;~~

~~b. At least equivalent in length to the perimeter of the tank; and~~

~~c. Constructed so that surface water does not travel over 10 feet horizontally to the collection trough.~~

~~13. Weir loading:~~

~~a. Weir loading shall not exceed 20 gallons per minute per foot of weir length for units used as softeners; and~~

~~b. 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 foot per second.~~

~~14. Upflow rates shall not:~~

~~a. Exceed 1.75 gpm/ft^2 of area at the slurry separation line for units used as softeners; or~~

~~b. Exceed 1.0 gpm/ft^2 of area at the sludge separation line for units used as clarifiers.~~

~~15. Consideration shall be given to providing a superstructure to enclose the solids contact unit, to enhance the treatment process, and for the protection of piping and associated sampling valves.~~

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 in-line 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 commissioner. 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 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 commissioner. 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 commissioner. The design should allow the velocity gradients noted in subdivision D 3 of this section 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 commissioner 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 ft/sec 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 should not be located lower than 3 ft 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 commissioner 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 twelve 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 2 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 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 shall:

1. Be equipped with an adjustable drive mechanism;

2. Insure 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 blow-off; and

6. Suitable controls for sludge withdrawal.

F. Cross connections.

1. Blow-off outlets and drains shall terminate and discharge at a place satisfactory to the commissioner; 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 commissioner 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 when pilot or full scale demonstration studies demonstrate that the media is capable of meeting the filter effluent turbidity treatment technique requirements in Part II of this chapter.

1. Filters may be of single media, dual media or multi-media 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 of 0.45 mm to 0.55 mm with a uniformity coefficient of not greater than 1.65 when used alone.

(2) An effective size of 0.8 mm to 1.2 mm with a uniformity coefficient of not greater than 1.85 when used in dual or multi-media filters.

b. Silica sand. A sieve analysis shall be provided. The media shall be clean silica sand having an effective size of from 0.35 mm 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 of from 0.15 mm to 0.35 mm.

d. Granular activated carbon (GAC) may be used as a media for filtration. The commissioner 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 commissioner may allow larger size media based upon pilot or full scale demonstration testing. The commissioner 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 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 of 0.8 mm to 2.0 mm and a uniformity coefficient not greater than 1.7.

2. Gravel, when used as the supporting media, shall consist of hard, rounded particles and shall not include flat or elongated particles. The coarsest gravel shall be 2½ 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 commissioner where proprietary filter bottoms are proposed.

TABLE 874.1

Gravity Filter Gravel Support Bed

SIZE	DEPTH
2 1/2 to 1 1/2 inches	5 to 8 inches
1 1/2 to 3/4 inches	3 to 5 inches
3/4 to 1/2 inches	3 to 5 inches
1/2 to 3/16 inches	2 to 3 inches
3/16 to 3/32 inches	2 to 3 inches

G. Filter bottoms and strainer systems. The commissioner 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 or 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 1½ 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 psi;

b. A vacuum breaker or other device or assembly to prevent backsiphonage;

c. Adequate surface wash water to provide 0.5 to 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 re-stratify 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 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 combined filter effluent.

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 in lieu of an indicating and recording gauge on filters having a capacity of 100 gallons per minute 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, 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:

(1) The source water;

(2) The rapid mix effluent; and

(3) 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 supplies or GUDI water supplies.

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 commissioner may require presedimentation meeting the requirements of 12VAC5-590-870 D be provided prior 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 maybe considered by the commissioner.

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 combined filter effluent.

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 startup 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. ~~Filtration~~ Diatomaceous earth filtration.

~~A. Rapid rate gravity filters acceptable for the treatment of water from surface water sources or groundwater sources under the direct influence of surface water.~~

~~1. Pretreatment is required where rapid rate gravity filters are utilized. Pretreatment shall include but not be limited to disinfection, coagulation, flocculation, and sedimentation.~~

~~2. At least two filtering units shall be provided at plants having a rated capacity of more than 100 gpm and less than 2 MGD. The total number of filters necessary at plants having a rated capacity equal to or greater than 2 MGD may be estimated utilizing the following formula:~~

~~$N = 2.7 (Q)^{0.5}$~~

~~(Formula as per Morrell and Wallace from Hardenbergh and Rodie's "WATER SUPPLY AND WASTE DISPOSAL 1960").~~

~~Where N equals number of filter units and Q equals plant capacity in million gallons per day.~~

~~3. The design rate of filtration shall be two gallons per minute per square foot of filter area.~~

~~4. The filter structure shall be so designed as to comply with the following requirements:~~

~~a. The walls within the filter shall be vertical;~~

~~b. The filter walls shall not protrude into the filter media;~~

~~c. The filter shall be covered by a superstructure if determined necessary under local climatic conditions;~~

d. There shall be head room to permit normal inspection and operation;

e. The filter shall have a minimum depth of 8½ feet as measured from the normal operating water surface to the bottom of the underdrainage system;

f. A minimum water depth of three feet as measured from the normal operating water surface to the surface of the filter sand;

g. There shall be a water seal on the effluent line to prevent backflow of air to the filters;

h. A curb at least four inches high shall surround each filter to prevent floor drainage into the filter;

i. A hand rail shall enclose each filter or filter bank;

j. 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 parameter, the linear velocity in pipes and conduits from settling basins to filters shall not exceed 1.0 foot per second;

k. Influent pipes or conduits where solids loading is heavy, or following lime soda softening, shall be straight and equipped with cleanouts.

l. Washwater drain capacity shall be sufficient to carry the maximum flow;

m. Access in the form of walkways not less than 24 inches in width shall be provided to each filter; and

n. The normal operating water surface on a filter shall be at the same hydraulic grade level as the sedimentation basin.

5. Washwater troughs shall be so designed as to provide:

a. Bottom elevation of the trough above the maximum level of expanded media during washing;

b. A top elevation of the trough above the filter surface, not to exceed 30 inches;

c. A two inch freeboard at the maximum rate of wash;

d. A level top or edge;

e. Spacing so that each trough serves the same number of square feet of filter area; and

f. Maximum horizontal travel of suspended particles to reach trough not to exceed three feet.

6. Filter material.

a. Sand--A sieve analysis shall be provided by the design engineer. The media shall be clean silica sand having:

(1) A depth of not less than 27 inches and generally not more than 30 inches after cleaning and scraping; and

(2) An effective size of from 0.35mm to 0.5mm, depending upon the quality of the raw water and a uniformity coefficient not greater than 1.6.

b. Supporting media for the filter sand-A sieve analysis shall be provided by the design engineer. A three-inch layer of torpedo sand shall be used as a supporting media for the filter sand; such torpedo sand shall have:

(1) An effective size of 0.8mm to 2.0mm; and

(2) A uniformity coefficient not greater than 1.7.

c. Anthracite-A sieve analysis shall be provided by the design engineer. Clean crushed anthracite or a combination of sand and anthracite may be considered on the basis of data specific to the project; this media shall have:

(1) An effective size from 0.45mm to 0.8mm; and

(2) A uniformity coefficient not greater than 1.7.

d. Gravel, when used as the supporting media, shall consist of hard, rounded particles and shall not include flat or elongated particles. The coarsest gravel shall be 2 ½ inches in size when the gravel rests directly on the strainer system, and must 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 following size and depth distribution:

SIZE	DEPTH
2-1/2 to 1-1/2 inches	5 to 8 inches
1-1/2 to 3/4 inches	3 to 5 inches
3/4 to 1/2 inches	3 to 5 inches
1/2 to 3/16 inches	2 to 3 inches
3/16 to 3/32 inches	2 to 3 inches

Reduction of gravel depths may be considered upon application to the division where proprietary filter bottoms are proposed.

e. Granular activated carbon - See 12VAC5-590-960 B 6.

7. Porous plate bottoms shall not be used where iron or manganese may clog them or with waters softened by lime. The design of manifold type collection systems shall be such as to:

a. Minimize loss of head in the manifold and laterals;

b. Assure even distribution of washwater and an even rate of filtration over the entire area of the filter;

c. Provide a ratio of the area of the final openings of the strainer systems to the area of the filter of about 0.003;

d. Provide a total cross sectional area of the laterals at about twice the total area at the final openings; and

e. Provide a manifold which has a cross sectional area which is 1 ½ to two times the total area of the laterals.

8. Surface wash facilities are required. Revolving type surface washers shall be provided; however, other types may be considered. All rotary surface wash devices shall be designed with:

a. Provisions for water pressures of 45 to 100 psi;

b. A vacuum breaker or other device to prevent backsiphonage;

c. Provisions for adequate surface wash water to provide 0.5 to one gallon per minute per square foot of filter area; and

d. Air washing may be considered.

9. The following shall be provided for every filter:

~~a. A sampling tap shall be placed between the filter and the effluent rate of flow controller and shall be equipped with an auxiliary spigot at the point of connection to the effluent line;~~

~~b. Indicating and recording loss of head gauges shall be required on all filters having a capacity of greater than 100 gallons per minute. An indicating loss of head gauge shall be required on all filters having a capacity of 100 gallons per minute or less;~~

~~c. Indicating and recording rate of flow gauges shall be required on all filters having a capacity of greater than 100 gallons per minute. An indicating and totalizing water meter may be used in lieu of an indicating and recording gauge on filters having a capacity of 100 gallons per minute or less;~~

~~d. Effluent rate of flow controllers of the direct acting, indirect acting, constant rate, or declining rate types shall be required on each filter. All control devices used must 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, at the time of failure;~~

~~e. Provisions for draining the filter to waste (rewash) with appropriate measure for backflow prevention are required;~~

~~f. Hose bibb, hose, and suitable rack for storage of hoses are required; and~~

~~g. Indicating and recording turbidimeters on filter effluent with automatic high turbidity alarm are required at all plants having a capacity of 10 MGD or more.~~

~~10. Provisions shall be made for washing filters (backwashing) as follows:~~

~~a. A minimum rate of 15 gallons per square foot per minute, consistent with water temperatures and specific gravity of the filter media; a rate of 20 gallons per square foot per minute or more is recommended to provide for adequate expansion of the filter media;~~

~~b. Filtered water shall be provided at the required rate by washwater tanks, a washwater pump, from the high service main, or a combination of these;~~

~~c. Washwater pumps shall be in duplicate unless an alternate means of obtaining washwater is available;~~

~~d. The volume of washwater shall provide for not less than 15 minutes wash of one filter at the design rate of wash;~~

~~e. A washwater controller or valve shall be provided on the main washwater line to obtain the desired rate of filter wash with the washwater valves on the individual filters open wide;~~

~~f. The rate of flow indicator on the main washwater line shall be located so that it can be easily read by the operator during the washing process; and~~

~~g. Where backwash pumps are provided, a means for air release must be provided between the backwash pump and the washwater valve.~~

~~11. Miscellaneous:~~

~~a. Roof drains shall not discharge into the filter or basins and conduits preceding the filters;~~

~~b. Provisions must be made for continuous operation of all other filtering units while one filtering unit is out of operation; and~~

~~c. Automatic startup of filtering units is prohibited.~~

~~B. High rate gravity filters are acceptable for the treatment of water from surface water sources or groundwater sources under the direct influence of surface water. See 12VAC5-590-890 for design requirements.~~

~~C. Slow sand gravity filters are acceptable for the treatment of water from certain surface water sources or certain groundwater sources under the direct influence of surface water.~~

~~1. Source restrictions. Raw water quality for application to a slow sand filter without pretreatment shall meet the following requirements:~~

~~a. Not exceed a turbidity level of 5 NTU monthly average or 30 NTU peak day over a one year period;~~

~~b. Not exceed 800 total coliforms in 80% of a minimum of 50 samples taken over a minimum of a 52 week period;~~

~~c. Not exceed an apparent color level of 15 CU monthly average over a one year period; and~~

~~d. Groundwater sources under the direct influence of surface water shall pilot test to determine if the water contains sufficient nutrients for slow sand filtration to be a viable option.~~

~~2. Pretreatment. Raw waters that cannot meet the criteria listed in 12VAC5-590-880 C 1 a through c shall be treated to that quality prior to application to a slow sand gravity filter.~~

~~a. Presedimentation may be an appropriate pretreatment depending on the size and specific gravity of the turbidity particles.~~

~~b. Coarse media filtration of either a horizontal or vertical flow configuration may be appropriate for reducing levels of smaller size particles. Normally such roughing filters would be designed to accommodate periodic media removal, cleaning, and replacement.~~

~~c. Chemical flocculation and coagulation is normally not appropriate pretreatment for slow sand gravity filters.~~

~~d. Preoxidation is normally not appropriate pretreatment for slow sand gravity filters.~~

~~3. Number of filters. 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.~~

~~4. Filter media. Sand shall be clean silica sand that meets the following criteria:~~

~~a. The effective size shall be between 0.15 mm and 0.35 mm.~~

~~b. The uniformity coefficient shall not exceed 2.5.~~

~~c. The sand depth shall not exceed 55 inches. A minimum depth of 30 inches is required for normal operation.~~

~~5. Supporting media. Gravel shall meet the requirements of 12VAC5-590-880 A 6 d.~~

~~6. Structural details.~~

~~a. Sufficient head room shall be provided for normal movement on the filter by operating personnel for periodic sand removal operations.~~

~~b. Adequate manholes and access ports shall be provided for moving sand off and onto the filter.~~

~~c. There shall be no common wall between finished water and any lesser quality water.~~

~~d. Consideration should be given to providing facilities for dirty sand storage and washing, as well as for clean sand storage.~~

~~e. All slow sand filters should be covered.~~

~~7. Hydraulic design.~~

~~a. Filter to waste shall be provided for all slow sand filters.~~

~~b. Water entering the filter shall be distributed in a manner such that the surface of the filter shall not be disturbed in any way.~~

~~c. The nominal rate of filtration may range from 45 to 150 gpd/ft² (0.031 to 0.10gpm/ft²) of sand area.~~

~~d. 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.~~

~~e. 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 1.0 ft/sec. The underdrain spacing shall not exceed 12 feet.~~

~~f. Each filter shall be capable of being filled with water from the bottom up.~~

~~g. Each filter shall be equipped with a loss-of-head guage; 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. Performance report. At the conclusion of at least 12 months but no more than 18 months operation of the full scale plant an engineering report shall be submitted to the division that summarizes operating conditions and establishes optimum filter curing time, optimum filter run times, raw and finished water bacteriological and turbidity data, and any other pertinent factors.~~

~~D.~~ A. Diatomaceous earth filtration ~~is essentially a straining process. The use of these filters is acceptable for application to surface waters or groundwaters under the direct influence of surface water~~ shall be limited to treatment of surface waters or GUDI water supplies with low turbidity and low bacterial contamination, and may be used for iron removal ~~for groundwaters~~ from groundwater.

~~1. Source restrictions. Raw water quality for application to a diatomaceous earth filter without pretreatment shall meet the following requirements:~~

~~a. Bacteria shall not exceed 50 total coliforms in any sample.~~

~~b. Color shall not exceed 15 apparent CU units in any sample.~~

~~c. Turbidity shall not exceed 5 NTU in any sample.~~

~~2. Pretreatment. If the raw water can be treated to meet the above source restrictions diatomaceous earth filtration may be utilized.~~

~~3.~~ 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.

~~a. Conditions of the the study, such as duration, filter rates, head loss accumulation, slurry feed rates, turbidity removal, bacteria removal, and other relative information shall be approved by the division prior to the study.~~

~~b. Satisfactory pilot plant results shall be obtained prior to submission of final construction plans and specifications.~~

~~c. The pilot plant study shall demonstrate the ability of the system to meet applicable drinking water standards at all times.~~

~~4.~~ C. Types of filters. Pressure or vacuum diatomaceous earth filtration units will be considered for approval.

~~5.~~ D. Treated water storage. Treated water storage capacity in excess of normal requirements shall be provided to:

~~a.~~ 1. Allow operation of the filters at a uniform rate during all conditions of system demand at or below the approved filtration rate, and

~~b.~~ 2. Guarantee continuity of service during adverse source water conditions without bypassing the system.

~~6.~~ E. Number of units. At least two filtering units shall be provided at plants having a rated capacity of more than 100 gpm.

~~7.~~ F. Precoat.

~~a.~~ 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.

~~b.~~ 2. Quantity. Diatomaceous earth in the amount of 0.2 lb/ft² of filter area~~ or an amount sufficient to apply a minimum of ⅕ inch coating shall be used with recirculation~~.

~~8.~~ G. Body feed. A body feed system to apply additional amounts of diatomaceous earth slurry during the filter run is required.

~~a.~~ 1. Quantity. Rate of body feed is dependent on source water quality and characteristics and must be determined in the pilot plant study.

~~b.~~ 2. Adequate accessibility to the feed system and slurry lines is required.

~~c.~~ 3. Continuous mixing of the body feed slurry is required.

~~d.~~ 4. Consideration should be given to providing a coagulant coating (alum or suitable polymer) of the body feed.

~~9. Filtration~~.

~~a.~~ H. Rate of filtration. The ~~recommended nominal rate is 1.0 gpm/ft² of filter area and~~ hydraulic loading rate shall not exceed 1.5 gpm/ft² of filter area. The filtration rate shall be controlled.

~~b.~~ 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.

~~c.~~ J. Recirculation. A recirculation or holding pump shall be employed to maintain differential pressure across the filter when the unit is not in operation in order to prevent the filter cake from dropping off the filter elements. A minimum recirculation rate of 0.1 gpm/ft² filter area shall be provided.

~~d.~~ 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 ~~such~~ 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(s)~~ septum or septums for cleanliness or damage. Consideration should be given to providing septum assemblies where an individual ~~septums~~ septum can be removed, cleaned, repaired, and replaced.

~~e.~~ L. Inlet design. The filter influent shall be designed to prevent scour of the diatomaceous ~~each~~ earth from the filter element.

~~10.~~ M. Backwash. Provision shall be made for periodic backwashing of filter. A satisfactory method to thoroughly remove and dispose of spent filter cake shall be provided.

~~11.~~ N. Appurtenances. The following shall be provided for every filter:

~~a.~~ 1. Sampling taps for raw and filtered water~~,~~;

~~b.~~ 2. ~~Loss~~ A loss of head or differential pressure gauge~~,~~;

~~c.~~ 3. ~~Rate-of-flow~~A rate-of-flow indicator, preferable with totalizer~~,~~; and

~~d.~~ 4. A throttling valve used to reduce rates below normal during adverse ~~raw~~ source water conditions.

~~12. Monitoring. Turbidity monitoring is required for filter effluent. The monitoring may be done by recorder or daily periodic measurements.~~

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 combined filter effluent.

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 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 on-site start-up and follow-up training.

~~E. Direct filtration.~~

~~1. General. Direct filtration refers to the filtration of high quality and seasonally consistent raw water without prior sedimentation. Design shall be preceded by a pilot study acceptable to the division. An in-plant demonstration study may be appropriate where a conventional treatment plant is to be converted to direct filtration.~~

~~2. Preliminary engineering report. A report shall be prepared and submitted to the division which included the following specific items, in addition to those listed in 12VAC5-590-200 C:~~

~~a. Historical summary of meteorological conditions.~~

~~b. Historical summary of raw water quality covering a period of at least one year with special reference to fluctuation in quality and possible sources of contamination. The following raw water parameters should be evaluated:~~

~~(1) Apparent color~~

~~(2) Turbidity~~

~~(3) Bacterial concentration~~

~~(4) Microscopic biological organisms~~

~~(5) Temperature~~

~~(6) Total solids~~

~~(7) General inorganic and organic chemical characteristics~~

~~(8) Additional parameters as required by the division.~~

~~c. Description of the pilot plant study methods and work to be done.~~

3. The pilot plant or in-plant demonstration study shall be conducted over a sufficient time to treat all expected raw 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. The following items, as a minimum, shall be addressed:

a. Chemical mixing conditions including shear gradients and detention periods.

b. Chemical feed rates.

c. Use of various coagulant and filtration aids including polymers.

d. Flocculation conditions and contact time necessary for optimum filtration for each coagulant proposed.

e. Filtration rates.

f. Filter gradation, types of media, and depth of media.

g. Filter breakthrough conditions and backwash requirements.

4. Final engineering report. A final report including the engineer's design recommendation shall be prepared and submitted prior to the submission of plans and specifications.

5. Treatment facilities.

a. Flash mixing and flocculation. The design shall be based on the results of the pilot plant or in-plant demonstration study and the requirements in 12VAC5-590-870 C and D.

b. Filtration. Filters shall be dualmedia or multimedia gravity filters. The final design shall be based on the results of the pilot plant or in-plant demonstration study and the requirements in 12VAC5-590-890. Turbidity at the sand-coal interface of each filter shall be monitored by indicating and recording equipment.

6. Plant siting. The plant design should allow for the future installation of sedimentation basing.

F. Rapid rate pressure filters.

The use of these filters may be considered for iron and manganese and other clarification processes. Pressure filters shall not be used in the filtration of polluted water, water from surface water sources, groundwater under the direct influence of surface water, or following lime soda softening.

1. Minimum criteria relative to number, rate of filtration, structural details and hydraulics, filter media, etc. provided for rapid rate gravity filters also apply to pressure filters where appropriate.

2. The normal rate of filtration shall be 3 gpm/ft² of filter area.

3. The filters shall be designed to provide:

a. Loss of head gauges on the inlet and outlet pipes of 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 and backwashing of each filter individually with an arrangement of piping as simple as possible to accomplish these purposes;

d. Minimum sidewall shell height of five feet. A corresponding reduction in sidewall height is acceptable where proprietary bottoms permit reduction of the gravel depth;

e. The top of the washwater collection trough to be at least 18 inches above the surface of sand;

~~f. The underdrain system to collect efficiently the filtered water and to distribute the backwash water at a rate not less than 15 gpm/ft² of filter area;~~

~~g. Location of flow indicators and controls that is easily readable while operating the control valves;~~

~~h. Air release valve on the highest point of each filter;~~

~~i. Accessible manhole to facilitate inspections and repairs;~~

~~j. Means to observe the wastewater during backwashing; and~~

~~k. Construction to prevent cross connection.~~

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 G.

E. Structural details.

1. All slow sand filters should 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 finished water and any lesser quality water.

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 combined filter effluent.

9. The filters shall be designed to operate to waste after scraping or replacement of 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 to provide for pathogen and turbidity removal. The design requirements when using this technology for other purposes, such as for softening or organics removal, shall be established by the commissioner on a individual basis.

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 pilot plant study shall be conducted on the water to be treated prior to the installation of a membrane filtration system unless the owner can demonstrate to the satisfaction of the commissioner that the supply water quality range over all four seasons of a year will be adequately treated by the proposed design.

D. All membrane treatment units shall employ a hollow fiber flow path. 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 waterworks capacity and water demand. Multiple membrane units should be provided where the design capacity exceeds 0.5 MGD.

F. Approved materials and chemicals.

1. All membrane materials and associated piping, components, etc. in contact with the water shall be in accordance with 12VAC5-590-515.

2. Chemicals used in any membrane cleaning process shall be in accordance with 12VAC5-590-515.

G. Turbidity monitoring.

1. Source water continuous turbidity indicating and recording equipment shall be provided.

2. Feed water (between prefiltration and each membrane unit) continuous turbidity indicating and recording equipment shall be provided.

3. Filtrate continuous turbidity indicating and recording equipment shall be provided for each membrane unit.

4. Where more than one membrane unit is installed, combined filter effluent continuous turbidity indicating and recording equipment shall be provided.

H. Indicating and recording equipment for entry point chlorine residual monitoring shall be provided.

I. Pressure monitoring:

1. Indicating equipment shall be provided for monitoring pressure drop across any prefilter.

2. Indicating and recording equipment shall be provided for monitoring pressure drop across membrane modules, i.e., transmembrane pressure.

3. Integrity monitoring. Indicating and recording equipment for direct integrity test monitoring shall be provided for 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. Recycle to each unit, percent of feed flow, if applicable;

4. Entry point, gpm and totalized; and

5. Waste.

K. Alarms. An alarm system shall be provided that will report alarm conditions and shut down the treatment plant and entry point flow.

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. Alarm conditions. The following points shall be monitored by the alarm system. Alarm and shut down set point conditions will be determined by the commissioner on a individual basis.

a. Source water turbidity;

b. Feed water turbidity where appropriate;

c. Feed water flow;

d. Filtrate turbidity from each unit exceeding operational control criteria;

e. Membrane direct integrity test initiation, failure, and exceeding operational control criteria;

f. Transmembrane pressure at each unit;

g. Entry point disinfectant residual;

h. Air pressure; and

i. Where the membrane may be easily damaged or rendered inoperable due to excess feed water turbidity or debris, feed water monitoring equipment and alarm and shutdown set points shall be provided for each unit. The alarm and shutdown set points will be determined on a individual basis with the manufacturer's warranty considered.

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 reduce 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 ¼-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 piping, including all joints and valves, shall be compatible with the cleaning solution and shall be corrosion resistant.

P. Consideration shall be given to minimizing noise and vibration inside the treatment plant, particularly from the air compressor or compressors.

12VAC5-590-883. Bag and cartridge filtration.

A. Bag or cartridge filtration shall be limited to treating surface water or GUDI sources with low turbidity.

B. A pilot plant study shall be conducted on the water to be treated prior to 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 it meets the requirements of this section.

D. General design requirements.

1. All system components such as housing, bags, cartridges, gaskets, O-rings, etc. shall be in accordance with 12VAC5-590-810. All cartridge filter housing shall have ASME Boiler and Pressure Vessel Certification.

2. Indicating and recording turbidimeters meeting requirements of 12VAC5-590-770 B shall be provided for the source water and the combined filter effluent. The commissioner 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 startup 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 control of each unit for optimal performance.

2. Procedure criteria (such as pressure differential, turbidity, etc.) 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 on-site start-up and follow-up training.

12VAC5-590-890. High rate treatment processes. (Repealed.)

~~A. General.~~

~~High rate treatment processes are characterized by:~~

~~1. Precise coagulation control;~~

~~2. Turbidity monitoring throughout the process;~~

~~3. pH monitoring throughout the process;~~

~~4. Reduced flocculation time;~~

~~5. Reduced sedimentation time;~~

~~6. Use of multimedia filters incorporating anthracite and silica or other types of filter materials; and~~

~~7. Filter rates greater than two gallons per minute per square foot of filter area and not exceeding four gallons per minute per square foot of filter area.~~

~~B. Instrumentation.~~

~~1. The coagulation process shall be controlled by:~~

~~a. Zeta potential shall be measured by microelectrophoresis;~~

~~b. Dual pilot filters shall be required. The 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, and which is operated in the same manner as the larger plant units except that the plant raw water after the treatment chemicals have been added rather than the coagulated and settled water is applied to the pilot filter. The pilot filter shall be equipped with recording turbidimeters on the effluent to measure the filterability of the water as reflected by turbidity monitoring. Departures from these standards using proprietary pilot filters may be considered;~~

c. Streaming current monitor--a continuous sampling instrument which measures the electric current generated when water flows past suspended particles contained in the water; and

d. In addition to one of the above devices, a multiple six-gang stirring machine for performing jar tests shall be provided.

2. Indicating and recording turbidity monitoring shall be provided for monitoring the turbidity of:

a. The raw water;

b. Settled water from each sedimentation basin;

c. Filter effluent from each filter; and

d. Finished water leaving the treatment plant.

3. Indicating and recording pH monitoring equipment shall be provided for monitoring:

a. The raw water;

b. The flash mix effluent; and

c. The finished water leaving the treatment plant.

C. Unit processes.

1. Flash mix facilities shall conform with 12VAC5-590-870 C.

2. Flocculation design shall comply with 12VAC5-590-870 D, except the minimum detention time shall be 20 minutes.

3. Sedimentation design shall comply with 12VAC5-590-870 E, except the minimum effective detention time shall be three hours.

4. Filtration.

a. The maximum rate of filtration shall not exceed four gallons per minute per square foot of filter area.

b. Number of filter units. At least two units shall be provided at plants having a rated capacity less than two million gallons per day. The total number of filters necessary at plants having a rated capacity equal to or greater than two million gallons per day may be estimated using the following formula:

$N = 1.35 (Q)^{0.5}$

(Based upon the formula as per Morrell and Wallace from Hardenbergh and Rodie's "WATER SUPPLY AND WASTE DISPOSAL 1960" and modified for the high rate process).

Where N equals the number of filter units, Q equals the plant capacity in million gallons per day.

c. Filters incorporated in the high rate treatment process shall be of the dual media or multimedia type. The media shall consist of anthracite, silica sand, or other suitable filter materials. Both dual media and mixed media filters will be considered. Since filters media designs utilized in the high rate treatment process are generally proprietary in nature, no attempt will be made to set standards for the minimum filter media depth, the effective size and uniformity coefficient of the filter media, or the specific gravity. However, beds having a minimum total depth of 27 inches of filter media with a minimum of 10 inches of fine sand will be considered. Other proposals for high rate processes shall be considered individually by the division.

d. Structural details and hydraulics - see 12VAC5-590-880 A 4.

e. Washwater trough - see 12VAC5- 590-880 A 5.

~~f. Filter bottoms and strainers - see 12VAC5-590-880 A 7.~~

~~g. Surface wash - see 12VAC5-590-880 A 8.~~

~~h. Appurtenances - see 12VAC5-590-880 A 9.~~

~~i. Backwash - see 12VAC5-590-880 A 10.~~

~~j. Miscellaneous - see 12VAC5-590-880 A 11.~~

~~5. Chemical application.~~

~~a. Suitable equipment for application of filter aids (polymers) to the influent of the filters shall be provided.~~

~~b. See 12VAC5-590-860.~~

12VAC5-590-895. Pre-engineered package treatment units.

A. Pre-engineered package treatment units are defined as pre-designed, 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. combined filter effluent.

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 startup 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 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 on-site start-up and follow-up training.

12VAC5-590-900. ~~Softening~~ Cation exchange softening.

~~Softening shall not be used as the sole treatment method for surface waters or bacteriologically contaminated groundwater.~~ The softening ~~process~~design selected shall be based upon the mineral qualities of the ~~raw~~ source water and the desired finished water quality in conjunction with requirements for disposal of sludge or brine water, cost of plant, cost of chemicals, and plant location.

~~A. Lime, excess lime, and excess lime soda processes. The applicable design standards for mixing, flocculation, and sedimentation are the same for the lime, excess lime, and excess lime soda processes as for conventional clarification except that the minimum flash mix time is five minutes, flocculation time is 40 minutes, and settling time is two hours. Where softening is included as a treatment process in conjunction with clarification, the greater detention time criteria shall govern. For criteria pertaining to softening with solids contact units, see 12VAC5-590-870 F.~~

~~1. Mechanical sludge removal equipment shall be provided in the sedimentation basin.~~

~~2. Determinations shall be made of the CO_2 content of the raw water. When concentrations exceed 10 milligrams per liter, the economics of removal by aeration as opposed to removal with lime should be considered.~~

~~3. Equipment for stabilization of water softened by the excess lime and excess lime soda processes is required.~~

~~4. Staging shall be considered when the excess lime soda process is employed.~~

~~5. Provision shall be included for proper disposal of softening sludges.~~

~~6. The use of excess lime shall not be considered an acceptable substitution for chlorination.~~

~~B. Cation exchange process.~~

A. Iron, manganese, or a combination of the two, in the oxidized state or unoxidized state, ~~should~~shall not exceed 0.3 ~~milligrams per liter~~mg/L in the water ~~as~~ applied to the ion exchange material. ~~Pretreatment shall should be required when the content of iron, manganese, or a combination of the two, is one milligram per liter 1.0 mg/L or more.~~

~~1.~~ B. The units ~~may~~shall be of pressure or gravity type, ~~or~~ of either an upflow or downflow design, using automatic or manual regeneration. ~~Automatic regeneration is suggested~~ recommended for small plants.

~~2.~~ C. The design capacity for hardness removal ~~should~~shall not exceed 20,000 grains per cubic foot when resin is regenerated with 0.3 pounds of salt per kilograin of hardness removed.

~~3.~~ D. The depth of the exchange material ~~should~~ shall not be less than three feet.

~~4.~~ E. The hydraulic loading rate ~~of softening~~ should not exceed ~~seven gallons per square foot per minute~~ 7 gpm/ft^2 and the backwash rate should be ~~six to eight gallons per square foot per minute~~ 6-8 gpm/ft^2.

~~5.~~ F. The freeboard shall depend upon the specific gravity of the media and the direction of the water flow.

~~6.~~ G. The bottoms, strainer systems and support for the exchange material shall conform to criteria provided for rapid rate gravity filters.

~~7.~~ H. 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 ~~such~~ a manner as to prevent any possibility of backsiphonage.

~~8.~~ I. A bypass shall be provided around ~~softening~~ 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.

~~9.~~ J. Waters having turbidity of five ~~units~~ NTUs or more ~~turbidity~~ 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 residual chlorine. Phenolic resin shall not be used.

~~10.~~ K. ~~Smooth nose sampling~~ 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.

~~11.~~ L. 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 ~~having~~ 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.

~~12.~~ M. Wet salt storage basins shall have sufficient capacity to store at least a 30 days operating supply.

~~13.~~ N. Stabilization of the finished water for corrosion control ~~shall be provided~~ should be considered.

~~14.~~ O. Suitable disposal must be provided for brine waste.

~~15.~~ P. Pipes and contact materials shall be resistant to the aggressiveness of salt.

~~16. Salt storage tanks and feed equipment should be enclosed and separated from other operating areas in order to prevent damage to equipment.~~

12VAC5-590-910. Aeration. ~~(Also see 12VAC5-590-970.)~~

A. Aeration treatment ~~devices as described herein may be~~ is acceptable for oxidation, separation of gases or for taste and odor control. General design requirements include the following:

~~A. Natural draft aeration.~~

~~The design of natural draft aeration shall provide the following:~~

~~1. The water shall be distributed uniformly onto the top tray;~~

~~2. The water shall be discharged through a series of three or more trays with the separation of trays not less than six inches;~~

~~3. The trays shall be loaded at a rate ranging from one gallon per minute to five gallons per minute for each square foot of total tray area;~~

~~4. The trays shall have slotted, woven wire cloth, or perforated bottoms;~~

~~5. The perforations shall be 3/16 to ½ inches in diameter and spaced one to three inches on centers when perforations are used;~~

~~6. Eight to 12 inches of inert media shall be used, such as coke or limestone which shall be two to six inches in size, and will not readily disintegrate due to freezing cycles;~~

~~7. The aerated water shall receive disinfection treatment; and~~

~~8. The trays shall be designed using materials resisting deterioration with consideration being given to corrosion, slime, and algae control.~~

~~B. Forced or induced draft aeration devices shall be designed to:~~

~~1. Provide an adequate liquid distribution and countercurrent of air through the enclosed aeration column;~~

~~2. Be insectproof and lightproof;~~

~~3. Be such that air introduced into column shall be screened through insect proof screen and be as free of dust as possible;~~

~~4. Ensure that water outlet is adequately sealed to prevent unwanted loss of air; and~~

~~5. Ensure that the sections of the aerator can be easily reached and removed for maintenance.~~

~~C. Pressure aeration may be used for oxidation purposes if a pilot plant study indicates the method is applicable; it is not acceptable for removal of dissolved gases. Filters following pressure aeration shall have adequate exhaust devices for release of air. Pressure aeration devices shall be designed to:~~

~~1. Give thorough mixing of compressed air with the water being treated; and~~

~~2. Provide screened and filtered air, free of obnoxious fumes, dust, dirt, and other contaminants.~~

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 prior to 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, 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 12 VAC5-590-340.

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 volatile organic chemicals, trihalomethanes, carbon dioxide, and radon.

1. Justification shall be provided for the selected design parameters (height and diameter of the unit, air to water ratio, packing depth, surface loading rate, etc.). 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, 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.

~~D.~~E. Other methods of aeration ~~may be used if applicable to the treatment needs. Such methods include, but are not restricted to, spraying, diffused air, and mechanical aeration. The treatment processes~~ shall be designed to meet the particular needs of the water to be treated and are subject to the approval of the ~~division~~ commissioner.

~~E. Aerators that discharge through the atmosphere should be protected from wind by being placed in a louvered enclosure designed to provide easy access to the interior.~~

~~F. Aerators that are used for oxidation or removal of dissolved gases from waters that will be given no further treatment other than chlorination shall be protected from contamination from insects and birds.~~

~~G. Ventilation shall be provided to prevent the accumulation of released gases in the building housing the treatment facilities.~~

~~H. A bypass should be provided for all aeration units.~~

12VAC5-590-920. Iron and manganese control.

A. Iron and manganese control, as used herein, refers solely to treatment processes designed specifically for this purpose. The treatment process used will depend upon the character of the ~~raw~~ 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 ~~division~~ commissioner. The commissioner may require that pilot studies be conducted.

~~It may be necessary to operate a pilot plant in order to gather all information pertinent to the design.~~

~~A. Removal~~ B. Iron and manganese removal by oxidation~~, detention,~~ and filtration.

1. Oxidation ~~may be by aeration or by chemical oxidation with~~ shall be accomplished by aeration, or by chemicals such as chlorine ~~or~~, potassium permanganate, sodium permanganate, or a combination thereof.

~~2. A minimum detention of 30 minutes shall be provided following oxidation by aeration in order to insure that the oxidation reactions are as complete as possible. This minimum detention time shall be reduced only when a pilot plant using the water under study demonstrates a lesser detention time. The detention basin shall be designed as a holding tank with no provision for sludge collection but with sufficient baffling to prevent short circuiting. Sedimentation basins shall be provided when treating water with high iron or manganese content or where chemical coagulation is used to reduce the load on the filters. The detention time shall be in a range of one to four hours where sedimentation is necessary prior to filtration. Pilot studies should be made of the water to determine the necessary detention time.~~

~~3. Filtration - see 12VAC5-590-880.~~

~~B. Removal by lime-soda process - see 12VAC5-590-900 A.~~

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 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 6 – 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 prior to 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. Location of flow indicators and controls that is 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. Removal by units using continuous potassium permanganate regeneration.~~

~~1. This process consists of a continuous feed of potassium permanganate to the influent of a manganese greensand filter. Positive displacement type feeders shall be provided, and the feed rate shall be adequately controlled by using feeders which are paced by water meters or ratio type feeders (which are a combination type feeder and flow meter) to prevent an overdosage of potassium permanganate.~~

~~1. The permanganate shall be applied following pH affecting chemicals.~~

~~2. Other oxidizing agents or processes such as chlorination or aeration may be used prior to the permanganate feed to reduce the cost of the chemical.~~

~~3. The normal filtration rate is three gallons per minute per square foot. Lower filtration rates may be required or higher filtration rates may be permitted if justified by field studies and approved by the division~~

~~4. The normal wash rate is eight to 12 gallons per minute per square foot.~~

~~5. Air washing may be provided.~~

~~6. Sample taps shall be provided.~~

~~a. Prior to application of permanganate;~~

~~b. Immediately ahead of filtration;~~

~~c. At a point between the anthracite coal media and the manganese treated greensand;~~

~~d. Halfway down the manganese treated greensand; and~~

~~e. For filter effluent.~~

~~D. Removal by ion exchange. This process of iron and manganese removal may not be acceptable for waters containing high concentrations (more than 1.0 milligrams per liter) of iron, manganese, or combination thereof. Applications may be limited based on the media used. This process may not be acceptable where either the raw water or wash water contains dissolved oxygen. (See 12VAC5-590-900 B for general cation exchange information.)~~

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 commissioner may require pilot studies be conducted to determine post-exchange pH/alkalinity adjustment. See 12VAC5-590-900 for general ion exchange design requirements.

~~E.~~ D. Sequestering ~~- see 12VAC5-590-950 E~~ iron and manganese.

1. Sequestration with polyphosphates shall be considered for polishing filtered water, however it shall not be used where 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's 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 commissioner on a individual basis. Operational data from actual full scale facilities treating waters of similar quality or pilot tests may be required.

~~F.~~E. Sampling taps shall be provided for control purposes. Taps shall be located on each ~~raw~~ source water ~~source~~, each treatment unit influent and each treatment unit effluent.

~~G. Testing equipment shall be provided for all plants~~F. Iron and manganese testing equipment shall be provided. ~~The~~ Iron test equipment shall ~~have the capacity to accurately measure the iron content to a minimum of 0.1 milligrams per liter and to indicate manganese removal.~~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 commissioner may approve proprietary treatment processes for the removal of iron and manganese on a 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.

~~Where practicable and feasible, the board may require owners of waterworks to provide artificial fluoridation so as to bring the fluoride ion concentration to the optimum level as set forth in Article 1 of Part II.~~

A. ~~Prior to the issuance of a permit for fluoridation, plans, specifications, operating procedures, and methods of supervision shall be submitted to the division. These shall be in conformity with requirements to be determined for each individual installation by the division.~~

Fluoridation feed systems shall be designed to deliver the optimum fluoride ion concentration of 0.7 mg/L.

B. Fluoride compounds. Commercial sodium fluoride, sodium ~~silicofluoride~~ fluorosilicate (also called sodium silicofluoride) and fluorosilicic acid (also called hydrofluorosilicic acid) shall conform to the applicable AWWA standards and meet the requirements of 12VAC5-590-515. Use of other chemicals ~~which~~ that may be made available ~~must~~ shall be approved by the ~~division~~ commissioner.

C. Fluoride compound storage. Fluoride chemicals shall be isolated from other chemicals to prevent contamination. Compounds shall be stored in covered or unopened shipping containers in a separate room (except sodium fluoride saturators) with the chemical feeder. ~~The room must be provided with mechanical ventilation to the outside of the building.~~

D. Chemical feed installations.

~~1. Chemical feed installations shall conform to 12VAC5-590-860.~~

~~2.~~1. Scales and loss of weight recorders for dry chemical feeders and hydrofluorosilicic acid feeders shall be provided.

~~3. Feeders~~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 so located to provide adequate mixing.

~~4. The point of application of hydrofluorosilicic acid, if into a pipe, shall be so located as to provide adequate mixing.~~

~~5.~~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 sodium fluoride saturator feeders shall be softened if the hardness exceeds 50 mg/L.

b. The fluoride source. Use only sodium fluoride in saturators.

c. A flow restrictor with a maximum flow of 2.0 gpm on all upflow saturators.

~~6. The water applied to sodium fluoride saturator feeders shall be softened if hardness exceeds 75 milligrams per liter.~~

~~7. Unless otherwise approved, fluoride shall be applied to the raw water with the feeder paced by the raw water meter.~~

6. Adequate fluoride feed rate control and mixing shall be provided.

~~8~~7. Provisions shall be made for venting ~~hydrofluorosilicic~~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 ~~wetmopping~~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 ~~division~~commissioner.

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.

~~A.~~ B. Blending. Blended water ~~must~~ shall result in all water delivered to the distribution system being of the same quality.

~~B.~~ C. Treatment.

~~1. Chemical feed shall conform to 12VAC5-590-860.~~

~~2.~~ 1. Treatment ~~includes use of~~ shall include, but not be limited to ion exchange, activated alumina, bone char, reverse osmosis or electrodialysis. ~~Other processes may be utilized if they adequately defluoridate.~~ The selected design ~~is to~~shall be supported by pilot studies unless at least two pilot studies, or two prototype plants, have demonstrated that the selected design is feasible. ~~Such~~These studies or prototypes ~~should~~shall be for waters having characteristics similar to the water that is to be treated.

~~3. Raw water~~2. Water pH shall be adjustable to an optimum level to achieve the best fluoride removal.

~~4.~~ 3. With any one unit out of service, the remaining unit or units ~~must~~ shall be capable of ~~handling peak day flows~~ treating the maximum plant flow rate.

~~5.~~ 4. Filter clogging constituents such as iron having a concentration greater than 1.0 ~~milligrams per liter~~ ~~should~~mg/L shall be removed prior to ~~defluoridation~~fluoride removal. ~~If applicable, chlorination is to be applied after defluoridation.~~

~~6.~~ 5. Test equipment ~~must~~ shall be provided and must be accurate to at least 0.1 ~~milligrams per liter~~ mg/L.

~~7.~~ 6. An operation and maintenance ~~(O & M)~~ manual ~~must~~ shall be provided.

12VAC5-590-950. ~~Stabilization~~ Corrosion control or stabilization.

A. Water that is unstable due either to natural causes or to the treatment given to the water ~~should~~ shall be stabilized. ~~Water treated with excess lime for softening or manganese removal shall be treated by carbon dioxide or acid.~~

~~A. Carbon dioxide addition.~~

~~1. The recarbonation chamber design should provide:~~

~~a. A detention time of three to 10~~ 20 ~~minutes;~~

~~b. A depth of about eight feet; and~~

~~c. A reaction tank with a detention time of 20 minutes.~~

~~2. Adequate precautions shall be taken to prevent the possibility of carbon monoxide entering the plant from the recarbonation and reaction chamber.~~

~~B. Sulfuric acid.~~

~~1. Feed equipment for sulfuric acid shall conform to 12VAC5-590-860.~~

~~2. Adequate precautions shall be taken for safety.~~

~~C. Removal of free carbon dioxide. Carbon dioxide may be removed by an alkali, following aeration. The addition of an alkali following aeration may not be necessary when the alkalinity of the aerated water is greater than 80 milligrams per liter.~~

~~D~~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 milligrams per liter. Soft waters should be treated with lime to provide the required calcium. Soft waters which 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.

~~E. Polyphosphates. Polyphosphates are applicable for sequestering dissolved minerals.~~

C. Phosphates or other corrosion inhibitors may be used for corrosion control when meeting the requirements of NSF/ANSI Standard 60 and applied in accordance with the manufacturer's recommendations. Stock phosphate solution shall be disinfected in accordance with the manufacturer's recommendations unless the phosphate solution is fed directly from the covered shipping container.

~~1. Feed equipment shall conform to 12VAC5-590-860.~~

~~2. Phosphate chemicals shall be food grade.~~

~~3. Stock phosphate solution shall be kept covered and disinfected by carrying approximately 10 milligrams per liter chlorine residual.~~

~~4. Satisfactory chlorine residuals should be maintained in the distribution system when phosphates are used.~~

~~F. Under some conditions, softening plants can be designed using split treatment in which raw water is blended with softened water to partially stabilize the water. Treatment plants designed to utilize split treatment should, in most cases, also contain facilities for further stabilization by other means.~~

~~G. Water unstable due to biochemical action in the distribution system. Residual chlorine throughout the distribution systems may be used to prevent corrosion due to decomposition of organic matter (especially in dead-ended mains), the biochemical action within tubercles and the reduction of sulfates to sulfides.~~

~~H~~D. Cathodic protection ~~may be used to prevent or minimize~~shall be acceptable for preventing or reducing corrosion of the inner surfaces of water storage tanks and standpipes and the outer surfaces~~s~~ of metal ~~conduits~~pipe.

~~I~~E. Laboratory equipment shall be provided for determining the effectiveness of stabilization treatment and concentration of chemicals in the treated water.

12VAC5-590-960. Taste and odor control.

~~Tastes and odors found in water are primarily organic in nature. Since the presence of taste and odor problems in a water supply suggests to the consumer that the water may contain potentially toxic agents, expenditures are justified to improve the aesthetic quality of the water and maintain the consumers' confidence in the water utility.~~

A. ~~Source treatment. Taste and odor problems in raw~~ surface water sources are ~~most frequently caused by the presence of plankton, or more specifically, algae. The treatment methods and dosages listed below have been found effective in some applications.~~

~~1.~~ The continuous or periodic treatment of ~~raw water~~ 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 ~~milligrams per liter~~ mg/L, as copper, in the treatment plant finished water.

B. Surface water aerators or diffused aeration systems shall be acceptable for de-stratifying reservoirs, reducing or eliminating seasonal turnover and the releasing of 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, 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 residual chlorine that is directly proportional to the amount of chlorine added.

~~2. The periodic treatment of the shallow areas of a reservoir with an activated carbon dosage of 0.2 to 0.5 pounds per 1,000 square feet of water surface has been found effective in some applications~~.

~~3. A potassium permanganate dosage from 0.4 to 4.0 milligrams per liter has been found effective in some applications.~~

~~4.~~ 3. ~~Chlorine dosages that produce 0.2 to 1.0 milligrams per liter of free chlorine in the treated water have been found effective in some applications. Prior to treatment, this treatment method should be evaluated to determine that it will not cause any objectionable tastes or odors in the treated water.~~

~~B. Treatment methods. The waterworks shall be designed to produce high quality water regardless of any changes or emergencies that may arise with the raw water source. Provisions to handle taste and odor problems should be included in all designs regardless of the anticipated raw water quality.~~

~~1. Provisions shall be included in the design of the treatment plant to add chlorine or other approved oxidizing chemicals at the reservoir or at the head of the treatment plant. If breakpoint chlorination is proposed to treat taste and odor problems, extreme caution is warranted to insure that the actual breakpoint of the water is determined accurately. Dechlorination may be required if deemed necessary.~~

~~2. Chlorine dioxide can be utilized to treat any taste and odor problems susceptible to oxidation.~~

~~3. Potassium permanganate has oxidizing capabilities that can be utilized to treat taste and odor problems. It is normally fed to the raw water during the flash mix operation in a dosage such that the pink color formed during its solution travels only 1/2 to 2/3 of the length of the sedimentation basins.~~

~~4. Aeration has been used successfully to treat tastes and odors attributed to volatile organic matter but has shown limited success in treating tastes and odors associated with dissolved and suspended organic matter. Aeration facilities shall be designed in accordance with the provisions of 12VAC5-590-910~~.

~~5. When taste and odor problems are anticipated on an intermittent basis, treatment facilities shall be included in the water treatment plant design for the addition of powdered activated carbon. The dosage of powdered activated carbon required to treat taste and odor problems will vary with each individual raw water, and extensive lab work should be undertaken to ascertain that the carbon feed equipment is properly sized. The carbon feed equipment shall be capable of adding at least 40 milligrams per liter of powdered activated carbon regardless of the anticipated raw water quality. In the water treatment plant design, facilities should be provided to add powdered activated carbon to the flash mixer, to the flocculation basins, at the midpoint of sedimentation basins, and to the conduits leading to the filters.~~

~~The carbon can be added as a premixed slurry, or by means of a dry feed machine as long as it is assured that the carbon is properly wetted. All mechanisms for handling dry carbon should be tightly sealed and dust collection is required on all installations. The feed machine hopper wall should be on at least a 60 degree angle to the horizontal.~~

~~The carbon feed lines to the application points should be sized to handle the carbon suspension and should be equipped with flushing provisions.~~

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 sedimentation basins.

1. PAC shall not be applied near the point of chlorine or other oxidant application.

2. Continuous agitation or re-suspension equipment shall be required to keep the PAC from depositing in the slurry/storage tank.

3. All mechanisms for handling dry PAC shall be tightly sealed. Dust collection is required on 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.

~~6. Granular activated carbon units may be used in place of filters described in 12VAC5-590-880 with appropriate pretreatment described in 12VAC5-590-870. Rates of flow shall be consistent with the type and intensity of the problem. The design of the facilities must be supported by the results of pilot plant studies~~

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.

12VAC5-590-970. Removal of volatile synthetic organic chemicals (VOCs). (Repealed.)

~~Appropriate processes or technologies (either specified as BAT in Appendix N or a division-approved alternative, such as other aeration techniques) that treat all the water in the waterworks shall be applied to achieve compliance. The selected design is to be supported by pilot studies unless at least two pilot studies, or two prototype plants, have demonstrated that the selected design is feasible. Such studies or prototypes shall be for waters having characteristics similar to the water that is to be treated.~~

~~A. Granular Activated Carbon (GAC). As in taste and odor control, GAC units may be used with appropriate pretreatment described in 12VAC5-590-870 B. The elements of a GAC system include carbon contactors, a carbon storage and transfer system, a regeneration system and a control system.~~

~~The selected GAC shall meet AWWA Standards. Multiple units shall be provided to process at least the peak day flow rate with one unit out of service. As carbon is corrosive, the use of noncorrosive piping and storage materials is mandatory.~~

~~B. Packed tower aeration. (Also see 12VAC5-590-910.)~~

~~1. Usually more efficient than other types of waterfall (natural) aeration.~~

~~2. With one unit out of service, the remaining unit(s) must be capable of handling peak day flows.~~

12VAC5-590-975. Removal of radionuclides.

A. Processes for 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 commissioner, 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 an acceptable surrogate shall be included in the project design.

12VAC5-590-980. ~~Microscreening.~~ (Repealed.)

~~A microscreen is a mechanical supplement to treatment capable of removing suspended matter from water by straining. It shall not be used as a substitute for clarification or filtration.~~

~~A. The design of microscreening facilities shall give due consideration to:~~

~~1. A sanitary survey and chemical and biological evaluation;~~

~~2. The nature of suspended matter to be removed;~~

~~3. The corrosiveness of water;~~

~~4. The effect of chlorination when required as pretreatment; and~~

~~5. Control of the hydraulic capacity of the microscreen.~~

~~B. The design shall provide:~~

~~1. For durable, corrosion resistant screens;~~

~~2. A bypass and cleaning arrangement;~~

~~3. Duplicate units for continuous operation;~~

~~4. Protection against back siphonage when potable water is used for washing; and~~

~~5. Proper disposal of wash water.~~

12VAC5-590-985. GAC contactors.

A. GAC contactors may be used to adsorb natural organic compounds, taste and odor compounds, and synthetic organic chemicals. The most common applications of GAC contactors in drinking water treatment plants are (1) post-filtration adsorption and (2) 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 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- 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 commissioner, 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, but are not limited to, the following:

1. Filter backwash water;

2. Coagulant ~~sludges~~ residuals;

3. Softening ~~sludges~~ residuals;

~~4. Microscreening sludges;~~

~~5.~~ 4. Iron and manganese ~~sludges~~ residuals

~~6.~~ 5. ~~Sludges~~ Settled solids from presedimentation units; and

~~7.~~ 6. Brine wastes.

B. After receipt of plans and specifications from the consulting engineer for the water treatment facilities, the ~~division~~ commissioner will advise the State Water Control Board of any

proposal to treat and discharge industrial wastes into state waters. The ~~division~~ commissioner will submit to the State Water Control Board a letter report to include 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 ~~12VAC5-590-420 K~~ 12VAC5-590-395 C, the State Water Control Board will then deal directly with the ~~consulting engineer~~owner in reference to the final disposal of these wastes ~~and~~.

D. The sanitary wastes from water treatment plants must receive treatment. Wastes from these facilities ~~must~~shall be discharged either directly to a sanitary sewer system or to an ~~approved~~ individual waste disposal facility providing suitable treatment approved by the State Water Control Board.

12VAC5-590-1000. Disinfection.

A. ~~Objective. To~~ The objective of disinfection is to prevent the occurrence of waterborne diseases from the consumption of drinking water.

~~B. Methods. Disinfection shall be accomplished by the application of chlorine. The specific chlorine compound shall be selected on the basis of water flow rates, application rates, pH of the water, cost of equipment and chemicals, availability of disinfectant, and reliability of feed equipment. Alternate chemicals and methods for disinfection are to be handled as unconventional and the procedures of 12VAC5-590-300 apply.~~

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 commissioner. Consideration shall be given to minimizing the formation of disinfection byproducts 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 or store potable water shall be disinfected with chlorine prior to being placed in service, in accordance with the AWWA Standards C651, C652 and C653. All disinfectant residual 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 commissioner on a individual basis.

~~C. Equipment.~~

~~1. Solution feed vacuum type gas chlorinators are generally preferred. The use of hypochlorite feeders of the positive displacement type may be considered for small installations.~~

~~2. Chlorinator capacities will vary, depending on the use and point of application of the chlorine and the raw water quality. Chlorination capacity shall be such that a minimum dosage of 15 milligrams per liter may be fed at all times.~~

~~3. Standby chlorination equipment shall be provided and chlorination capacities shall comply with 12VAC5-590-1000 C 2 with any unit out of operation for repairs. Spare parts shall be available for all chlorinators to replace parts which are subject to wear and breakage. All chlorinators shall be properly maintained and operated.~~

~~4. 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 as well. Equipment for backflow prevention shall be provided. A pressure gauge shall be provided on each chlorinator water supply line.~~

~~5. Scales for weighing cylinders shall be provided at all waterworks using chlorine gas. At large waterworks, scales of the indicating and recording type are recommended. Scales shall be recessed unless they are of the low platform type.~~

~~6. Where manifolding of several cylinders is required to evaporate sufficient chlorine, consideration shall be given to the installation of gas evaporators.~~

~~7. A bottle of ammonia hydroxide solution shall be available for detecting chlorine gas leaks. Consideration shall also be given to the provision of caustic soda solution reaction tanks for absorbing the contents of leaking one-ton cylinders where such cylinders are in use. At large installations, consideration should be given to the installation of automatic gas detection and related alarm equipment. Emergency cylinder repair kits shall be provided.~~

~~8. Piping and connections for chlorine gas.~~

~~a. Piping arrangements should be as simple as possible. Pressure gauges shall be installed on the piping to each chlorinator. The number of screwed or flanged joints should be held to a minimum. Piping systems should be well supported and adequately sloped to allow drainage; low spots should be avoided. Suitable allowance should be provided for pipe expansion due to changes in temperature. Liquid chlorine has a high coefficient of thermal expansion. If liquid chlorine (containing no gas bubbles) is trapped between two valves, high pressure will develop upon increase in the temperature of the chlorine. This pressure may lead to hydrostatic rupture of the line. The effects of possible rupture should be considered in the design of any piping system. Where such rupture would present an undue hazard to personnel or equipment by allowing large quantities of chlorine to escape, protection of the system against hydrostatic pressure should be provided.~~

~~b. Condensation or reliquefaction of chlorine may occur in chlorine gas lines which pass through areas where the temperature is below the temperature pressure equilibrium indicated in the vapor pressure curve. Where adequate superheat is not provided by a vaporizer, condensation can be prevented by reducing the pressure with a pressure reducing valve.~~

~~c. It is recommended that joints in chlorine piping be flanged or welded. If threaded joints are used, extreme care should be taken to obtain clean, sharp threads. A lubricating pipe dope suitable for chlorine should be used. All threading oil must be thoroughly cleaned from the pipe. For permanent joints, linseed oil and graphite, glycerine or Teflon tape may be used. If Teflon tape is used, all remnants must be removed before joints are remade.~~

~~d. Fittings and appurtenances must be suitable for handling dry chlorine.~~

~~9. Chlorine solution is very corrosive to all of the common construction metals. At low pressures, chlorine solution can be handled in chemical stoneware, glass or porcelain equipment, and by certain alloys. Hard rubber, unplasticized polyvinylchloride, glassfiber reinforced polyester, polyvinylidene chloride, and fully halogenated fluorocarbon resins~~

have been used successfully. Low molecular weight polyethylene, fiber reinforced rubber hose, and wrapped rubber hose have been used successfully for small capacity chlorinators. All of these materials must be selected with great care. For higher pressures, combinations using resistant lining materials (rubber, kynar, saran, Teflon, etc.) with the common metals for strength should be used.

Titanium may be used with chlorine solution, but must not be used with chlorine gas. Tantalum is inert to chlorine solution at temperatures up to 300°F. Hastelloy Alloy C® and Monel Alloy® are widely used. Platinum and silver find special applications. In general, operations involving chlorine solution require individual study.

Chlorine and equipment suppliers shall make recommendations only after careful survey of all factors involved.

10. Chlorine solution and hypochlorite solution piping shall be arranged such that prechlorination or postchlorination may be accomplished by any or all chlorinators.

D. Engineering design.

1. Any building to house chlorine equipment or containers should be designed and constructed to protect all elements of the chlorine system from fire hazards. If flammable materials are stored or processed in the same building, a fire wall should be erected to separate the two areas. Fire resistive construction is recommended.

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. Such rooms shall be at ground level, and should be separated from the feed area.

At least two means of exit should be considered from each separate room or building in which chlorine is stored, handled, or used. All exit doors shall open outward.

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.

Feed lines shall not carry chlorine gas beyond the chlorine feeder room unless the chlorine is under vacuum.

2. 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 prior to use unless an evaporator is employed.

3. Forced, mechanical ventilation which will provide one complete air change per minute shall be installed in all chlorine feed rooms and rooms where chlorine cylinders are stored. The entrance 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 such 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.

4. The electrical controls for the fans and lights shall be such that they will automatically operate when the door is opened and can be manually operated from the outside without opening the door.

E. Respiratory protection. The use of self-contained breathing apparatus (SCBA) in compliance with OSHA Respiratory Protection Standard 1910.134, "VIRGINIA OSHA STANDARDS" for General Industry, is required whenever anyone is dealing with an accidental

~~release of chlorine. All waterworks that use chlorine gas at their treatment facility shall maintain a respiratory protection plan including emergency procedures, evacuation plans, designated SCBA personnel and any special site specific requirements. All respiratory protection devices shall be stored to protect against dust, sunlight, heat, extreme cold, excessive moisture or damaging chemicals; and in a location remote from the chlorine area.~~

~~F. Application of chlorine.~~

~~1. Provisions shall be made to ensure uniform mixing of the chlorine solution or hypochlorite solution with the water near the point of application.~~

~~2. Residual and contact time.~~

~~a. Waterworks with surface water sources shall provide a minimum residual (C) and contact time (T) as calculated in accordance with Appendix L. Appendix L contains information on CT calculations and methods, as well as information on contact tank baffling arrangements.~~

~~b. Waterworks with groundwater sources shall provide a minimum 30 minute hydraulic detention period (based on design flow) for chlorine contact.~~

~~G. Evaluation of effectiveness.~~

~~1. Sampling - see 12VAC5-590-770.~~

~~2. Equipment shall be provided for measuring chlorine residual employing any method listed in the most recent edition of "Standard Methods for the Examination of Water and Wastewater."~~

~~The equipment should enable residual chlorine measurement to the nearest 0.1 milligram per liter in the range below 0.5 milligram per liter, and to an accuracy of approximately 25% above 0.5 milligram per liter. The installation of continuous automatic chlorine residual analyzers recording and proportioning systems may be required on large installations.~~

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 of surface water sources or GUDI sources shall provide sufficient capacity to achieve the required microbial log inactivation specified in Table 501.1.

b. Chorine feed systems for primary disinfection of groundwater sources shall provide sufficient capacity to achieve 4-log virus inactivation.

c. Chlorine feed systems for secondary disinfection 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 of surface water sources or GUDI sources 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 commissioner 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 chlorine solution water supply piping shall be designed to prevent contamination of the treated water supply.

a. At all facilities treating surface water, pre- 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 supply to each ejector shall have a separate shut-off valve. A master shut-off 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. Owners of waterworks with surface water sources or GUDI sources shall provide a minimum residual (C) and contact time (T) as calculated in accordance with 12VAC5-590-501.

b. Owners of waterworks with groundwater sources that are required to disinfect shall provide a minimum residual (C) and contact time (T) to achieve four-log inactivation of virus, 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 12VAC5-590-501.

7. Automatic proportioning chlorinators shall be provided where the rate of flow is not reasonably constant.

8. Equipment shall be provided for measuring chlorine residual, employing any method specified in 12VAC5-590-440. The equipment shall be capable of residual chlorine 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 which serve 3,300 or more persons, or at any waterworks required by the commissioner. Where continuous chlorine residual analyzers are provided, the commissioner 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 as well. Equipment for backflow prevention shall be provided. A pressure gauge shall be provided on each chlorinator water supply line.

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 elements 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 prior to 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 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 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 so designed and sloped so as not to allow accumulation of gasses 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 to keep employee exposures below the Airborne Exposure Limits, as defined by (name of government regulation). 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/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 commissioner.

E. The owner shall inform the public in accordance with 12VAC5-590-540 prior to initiating any disinfection process involving chloramines.

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, reduce disinfection byproduct precursors. Chlorine dioxide may be used for primary disinfection. Where chlorine dioxide is used, consideration shall be given to formation of the byproducts chlorite and chlorate.

B. Chlorine dioxide is generated on-site 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 in accordance with 12VAC5-590-540 prior to initiating any chlorine dioxide usage.

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 disinfection byproduct precursors, 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 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/bromate analyses.

E. Ozone systems shall be granted disinfection credit for Giardia lamblia, Cryptosporidium, and viruses, in accordance with 12VAC5-590-401 and 12VAC5-0590-501, 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, on-line monitors per ozone contactor shall be provided. The location of the monitors shall be acceptable to the commissioner. A portable ozone monitor shall be provided as a back-up.

2. Ozone systems using multiple, consecutive contact chambers, with gaseous ozone injected in the initial chambers, shall be designed to measure ozone residual and compute log inactivation of Giardia lamblia and virus using the $C_{effluent}T_{10}$ Method or the Log Integration CT_{10} Method, as described in EPA Guidance Manual: LT2 Toolbox.

3. Sample 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. UV systems may be used for primary disinfection and shall be granted inactivation credit for Giardia lamblia and Cryptosporidium in accordance with 12VAC5-590-401 E 7 c, provided that they meet the requirements of this section.

B. Only UV reactors that have undergone validation testing to determine the operating conditions under which the reactors deliver the required UV dose shall be considered for inactivation credit.

C. UV systems shall meet the requirements of 12VAC5-590-401 E 7 c.

D. Design requirements.

1. Reactors. At least two reactors shall be provided. Reactors shall be sized to treat the design flow with the largest reactor out of service.

2. Sensors. Online sensors shall be provided to measure UV intensity or UV transmittance, as required for the control method used. The number of sensors provided shall be the same as that used in validation of the reactor.

3. System hydraulics. A means of flow distribution and control among multiple reactors shall be provided, 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. Isolation valves upstream and downstream of each reactor, a drain, and sample taps for each reactor treatment train shall be provided. The hydraulic flow profiles and piping configuration shall be identical to or more protective than that tested during equipment validation. 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.

4. Instrumentation. In order to determine if the UV reactor or reactors are operating within validated conditions, the following parameters shall be monitored and reported: (i) on/off status of each reactor; (ii) flow rate through each 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.

5. All UV systems shall have automatic shutdown under critical alarm conditions, including: lamp/ballast failure; low liquid level; and high temperature.

6. Alarms shall be provided for: (i) low UV validated dose; (ii) low UV intensity; (iii) low UV transmittance; (iv) high flow rate; and (v) mechanical wiper failure, if applicable.

7. Electrical power. Ground Fault Interrupt circuits shall be provided for all lamps. Back-up power shall be provided for all UV treatment facilities.

8. Housing. 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, if applicable.

E. 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.

~~Article 4~~
~~Pumping Facilities~~

12VAC5-590-1010. ~~General~~ Basic pumping facility design criteria.

Pumping facilities shall be designed to maintain the sanitary quality of pumped water. ~~Subsurface pits or pump rooms and inaccessible installations should be avoided.~~ All pumps shall be accessible for servicing and repair.

12VAC5-590-1020. Location.

A. The pumping station shall be located ~~so that the proposed site will meet the requirements of the sanitary protection of the water quality and the hydraulics of the system and be protected against interruption of service by fire, flood, or any other hazard~~ 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 ~~such~~ that elevation;

2. Accessible at all times unless ~~permitted~~ allowed to be out of service ~~for a period of inaccessibility~~ by the commissioner;

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~~,~~

~~5. Located with respect to availability of a power or a fuel supply~~.

12VAC5-590-1030. ~~Groundwater facilities.~~ (Repealed.)

~~Where pumping facilities are used, wells and springs shall be vented by properly hooded and screened pipe extending at least 12 inches above the pump floor or ground surface. Where necessary, provisions shall be made for lubricating the pump from a point at least six inches above the top of the well cover by means which will prevent contamination of the water supply.~~

~~A. General well appurtenances.~~

~~The following well appurtenances are required:~~

~~1. A sanitary seal shall be provided on the top of the well casing;~~

~~2. A properly screened vent with the end elbowed downward shall be provided for the well casing;~~

~~3. A sampling tap shall be provided for raw water sampling which discharges in a downward direction and away from the well casing;~~

~~4. Adequate control switches, etc., for the pumping equipment shall be provided;~~

~~5. A water meter is required to determine water production for each well and the meter shall be located upstream of the well blow-off;~~

~~6. The well casing shall extend at least 12 inches above the concrete floor or apron surrounding the well;~~

~~7. Adequate support for the well pump and drop pipe shall be provided; and~~

~~8. Each well casing shall be equipped with a drawdown gauge, airline, and appurtenances for measuring the change in the elevation of the water level in the well.~~

~~B. Drilled wells with the prime mover mounted on the casing shall:~~

~~1. Have the casing extend 12 inches above the floor, and be equipped with a flange or suitable sanitary seal;~~

~~2. Have the casing firmly connected to the pump structure or have the casing inserted into a recess extending at least one inch into the base of the pump if a watertight connection is not provided;~~

~~3. Have the base of the pump not less than 12 inches above the pump room floor or apron; and~~

4. Have the pump foundation and base designed to prevent water from coming into contact with the joint between the casing and the prime mover.

C. Submersible pumps. Where a submersible pump is used, the top of the casing shall be effectively sealed against entrance of water under all conditions of vibration or movement of conductors or cables and shall have a gooseneck vent with a screen covered opening.

D. Discharge piping. The discharge piping shall be provided with separate means to pump (blowoff) water of unsatisfactory quality to a point away from the groundwater source but shall not be directly connected to a sewer. The discharge line shall:

1. Have control valves located above the pump floor;

2. Be protected against freezing;

3. Be valved to permit testing and control of each well;

4. Have watertight joints;

5. Have all exposed valves protected; and

6. Have erosion protection at the point of waste discharge.

E. General well pump house construction requirements.

1. The well pump house floor or apron surrounding the well shall:

a. Be of good quality concrete with adequate reinforcement;

b. Be a minimum of six inches in thickness;

c. Extend a minimum of three feet in all directions from the well; and

d. Slope at least ¼ inch per foot towards a screened four inch floor drain to atmosphere.

2. Well houses or well pump stations in pits are prohibited.

3. Well pump stations housing chlorination equipment shall meet the requirements of 12VAC5-590-1000.

12VAC5-590-1040. Pump stations.

A. Pump stations associated with surface water sources, treatment facilities, and finished water shall:

1. Have adequate space for the installation of additional units if needed and for the safe servicing of all equipment;

2. Be of durable construction, fire and weather resistant, and furnished with outward opening doors;

3. Have the floor elevation at least six inches above the finished grade, if possible;

4. Have the underground structure waterproofed;

5. Have all floors drained without impairing the quality of water being handled, and, if equipment is contained on the floor, the floor shall slope at least ⅛ inch in every foot to the point of discharge; and

6. Provide suitable outlet for drainage from pump glands without discharging onto the floor.

B. Suction wells. Suction wells shall:

1. Be watertight;

2. Have floors sloped to permit removal of water and entrained solids; and

3. Be covered or otherwise protected against contamination, including contamination by pump lubricants.

C. Equipment servicing in pump stations.

1. Craneways, hoist beams, eyebolts, or other adequate facilities for servicing or removal of pumps, motors, or other heavy equipment shall be provided.

2. Walkways shall be provided to lubrication points of equipment if these are located at intermediate points between floors.

3. Openings in floors, roofs, or wherever else needed for removal of heavy or bulky equipment shall be provided.

4. A convenient tool board or other facilities shall be provided as needed for proper maintenance of the equipment.

D. Stairways and ladders. Stairs are preferred in areas where there is frequent traffic or where supplies are transported by hand. They shall have risers not exceeding nine inches and treads wide enough for safety. Where ladders are used, intermediate landings should be provided if the vertical distance exceeds 10 feet. Stairways and ladders shall:

1. Be provided between all floors and in pits or compartments which must be entered and;

2. Have handrails on both sides and treads of nonslip material.

E. Heating. In pump houses not occupied by personnel, only enough heat need be provided to prevent freezing of equipment or treatment process. Provision shall be made for adequate heating for the comfort of the operator and the safe and efficient operation of the equipment.

F. Ventilation. Adequate ventilation shall be provided for all pumping stations. Forced draft ventiliation of at least six changes of air per hour (continuous operation) shall be provided for:

1. All rooms, compartments, pits and other enclosures below the grade floor; and

2. Any area where an unsafe atmosphere may develop or where excessive heat may build up.

G. Dehumidification. In areas where excess moisture could cause hazards to safety or damage to equipment, means for dehumidification shall be provided.

H. Lighting. Pump stations shall be adequately lighted throughout. All electrical work shall conform to the requirements of the state codes.

I. Pumps. At least two pumping units shall be provided. If only two units are provided, each shall be capable of delivering the peak demand. If more than two units are installed, they shall have sufficient capacity so that if any one pump is out of service, the remaining pumps are capable of carrying the peak demand. The pumping units shall:

1. Have ample capacity to supply the peak demand without overloading;

2. Be driven by a prime mover able to operate against the maximum head and air temperature which may be encountered; and

3. Have maintenance parts and tools readily available.

J. Suction lift. If suction lift is necessary, provision shall be made for priming the pumps. Suction lift should be less than 15 feet.

K. Priming. Prime water must not be of lesser sanitary quality than that of the water being pumped. Means shall be provided to prevent back siphonage. When an air operated ejector is used, the screened intake shall draw clean air from a point at least 10 feet above the ground or other source of contamination, unless the air is filtered by an apparatus approved by the Division. Vacuum priming may be used.

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 towards 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, 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 well pump house floor 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. ~~Booster pumps~~ Pumps and controls.

A. General.

1. Pumps, their 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 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, the provisions for filling the fuel storage tank, the fuel tank itself, and the fuel line shall be designed to protect the water supply 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 by-pass around the automatic control.

8. A suitable outlet for drainage from pump glands shall be provided without discharging onto the floor.

~~A~~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:

~~1.~~ a. They will not produce negative gauge pressure in their suction line; and

~~2.~~ b. The intake pressure shall be at least 20 psi when the pump is in normal operation~~;~~.

~~3.~~ 2. An automatic pressure cutoff or a pressure regulating valve shall be provided to prevent suction line pressure from dropping to below 10 psi~~; and~~.

~~4.~~ 3. Automatic or remote control devices shall have ~~a~~ sufficient range between the start and cutoff pressure, or another mechanism ~~which~~ that will prevent excessive cycling of the pumps.

~~B. Inline booster pumps. In addition to the other requirements of this section, inline booster pumps shall be accessible for servicing and repairs.~~

4. At least two pumping units shall be provided.

a. If only two units are provided, each shall be capable of delivering the peak hour demand, taking into account storage contributions.

b. If more than two units are installed, 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, a pump or pumps 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.

12VAC5-590-1060. Automatic and remote controlled stations. (Repealed.)

~~All automatic stations should be provided with an automatic signaling apparatus which will report to a facility manned 24 hours per day when the station is out of service. All remote controlled stations shall be electrically operated and controlled and shall have a signaling apparatus of proven performance. Installation of electrical equipment shall conform with the appropriate state codes.~~

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 D); 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 of the equipment.

1. If foot valves are necessary, 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-vacuum relief valve located upstream from the check valve, with exhaust/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 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 blow-off.

E. Additional requirements for well discharge piping.

1. Valves shall be provided to allow testing and control of each well.

2. A non-threaded 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. Blow-off.

a. A separate means to pump (blow-off) water of unsatisfactory quality to a point away from the groundwater source shall be provided. Blow-off 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.

12VAC5-590-1070. ~~Appurtenances.~~ (Repealed.)

~~A. Valves.~~

~~Pumps shall be adequately valved to permit satisfactory operation, maintenance, and repair of the equipment. If foot valves are necessary, they shall have a net valve area of at least two and one half times the area of the suction pipe and they shall be screened. Each pump shall have a positive acting check valve on the discharge side between the pump and shutoff valve.~~

~~B. Piping, in general, shall:~~

~~1. Be designed so that the friction head will be low;~~

~~2. Not be subject to contamination;~~

~~3. Be sloped in one direction to drains;~~

~~4. Have adequate cleanouts;~~

~~5. Have watertight joints;~~

~~6. Be protected against surge or water hammer;~~

~~7. Be such that each pump has an individual suction line or the lines shall be so manifolded that they will insure similar hydraulic and operational conditions; and~~

~~8. Have proper legends to identify the contents of the pipes (see 12VAC5-590-720 L).~~

~~C. Gauges and meters.~~

~~The station should have indicating, totalizing, and recording metering of the total water pumped. Each pump shall:~~

~~1. Have a standard pressure gauge on its discharge line;~~

~~2. Have a compound gauge on its suction line; and~~

~~3. Have recording gauges in the larger stations as required by the division.~~

~~D. Water seals.~~

~~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:~~

~~1. Be provided with a break tank open to atmospheric pressure; and~~

~~2. Have an air gap between feeder line and spill line of the tank, at least two inches or two pipe diameters, whichever is greater.~~

~~E. Controls.~~

~~Pumps, their prime movers, and all accessories shall be controlled in such a manner that they will operate at their rated capacity without overloading. Where two or more pumps are installed, provision shall be made for proper alternation. Alternation may be automatic or manual. Provision shall be made to prevent operation of the pump during the backspin cycle. Electrical controls should be located above grade.~~

~~F. Power.~~

~~When power failure would result in cessation of the minimum essential service, the power supply shall be provided from at least two independent sources or an auxiliary source shall be provided.~~

~~G. Auxiliary power supply.~~

~~When automatic prelubrication of pump bearings is necessary and an auxiliary power supply is provided, the prelubrication line shall be provided with a valved by-pass around the automatic control.~~

~~Article 5~~
~~Finished Water Storage Structures~~

12VAC5-590-1080. ~~General~~ Basic finished water storage design criteria.

A. Materials. 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 structures shall follow the current available American Water Works Association standards concerning steel tanks, standpipes, reservoirs, and elevated tanks wherever they are applicable. Other materials of construction are acceptable when properly designed to meet the requirements of this section.~~ Steel, concrete, composite, and plastic storage structures shall be designed, constructed, cleaned, disinfected and tested in

accordance with AWWA Standards. Safety cages, rest platforms, roof-ladder handrails and other safety devices shall be provided as required by VOSH.

~~A.~~ B. Location of finished water storage facilities.

1. The bottom of ground level reservoirs, storage tanks and standpipes should be placed ~~at the normal ground surface~~ 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 ~~reservoir~~ storage facility. ~~AWWA approved water pipe~~ 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 protected from ~~above~~ the 100-year flood ~~level~~. ~~Clearwells~~ Any clearwell constructed under filters may be ~~excepted~~ exempted from this requirement when the total design gives the same protection.

C. 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.

D. 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, overflow, low level, and pump malfunction warnings or alarms shall be provided.

~~B. All new finished water storage structures shall have suitable watertight roofs or covers which exclude birds, animals, insects, and dust.~~

~~C. No drain on a water storage structure shall have a direct connection to a sewer or storm drain.~~

~~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 shall not be allowed.~~

~~D. The overflow pipe of a finished water storage structure shall be brought down near the ground surface where any discharge will be visible and into a drainage inlet structure or a splash plate which will divert the overflow away from the storage structure. No overflow may be connected directly to a sewer or storm drain.~~

~~1. When an internal overflow pipe is used it shall be located in the access tube.~~

~~2. The overflow of a ground level finished water storage structure shall be high enough above normal or graded ground surface to prevent the entrance of surface water.~~

~~3. All nonpressure type finished water storage structures shall be provided with a downward discharging screened overflow.~~

~~E. Finished water storage structures shall be designed with convenient access to the interior for cleaning and maintenance. 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 the top or covering sod;

2. Fitted with a solid watertight cover which overlaps the framed opening and extends vertically down around the frame at leas two inches (shoebox type);

3. Hinged at one side; and

4. Fitted with a locking device.

F. Finished water storage structures shall be vented by separate vent structures. Open construction between the side wall and roof is not permissable.

1. Vents shall prevent the entrance of surface water.

2. Vents shall exclude birds and animals.

3. Vents shall exclude insects and dust, as much as this function can be compatible with effective venting, for elevated tanks and standpipes, four-mesh noncorrodible screen may be used.

4. Vents on ground level structures shall terminate in an inverted U construction the opening of which is 24 to 36 inches above the roof or sod and is covered with noncorrodible screen cloth to exclude insects.

G. The roof and sidewalls of all structures must be watertight with no openings except properly constructed vents, manholes, overflows, risers, drains, pump mountings, control ports, or piping for inflow and outflow.

1. Any pipes running through the roof or sidewall of a finished water storage structure must be welded or properly gasketed in metal tanks or should be connected to standard wall castings which were poured in place during the forming of a concrete structure; these wall castings shall have flanges imbedded in the concrete.

2. Openings in a storage structure roof or top designed to accommodate control apparatus or pump columns shall be curbed and sleeved with proper additional shielding and shoebox type cover to prevent the access of surface water into the structure.

3. Valves and controls shall be located outside the storage structure so that valve stems and similar projections will not pass through the roof or top of the structure.

H. The roof or cover of the storage structure should be well drained, but downspout pipes shall not enter or pass through the reservoir.

I. The safety of employees shall be considered in the design of the storage structure. As a minimum, such matters shall conform to pertinent building codes, laws, and regulations of the area where the reservoir is constructed.

1. Ladders, ladder guards, balcony railings, and safe location of entrance hatches shall be provided.

2. Elevated tanks with riser pipes over eight inches in diameter shall have protective bars over the riser opening inside the tank.

J. All finished water storage structures and their appurtenances, especially the riser pipes, overflows, and vents, shall be designed to prevent freezing which will interfere with proper functioning.

K. Every catwalk over finished water in a storage structure shall have a solid floor with raised edges so designed that shoe scrapings and dirt will not fall into the water.

L. The area surrounding a ground level structure should be graded in a manner that will prevent surface water from standing within 50 feet of the structure.

~~M. Proper protection should be given to metal surfaces by paints or other protective coatings, by cathodic protective devices, or both. Paint systems consistent with the most current available American Water Works Association standards and otherwise acceptable to the division shall be used. Cathodic protection should be designed and installed by competent technical personnel.~~

~~N. All finished water storage facilities shall be cleaned to remove all dirt and loose materials prior to 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 workmen's boots shall be disinfected before they are used to clean the storage facilities.~~

~~O. All finished water storage facilities shall be satisfactorily disinfected prior to 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.~~

~~1. One of the following disinfection methods shall be used. Other methods of disinfection may be approved on a case-by-case basis by the division.~~

~~a. The tank shall be filled to the overflow level with potable water to which enough chlorine has been added to produce an initial chlorine concentration of 50 mg/L in the full tank. The full tank should stand for 24 hours; however, in no case shall it stand less than six hours. At the end of the holding period, the chlorinated water shall be drained to waste, the tank refilled with potable water, and tested for satisfactory bacteriological quality before placing the tank in service.~~

~~b. All interior surfaces of the tank shall have applied a chlorine solution containing at least 200 mg/L of free available chlorine. The chlorine solution shall be applied with either spray equipment or brushes. Any equipment used to apply the chlorine solution shall either be new or previously used only for disinfection purposes. The chlorine solution shall remain in contact with the tank surfaces for at least 30 minutes. The tank shall then be filled with potable water to the overflow level and tested for satisfactory bacteriological quality before placing the tank in service; or~~

~~c. Potable water containing a free chlorine residual of 50 mg/L shall be placed in the tank to such a depth that when the tank is filled, the resulting chlorine concentration in the water will be at least two mg/L. The water containing 50 mg/L of chlorine shall stand in the tank for 24 hours. The tank shall then be filled with potable water and allowed to stand for 24 additional hours. At the end of the second 24 hour period, the chlorine residual shall be at least two mg/L. After analyses of the water for satisfactory bacteriological quality, the tank may be placed in service without draining the water used to disinfect it.~~

~~2. Testing of the water following disinfection shall be in accordance with 12VAC5-590-800 C.~~

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. The storage facility 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 2.

C. Drains.

1. No drain on a 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. Atmospheric 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 in lieu of screens if approved by the commissioner.

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. Atmospheric 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 non-corrodible 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. Any 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 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 so designed 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. Paint systems consistent with NSF/ANSI Standard 61 and AWWA Standard D102 shall be used. Cathodic protection shall comply with AWWA Standard D104 or D106. Geomembrane materials for lining or covering potable water storage structures shall comply with AWWA Standard D130.

M. All finished water storage facilities shall be cleaned to remove all dirt and loose materials prior to 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 prior to 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.

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.

1. Pressure tanks shall be located above the normal ground surface with the tank end 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.

2. Pressure tanks shall have bypass piping to permit operation of the system while the tank is being cleaned, repaired, or painted.

3. Pressure tanks shall have an access manway, a drain, and control equipment consisting of pressure gauge, water sight glass, automatic or manual air blow-off, pressure and vacuum relief valves and mechanical means for adding air. Pressure tanks less than 120 gal and bladder tanks are not required to have an access manway, sight glass, or vacuum relief valve.

4. Pressure tanks and pumps shall be designed to minimize pump cycling and to operate within manufacturer's recommendations.

12VAC5-590-1090. Plant storage.

~~The applicable design standards of 12VAC5-590-1080 shall be followed for plant storage.~~

A. ~~Washwater~~ Backwash water storage tanks shall be sized in conjunction with available pump units and finished water storage to ~~give~~ provide the filter backwash water required. Consideration ~~must~~ 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 ~~should~~ 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 ~~chlorine~~ disinfection, special attention ~~must~~ 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 waterproof electric light.

C. Finished water shall not be stored or conveyed in a compartment adjacent to ~~unsafe~~ 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.

~~E. Hydropneumatic (pressure) tanks may be acceptable in small water systems. When used, they shall comply with the requirements of state and local laws and regulations for the construction and installation of unfired pressure vessels.~~

~~1. The tank shall be located above the normal ground surface with the tank end containing the inlet pipe, the pressure gauge and other appurtenances projecting into an operating house to prevent freezing or be completely housed.~~

~~2. The tank shall have bypass piping to permit operation of the system while the tank is being cleaned, repaired, or painted.~~

~~3. Pressure or level-pressure operated start-stop controls shall be installed on the discharge piping to permit operation of the water supply system.~~

~~4. Each tank shall have an access manhole, a drain, and control equipment consisting of pressure gauge, water sight glass, automatic or manual air blowoff, pressure and vacuum relief valves and mechanical means for adding air. Appurtenances to small capacity tanks shall be determined by the division on a case-by-case basis.~~

~~5. Tanks and pumps shall be designed to minimize pump cycling and shall have at least the following capacity:~~

~~a. When the hydropneumatic tank is fed directly by a well or wells, the effective storage volume is one-third of the hydropneumatic tank's gross volume;~~

~~b. When the hydropneumatic tank is fed directly from ground storage, the effective storage volume is the effective volume of the ground storage tank plus the effective volume of the hydropneumatic tank; and~~

~~c. At least two booster or transfer pumps are required which have a combined capacity to meet the requirements of 12VAC5-590-690 C.~~

12VAC5-590-1100. ~~Distribution storage.~~ (Repealed.)

~~The applicable design standards of 12VAC5-590-1080 shall be followed for distribution storage.~~

~~A. The maximum variation between high and low water levels in finished water storage structures which float on a distribution system should not exceed 30 feet. Large diameter, shallow-depth reservoirs are preferable over small diameter, deep-depth reservoirs.~~

~~B. Adequate controls shall be provided to maintain levels in distribution system storage structures at all times.~~

~~C. Pressure tanks. (Also see 12VAC5-590-1090 E.)~~

~~1. A telemetering system and recording equipment should be provided, to a location where qualified personnel are available at all times, for the transmission and recording of storage levels in the distribution system.~~

~~2. Altitude valves or equivalent controls may be required for subsequent structures on the system.~~

~~3. Overflow, low level, and pump malfunction warnings or alarms should be transmitted to a location where qualified personnel are available for surveillance on a 24-hour basis.~~

~~Article 6~~
~~Water Distribution Systems~~

12VAC5-590-1110. ~~Materials~~ Distribution system materials.

A. The pipe ~~selected~~, fittings, joints, valves, hydrants and coatings shall have been manufactured in conformity with the ~~current available standards issued by the American Water Works Association if such standards exist or be approved by the National Sanitation Foundation for water distribution piping~~ most current AWWA standards and meet the NSF/ANSI Standard 61 requirements.

~~B. In the absence of such standards, pipe meeting applicable commercial standards and acceptable to the division may be considered.~~

~~C.~~ B. Used water mains that meet these standards may be used again after the pipe has been thoroughly cleaned and restored in accordance with applicable industry standards.

~~D. Packing and joint materials used in the joints of pipe shall meet the standards of the American Water Works Association or the National Sanitation Foundation.~~

~~E. Mechanical joints or slip joints with resilient gaskets are preferred.~~

12VAC5-590-1120. Minimum pipe size.

A. The minimum size pipe for water distribution ~~systems~~ 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~~; and~~.

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. ~~The minimum size of pipe where fire protection is to be provided or required shall be six inches in diameter.~~ 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. ~~The standard grading schedule of the Insurance Services Office and other related organizations shall be followed in other cases.~~

~~D. Any departure in sizing shall be justified by hydraulic analysis and future water use and can be considered only in special circumstances.~~

~~E. Water mains not sized to carry fire flows shall not be connected to fire hydrants.~~ Where a noncommunity waterworks serves a single building, the plumbing shall be in accordance with the most recent edition of 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. ~~System~~Distribution system design.

A. Dead-ends should be minimized by looping of ~~all~~ mains.

B. Where dead-end ~~lines~~ water mains occur, ~~they shall be provided with a fire hydrant, flushing hydrant, or blowoff for flushing purposes~~ 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 ~~for~~ to a depth of at least six inches below the bottom of the pipe and selected fill bedding provided.

D. ~~The specifications for installation shall include:~~

~~1. Pressure testing on installed pipe;~~

~~2. Allowable leakage of installed pipe; and~~

~~3. Reference to applicable American Water Works Association standards or manufacturers' recommended installation procedures~~Installed pipe shall be pressure-tested and meet allowable leakage as specified in AWWA Standards C600, C604, and C605, as applicable.

E. Any plastic or other nonmetallic pressurized ~~conduit~~ pipe installed underground shall ~~have affixed thereto~~ be provided with a material conductive of electricity or some other means of locating the ~~conduit while it is underground~~ 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 sewers:

1. Materials and types of joints for water and sewer mains;
2. Soil conditions;
3. Service branch connections into the water main and sewer mains;
4. Compensating variations in the horizontal and vertical separations;
5. Space for repairs and alterations of water and 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 sewer or sewer manhole. The distance shall be measured edge-to-edge.

2. Under unusual ~~conditions~~ situations when local conditions prevent a horizontal separation of 10 feet, the water main may be laid closer to a 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 sewer;

b. Where this vertical separation cannot be obtained, the sewer shall be constructed of ~~AWWA approved water pipe~~water distribution pipe, pressure tested in place ~~without leakage prior to backfilling; and~~ in accordance with 12VAC5-590-1110 and 12VAC5-590-1140;

c. The commissioner may approve concrete encasement of the water main or other physical barrier;

~~c.~~ 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 ~~lines~~ mains crossing sanitary sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water line and the top of the sewer whenever possible.

2. Under unusual ~~conditions~~ situations when local conditions prevent a vertical separation described in subdivision C 1 of this section, the following construction shall be used:

a. ~~Sewers~~ Sanitary sewers passing over or under water mains shall be constructed of the materials described in ~~subdivision B 2 b~~ 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 ~~lines~~ mains passing under 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 ~~line~~ main;

(2) Adequate structural support for the sewers to prevent excessive deflection of the joints and the settling on and breaking of the ~~waterline~~ water main; and

(3) That the length of the water ~~line~~ 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. ~~No water pipes shall pass through or come in contact with any part of a sewer manhole.~~ The minimum horizontal separation distance between water mains and septic tanks and drainfields, measured edge-to-edge, shall be 10 feet. Greater separation distance 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~~ blow-off chambers.

A. ~~Air and sediment accumulations may be removed through a standard fire hydrant; compressed air and pumping may be used for dewatering mains through hydrants.~~ Standard fire hydrants or blow-offs shall be considered to enable removal of sediment and air accumulations.

B. ~~Chambers~~ Drains in chambers or pits ~~containing~~ that contain valves, ~~blowoffs~~ blow-offs, meters, or other ~~such~~ appurtenances to a distribution system shall not be connected directly to

any storm drain or sanitary sewer, nor shall ~~blowoffs~~ blow-offs or air relief valves be connected directly to any sewer.

C. ~~Such chambers~~ 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. The chamber or pit shall be designed to facilitate air valve inspection and servicing.

E. Air relief and blow-off piping.

~~D.~~ 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 above-ground extension is not practical or desired, the open end of the relief pipe or blow-off 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 blow-off 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 prior to placement of the pit or chamber.

12VAC5-590-1170. Hydrants.

A. Where hydrant drains are not plugged, they shall be drained to the ground surface or to dry wells provided exclusively for this purpose in a manner that will avoid contamination of the hydrant or water main from high groundwater, surface flooding and ponding, and contaminant or pollutant spills.

B. Hydrant drains shall not be connected to sanitary sewers or storm drains.

C. Fire hydrants shall be connected only to water ~~systems~~ mains adequately designed for fire flows ~~in addition to domestic flow~~ in accordance with the requirements of 12VAC5-590-1120.

12VAC5-590-1180. Surface water crossings.

A. Surface water crossings, both over and under water, present special ~~problems and should~~ challenges and shall be discussed with the ~~division appropriate~~ Department before ~~final plans~~ project documents are prepared.

~~A. Above~~ 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 level.

~~B.~~ C. Under water crossings.

1. The pipe shall be of special construction, suitable to the method of installation and having flexible watertight joints.

2. ~~Valves~~ 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.

~~3. Sample taps shall be available at each end of the crossing and at a reasonable distance from each side of the crossing and not subject to flooding.~~

~~4. Permanent taps shall be made for testing and locating leaks.~~

12VAC5-590-1190. Water services and plumbing. (Repealed.)

~~Water services and plumbing shall conform to the Uniform Statewide Building Code.~~

12VAC5-590-1200. ~~Water pressure in systems.~~ (Repealed.)

~~The system shall be designed to maintain a minimum pressure of 20 psi in the distribution system at the design flow (see 12VAC5-590-690 C). Where the pressure at the service tap exceeds 80 psi, the provisions of the Uniform Statewide Building Code shall apply.~~

12VAC5-590-1210. Disinfection of water mains.

A. All water mains shall be disinfected in accordance with AWWA Standard C651 prior to 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. ~~Prior to disinfection all water mains shall be flushed unless the tablet method of disinfection is used. All valves and hydrants shall be operated during this operation. Flushing velocities should not be less than 2.5 feet per second.~~

~~C. Methods of chlorine application.~~

~~1. Continuous feed method - Potable water shall be introduced into the pipe main at a constant flow rate. Chlorine shall be added at a constant rate to this flow so that the chlorine concentration in the water in the pipe is at least 50 mg/L. The chlorinated water shall remain in the main at least 24 hours, after which, the chlorine concentration in the water shall be at least 10 mg/L. All valves and appurtenances shall be operated while the chlorinated water remains in the main;~~

~~2. Slug method - Potable water shall be introduced into the main at a constant flow rate. This water shall receive a chlorine dosage which will result in a chlorine concentration of 100 mg/L in a "slug" of the water. The chlorine shall be added long enough to insure that all portions of the main are exposed to the 100 mg/L chlorine solution for at least three hours. The chlorine residual shall be checked at regular intervals not to exceed 2,000 feet to insure that adequate residual is maintained. As the chlorinated water passes~~

~~valves and appurtenances, they shall be operated to insure disinfection of these appurtenances; or~~

~~3. Tablet method – Tablets shall be placed in each section and in all appurtenances. Enough tablets shall be used to insure that a chlorine concentration of 25 mg/L is provided in the water. They shall be attached by an adhesive to the top of the pipe sections and crushed or rubbed in all appurtenances. The adhesive shall be acceptable to the division. The velocity of the potable water in the main shall be less than 1 foot per second. The water shall then remain in contact with the pipe for 24 hours. All valves and appurtenances shall be operated while the chlorinated water is in the main.~~

~~This method shall not be used if nonpotable water or foreign materials have entered the mains or if the water temperature is below 5°C (41°F).~~

~~D. Final flushing. After the required retention period, the chlorinated water shall be flushed from the main using potable water.~~

~~E. Testing. After the mains have been flushed, the water mains shall be tested in accordance with 12VAC5-590-800 C. Samples shall be collected at regular intervals, not exceeding 2,000 feet, throughout the length of main.~~

~~F. Repairs. Cleaning, disinfecting, flushing, testing, or similar operational actions shall be in accordance with the current standard issued by AWWA (AWWA C-601).~~ 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. ~~Cover~~ Pipe cover.

All ~~distribution mains~~ 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. ~~Metering~~ Service lines and meters.

A. ~~Each~~ All new service connections in community waterworks ~~service connection should~~ 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 potable water supply.

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.