AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

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ENVIRONMENTAL PROTECTION RULES

CHAPTER 21

WATER SUPPLY RULE

(Recent revisions include new standards for arsenic and uranium)

Effective Date: September 24, 1992
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NOTE: The complete rule consists of the following parts:

The Text of The Rule, Subchapters 1 - 16
Appendix A, Parts 1 - 10 - General Standards
Appendix A, Part 11 - Small Scale Water Systems
Appendix A, Part 12 - Construction & Isolation Standards for Wells
Appendix B - Long Range Plan Requirements
Appendix C - Bacteriological Monitoring Requirements
Appendix D - Operation & Maintenance Manual Standards
Appendix E - Federal Regulations 40 CFR, Parts 141, 142, 143

Most people will not need all parts of the Rule. If you need a part that you do not have, please call the Water Supply Division at (800) 823-6500 or (802) 241-3400 and request the part(s) you need.

4.6 Fluoridation

Sodium fluoride, sodium silicofluoride and hydrofluorosilicic acid shall conform to the NSF *Drinking Water Treatment Chemicals and System Components Certification*. The proposed method of fluoride feed must be approved by the Secretary prior to preparation of final plans and specifications. The proposed method will conform to CDC *Water Fluoridation; A Manual for Engineers and Technicians*, latest edition.

4.6.1 Fluoride compound storage

Fluoride chemicals should be isolated from other chemicals to prevent contamination. Compounds shall be stored in covered or unopened shipping containers and should be stored inside a building. Unsealed storage units for hydrofluorosilicic acid must be vented to the atmosphere at a point outside any building. Bags, fiber drums and steel drums should be stored on pallets.

4.6.2 Chemical feed equipment and methods

In addition to the requirements in Part 5, fluoride feed equipment shall meet the following requirements:

(a) scales, loss-of-weight recorders, water meters or liquid level indicators, as appropriate, accurate to within five percent of the average daily change in reading shall be provided for chemical feeds;
(b) feeders shall be accurate to within five percent of any desired feed rate;
(c) the point of application of hydrofluorosilicic acid, if into a horizontal pipe, shall be in the lower half of the pipe;
(d) a fluoride solution, including hydrofluorosilicic acid, shall be applied by a positive displacement pump;
(e) anti-siphon devices shall be provided for all fluoride feed lines and dilution water lines;
(f) a device to measure the flow of water to be treated is required;
(g) the dilution water pipe shall terminate at least two pipe diameters above the solution tank when an upflow saturator is not used;
(h) water used for sodium fluoride dissolution shall be softened if hardness exceeds 75 mg/l as calcium carbonate;
(i) fluoride solutions shall not be injected to a point of negative pressure;
(j) the electrical outlet used for the fluoride feed pump should have a nonstandard receptacle and shall be electrically interconnected with the well or service pump; and
(k) sodium fluoride saturators should be of the upflow type and be provided with a meter and backflow protection on the makeup water line.

4.6.4 Protective equipment

Protective equipment, as outlined in Subpart 5.3.4, and as required by OSHA and VOSHA regulations, shall be provided for operators handling fluoride compounds.

4.6.5 Dust control

(a) Provision must be made for the transfer of dry fluoride compounds from shipping containers to storage bins or hoppers in such a way as to minimize the quantity of fluoride dust which may enter the room in which the equipment is installed. The enclosure shall be provided with an exhaust fan and dust filter which place the hopper under a negative pressure. Air exhausted from fluoride handling equipment shall discharge through a dust filter to the outside atmosphere of the building.

(b) Provision shall be made for disposing of empty bags, drums or barrels in a manner which will minimize exposure to fluoride dusts. A floor drain should be provided to facilitate the hosing of floors. A floor drain may require a discharge permit from the Secretary.

4.6.6 Testing equipment

Equipment shall be provided for measuring the quantity of fluoride in the water. Such equipment shall be subject to the approval of the Secretary.

4.7 Stabilization

Water that is unstable due to natural causes or to subsequent treatment should be stabilized.

4.7.1 Polyphosphates

The feeding of polyphosphates may be applicable for corrosion control.

(a) Feed equipment shall conform to Part 5, Chemical Application.

(b) Phosphate must meet NSF *Drinking water treatment chemicals and system components* certification.

(c) Stock phosphate solution must be kept covered and disinfected by carrying approximately 10 milligrams per liter free chlorine residual.

(d) Satisfactory chlorine residuals shall be maintained in the distribution system when phosphates are used.

4.7.2 Other treatment

Other treatment for controlling corrosive waters by the use of sodium silicate and sodium bicarbonate shall be used where necessary. Any proprietary compound must receive the specific approval of the Secretary before use. Chemical feeders shall be as required in Part 5.

4.7.3 Water unstable due to biochemical action in distribution system

Unstable water resulting from the bacterial decomposition of organic matter in water (especially in dead end mains), the biochemical action within tubercles, and the reduction of sulfates to sulfides should be prevented by the maintenance of a free chlorine residual throughout the distribution system.

4.8 Taste & Odor Control

Provision shall be made for the control of taste and odor as required by the Secretary. Chemicals shall be added sufficiently ahead of other treatment processes to assure adequate contact time for an effective and economical use of the chemicals. Where severe taste and odor problems are encountered in-plant and/or pilot plant studies are required.

4.8.1 Flexibility

Treatment plants that supply water with known taste and odor problems should have equipment available to treat these problems. The equipment should have several control processes available for treatment flexibility in addressing the problem.

4.8.2 Chlorination

Chlorination can be used for the removal of some objectionable odors. Adequate contact time must be provided to complete the chemical reactions involved. Excessive potential trihalomethane production through this process should be avoided by adequate bench-scale testing prior to design. The breakpoint technique of chlorinating is recommended.

4.8.3 Chlorine dioxide

Chlorine dioxide has been generally recognized as a treatment for tastes caused by industrial wastes, such as phenols. However, chlorine dioxide can be used in the treatment of any taste and odor that is treatable by an oxidizing compound. Provisions shall be made for proper storing and handling of the sodium chlorite, so as to eliminate any danger of explosion.

4.8.4 Powdered activated carbon

(a) Powdered activated carbon when prescribed should be added as early as possible in the treatment process to provide maximum contact time. Flexibility to allow the addition of carbon at several points is preferred. Activated carbon should not be applied near the point of chlorine application.
(b) The carbon can be added as a premixed slurry or by means of a dry feed machine as long as the carbon is properly wetted.
(c) Continuous agitation or resuspension equipment is necessary to keep the carbon from depositing in the slurry storage tank.
(d) Provision shall be made for adequate dust and explosion control.
(e) The required rate of feed of carbon in a water treatment plant depends upon the tastes and/or odors involved, but provision should be made for adding from 0.1 milligrams per liter to at least 40 milligrams per liter.
(f) Powdered activated carbon shall be handled as a potentially combustible material. It should be stored in a building or compartment as nearly fireproof as possible. Other chemicals should not be stored in the same compartment. Carbon feeder rooms should be equipped with explosion-proof electrical outlets, lights and motors.

4.8.5 Granular activated carbon adsorption units

See Subpart 4.2.1.6 of this appendix.

4.8.6 Copper sulphate and other copper compounds

Continuous or periodic treatment of water with copper compounds to kill algae or other growths shall be controlled to prevent copper in excess of 1.3 milligrams per liter as copper in the plant effluent or distribution system. Care shall be taken to assure an even distribution. A permit shall be obtained from the Secretary prior to any such treatment.(See 10 V.S.A., § 1263(a)).

4.8.7 Aeration

See Subpart 4.4 of this appendix.

4.8.8 Potassium permanganate

Application of potassium permanganate may be considered, providing the treatment shall be designed so that the products of the reaction are not visible in the finished water.

4.8.9 Ozone

Ozonation can be used as a means of taste and odor control. Adequate contact time must be provided to complete the chemical reactions involved. Ozone is generally more desirable for treating water with high threshold odors.

4.8.10 Other Methods

The decision to use any other methods of taste and odor control should be made only after careful laboratory and/or pilot plant tests and on consultation with the Secretary.

4.9 Microscreening

A microscreen is a mechanical supplement of treatment capable of removing some of the suspended matter from the water by straining. It may be used to reduce nuisance organisms, leaves, weeds and organic matter. It shall not be used in place of:

(a) filtration, when filtration is necessary to provide a satisfactory water, or
(b) coagulation, in the preparation of water for filtration.

4.9.1 Design

(a) Design shall give due consideration to:

(1) nature of the suspended matter to be removed
(2) corrosiveness of the water
(3) effect of chlorination, when required as a pretreatment
(4) duplication of units for continuous operation during equipment maintenance

(b) Design shall provide:

(1) a durable, corrosion-resistant screen
(2) by-pass arrangements
(3) protection against back-siphonage when potable water is used for washing
(4) proper disposal of wash waters (see Subpart 4.10 of this appendix).

4.10 Waste Handling & Disposal

Provisions must be made for proper disposal of water treatment plant waste such as sanitary, laboratory, clarification sludge, iron sludge, filter backwash water, and brine. All waste discharges shall be permitted by the Secretary. In locating waste disposal facilities, due consideration shall be given to preventing potential contamination of the water supply and groundwater.

Alternative methods of water treatment and chemical use should be considered as a means of reducing waste handling and disposal problems.

4.10.1 Sanitary waste

The sanitary waste from water treatment plants, pumping stations, etc., must receive treatment. Waste from these facilities must be discharged directly to a sanitary sewer system, when feasible, or to an on-site waste treatment facility approved by the Secretary.

4.10.2 Alum sludge

Lagooning may be used as a method of handling alum sludge. Lagoon size can be calculated using total chemicals used plus a factor for turbidity. Mechanical concentration may be considered. A pilot plant study is required before the design of a mechanical dewatering installation. Freezing changes the nature of alum sludge so that it can be used for fill. Alum sludge can be discharged to a sanitary sewer. However, approval of this method will depend on obtaining approval from the owner of the sewerage system as well as from the Secretary before final designs are made.

Lagoons should be designed to produce an effluent satisfactory to the Secretary and should provide for:

(a) location free from flooding
(b) where necessary, dikes, deflecting gutters or other means of diverting surface water so that it does not flow into the lagoon
(c) a minimum usable depth of five feet
(d) adequate freeboard
(e) adjustable decanting device
(f) effluent sampling point, and
(g) adequate safety provisions

4.10.3 "Red water" waste

Waste filter wash water from iron and manganese removal plants must be disposed of according to the Secretary’s requirements.

4.10.4 Waste filter wash water

Waste filter wash water from surface water treatment plants should have suspended solids reduced to a level acceptable to the Secretary before being discharged. Many plants have constructed holding tanks and returned this water to the inlet end of the plant.

The holding tank should be of such a size that it will contain the anticipated volume of waste wash water produced by the plant when operating at design capacity. A plant that has two filters should have a holding tank that will contain the total waste wash water from both filters calculated by using a 15 minute wash at 20 gallons per minute per square foot. In plants with more filters, the size of the holding tank will depend on the anticipated hours of operation. It is recommended that waste filter wash water be returned at a rate of less than 10 percent of the raw water entering the plant. Filter backwash water should not be recycled when the raw water contains excessive algae, when finished water taste and odor problems are encountered, or when trihalomethane levels in the distribution system may exceed allowable levels. As such, a discharge permit, or municipal sewer connection or alternate means of treatment shall be required for waste filter wash water.

Part 5 CHEMICAL APPLICATION

5.0 General

No chemicals shall be applied to treat drinking waters unless specifically allowed by the Secretary.

5.0.1 Plans and specifications

Plans and specifications shall be submitted for review and approval, as provided for in Subpart 2, and shall include

(a) description of feed equipment, including maximum and minimum feed ranges
(b) location of feeders, piping layout and points of application
(c) storage and handling facilities
(d) specifications for chemicals to be used and dilution level if any
(e) operating and control procedures including proposed application rates
(f) descriptions of testing equipment and procedures

5.0.2 Chemical application

Chemicals shall be applied to the water at such points and by such means as to:

(a) assure maximum efficiency of treatment;
(b) assure maximum safety to consumer;
(c) provide maximum safety to operators;
(d) assure satisfactory mixing of the chemicals with the water;
(e) provide maximum flexibility of operation through various points of application, when appropriate; and
(f) prevent backflow or back-siphonage between multiple points of feed through common manifolds.

5.0.3 General equipment design

General equipment design shall be such that:

(a) feeders will be able to supply, at all times, the necessary amounts of chemicals at an accurate rate throughout the range of water delivery;
(b) chemical feed pumps shall be installed so they can be easily calibrated;
(c) chemical contact materials and surfaces are resistant to the aggressiveness of the chemical solution;
(d) corrosive chemicals are introduced in such a manner as to minimize potential for corrosion;
(e) chemicals that are incompatible are not stored or handled together;
(f) all chemicals are conducted from the feeder to the point of application in separate conduits;
(g) chemical feeders are as near as practical to the feed point; and
(h) chemical feeders and pumps operate at no lower than 20 percent of the feed range.

5.1 Facility Design

5.1.1 Number of feeders

(a) Where chemical feed is necessary for the protection of the supply such as chlorination, coagulation, or other essential processes;

(1) a minimum of two feeders shall be provided;
(2) the standby unit or a combination of units of sufficient capacity should be available to replace any unit during shutdowns; and
(3) where a booster pump is required, duplicate equipment should be provided and, when necessary, standby power.

(b) A separate feeder shall be used for each chemical applied.
(c) Spare parts shall be available for all feeders to replace parts which are subject to wear and damage.

5.1.2 Control

(a) Feeders may be manually or automatically controlled, with automatic controls being designed so as to allow override by manual controls.
(b) Chemical feed rates shall be proportional to flow.
(c) A means to measure water flow must be provided in order to determine chemical feed rates.
(d) Provisions shall be made for measuring the quantities of chemicals used.
(e) weighing scales:
(1) shall be provided for weighing cylinders, at all plants utilizing chlorine gas;
(2) may be required for fluoride solution feed;
(3) should be provided for volumetric dry chemical feeders; and
(4) should be accurate to measure increments of 0.5 percent of load.

5.1.3 Dry chemical feeders

Dry chemical feeders shall:

(a) measure chemicals volumetrically or gravimetrically;
(b) provide adequate solution water and agitation of the chemical in the solution pot;
(c) provide gravity feed from solution pots where possible;
(d) completely enclose chemicals to prevent emission of dust to the operating room; and
(e) be specified as to make, model and design characteristics.

5.1.4 Positive displacement solution pumps

Positive displacement type solution feed pumps should be used to feed liquid chemicals, but shall not be used to feed chemical slurries. Pumps must be sized to match or exceed maximum head conditions found at the point of injection. Specify make and model number of pump for all pumps used.

5.1.5 Liquid chemical feeders - siphon control

Liquid chemical feeders shall be such that chemical solutions cannot be siphoned into the water supply byassuring discharge at a point of positive pressure; and

(a) providing vacuum relief;
(b) providing a suitable air gap; or
(c) other suitable means or combinations as necessary to prevent siphoning.

5.1.6 Cross connection control

Cross connection control meeting current AWWA Standard C-506 must be provided to assure that:

(a) the service water lines discharging to solution tanks shall be properly protected from backflow as required by the Secretary;
(b) liquid chemical solutions cannot be siphoned through solution feeders into the water supply as required in 5.1.5; and
(c) no direct connection exists between any sewer, and a drain or overflow from the feeder, solution chamber or tank by providing that all drains terminate at least six inches or two pipe diameters, whichever is greater, above the overflow rim of a receiving sump, conduit or waste receptacle.

5.1.7 Chemical feed equipment location

Chemical feed equipment shall:

(a) be located in a separate room to reduce hazards and dust problems;
(b) be conveniently located near points of application to minimize length of feed lines;
(c) be readily accessible for servicing, repair and observation of operation; and
(d) shown in schematic lay out for location and method of control and operation.

5.1.8 In Plant water supply

In plant water supply shall be:

(a) ample in quantity and adequate in pressure;
(b) provided with means for measurement when preparing specific solution concentrations by dilution;
(c) properly treated for hardness, when necessary;
(d) properly protected against backflow; and
(e) obtained from a location sufficiently downstream of any chemical feed point to assure adequate mixing and contact time if necessary.

5.1.9 Storage of chemicals

(a) Space should be provided for:

(1) at least 30 days of chemical supply;
(2) convenient and efficient handling of chemicals;
(3) dry storage conditions; and

(4) a minimum storage volume of 1.5 truck loads where purchase is by truck load lots.

(b) Storage tanks and pipelines for liquid chemicals shall be specific to the chemicals and not for alternates.

(c) Chemicals shall be stored in covered or unopened shipping containers, unless the chemical is transferred into an approved storage unit.

(d) Liquid chemical storage tanks must:

(1) have a liquid level indicator; and

(2) have an overflow and a receiving basin or drain capable of receiving accidental spills or overflows (meeting OSHA and VOSHA regulations).

5.1.10 Solution tanks

(a) A means which is consistent with the nature of the chemical solution shall be provided in a solution tank to maintain a uniform strength of solution. Continuous agitation shall be provided to maintain slurries in suspension.

(b) Two solution tanks of adequate volume may be required for a chemical to assure continuity of supply in servicing a solution tank.

(c) Means shall be provided to measure the solution level in the tank.

(d) Chemical solutions shall be kept covered. Large tanks with access openings shall have such opening curbed and fitted with overhanging covers.

(e) Subsurface locations for solution tanks shall;

(1) be free from sources of possible contamination; and

(2) assure positive drainage for groundwaters, accumulated water, chemical spills and overflows.

(f) Overflow pipes, when provided should:

(1) be turned downward, with the end screened;

(2) have a free fall discharge; and

(3) be located where noticeable.

(g) Acid storage tanks must be vented to the outside atmosphere, but not through vents in common with day tanks.

(h) Each tank shall be provided with a valved drain, protected against backflow in accordance with 5.1.5. and 5.1.6.

(i) Solutions tanks shall be located and protective curbings provided so that chemicals from equipment failure, spillage or accidental drainage shall not enter the water in conduits, treatment or storage basins.

5.1.11 Day tanks

(a) Day tanks should be provided where bulk storage of liquid chemical is provided.

(b) Day tanks shall meet all the requirements of 5.1.10.

(c) Day tanks should be scale-mounted, or have a calibrated gauge painted or mounted on the side if liquid level can be observed in a gauge tube or through translucent sidewalls of the tank. In opaque tanks, a gauge rod extending above a reference point at the top of the tank, attached to a float, may be used. The ratio of the area of the tank to its height must be such that unit readings are meaningful in relation to the total amount of chemical fed during a day.

(d) Hand pumps may be provided for transfer from a carboy or drum. A tip rack may be used to permit withdrawal into a bucket from a spigot. Where motor driven transfer pumps are provided a liquid level limit switch and an overflow from the day tank, must be provided.
(e) A means which is consistent with the nature of the chemical solution shall be provided to maintain uniform strength of solution in a day tank. Continuous agitation shall be provided to maintain chemical slurries in suspension.
(f) Day tanks shall be properly labeled to designate the chemical contained.
(g) Labels shall also specify size, make, model and material of each tank.

5.1.12 Feed lines:

(a) should be as short as possible, and:

(1) of durable, corrosion resistant material;
(2) easily accessible throughout the entire length;
(3) protected against freezing, and
(4) readily cleanable;

(b) should slope upward from the chemical source to the feeder when conveying gases;
(c) shall be designed consistent with scale-forming or solids depositing properties of the water, chemical, solution or mixtures conveyed; and
(d) shall be color coded. (See Subpart 2.14 of this appendix)

5.1.13 Handling

(a) Carts, elevators and other appropriate means shall be provided for lifting chemical containers to minimize excessive lifting by operators.
(b) Provision must 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 may enter the room in which the equipment is installed.
(c) Provision shall be made for measuring quantities of chemical used to prepare feed solutions.

5.1.14 Housing

(a) Floor surfaces shall be smooth, impervious, slip proof and well drained with a positive slope to floor drains.
(b) Vents from feeders, storage facilities and equipment exhaust shall discharge to the outside atmosphere above grade and remote from air intakes.

5.2 Chemicals

5.2.1 Shipping containers

Chemical shipping containers shall be fully labeled to include:

(a) chemical name, purity and concentration; and
(b) supplier name and address.

5.2.2 Specifications

All products or chemicals which may come in contact with water intended for use in a **Public** water system shall meet American National Standards Institute/NSF International Standards, specifically ANSI/NSF Standards 60 and 61.

5.2.3 Assay

Provisions may be required for assay of chemicals delivered.

5.2.4 Material Safety Data Sheets

A Material Safety Data Sheet must be obtained from each vendor for each chemical used and readily available for in plant review by operating personnel.

5.3 Operator Safety

5.3.1 Ventilation

Special provisions shall be made for ventilation of chlorine feed and storage rooms.

5.3.2 Respiratory protection equipment

Respiratory protection equipment, meeting the requirements the National Institute for Occupational Safety and Health (NIOSH), shall be available where chlorine gas is handled, and shall be stored at a convenient location, but not inside any room where chlorine is used or stored. The units shall use compressed air, have at least a 30 minute capacity, and be compatible with or exactly the same as units used by the fire department responsible for the plant.

5.3.3 Chlorine leak detection

A bottle of ammonium hydroxide, 56 percent ammonia solution, shall be available for chlorine leak detection; where ton containers are used, a leak repair kit approved by the Chlorine Institute shall be provided. Continuous chlorine leak detection equipment is recommended. Where a leak detector is provided it shall be equipped with both an audible alarm and a warning light.

5.3.4 Protective equipment

(a) At least one pair of rubber gloves, dust respirator of a type certified by NIOSH for toxic dusts, an apron or other protective clothing and goggles or face mask shall be provided for each operator as required by the Secretary. A deluge shower and/or eyewashing device should be installed where strong acids and alkalis are used or stored.
(b) Other protective equipment should be provided as necessary.

5.4 Specific Chemicals

5.4.1 Chlorine gas

(a) Chlorine gas feed and storage shall be enclosed and separated from other operating areas. The chlorine room shall be: