MISSOURI
DEPARTMENT OF
NATURAL RESOURCES

Title 10—DEPARTMENT OF NATURAL RESOURCES
Division 20—Clean Water Commission
Chapter 8—Minimum Design Standards

WORKING DOCUMENT

Strawman

The Department presents these draft materials for stakeholder review and discussion only.
Subject to the Red Tape Reduction review.

The Missouri Department of Natural Resources has identified 10 CSR 20-8, Minimum Design Standards, as a potential rulemaking amendment. This workgroup has been convened for the purpose of informal and voluntary public participation and discussions regarding the development of this rule prior to initiating formal rulemaking.

Under Governor Greitens' leadership, all state agencies are working to reduce regulations and other government processes that unnecessarily burden individuals and businesses while doing little to protect or improve public health, safety, and our natural resources. The Missouri Department of Natural Resources is committed to limiting regulation to what is necessary to protect Missouri's environment, implementing statutory mandates, and maintaining state control of programs. Any further proposed changes to rules discussed on this page are being developed with these goals in mind. We welcome your comments to help ensure that our regulations provide required protections but do not add unnecessary costs.

LEGEND: **STRAWMAN DRAFT 12/19/17**
Text to be *[deleted]* is in italics and bracketed.
Added text is **bolded**.

Title 10—DEPARTMENT OF NATURAL RESOURCES
Division 20—Clean Water Commission
Chapter 8—*[Design Guides]* Minimum Design Standards

10 CSR 20-8.190 Disinfection.

[PURPOSE: The following criteria have been prepared as a guide for the design of disinfection facilities. This rule is to be used with rules 10 CSR 20-8.110–10 CSR 20-8.220 for the planning and design of the complete treatment facility. This rule reflects the minimum requirements of the Missouri Clean Water Commission as regards adequacy of design, submission of plans, approval of plans and approval of completed sewage works. Deviation from these minimum requirements will be allowed where sufficient documentation is presented to justify the deviation. These criteria are taken largely from Great Lakes-Upper Mississippi River Board of State Sanitary Engineers Recommended Standards for Sewage Works and are based on the best information presently available. These criteria were originally filed as 10 CSR 20-8.030. It is anticipated that they will be subject to review and revision periodically as additional information and methods appear. Addenda or supplements to this publication will be furnished to consulting engineers and city engineers. If others desire to receive addenda or supplements, please advise the Clean Water Commission so that names can be added to the mailing list.]

PURPOSE: The following minimum criteria have been prepared as a standard for the design of wastewater systems. This rule is to be used with rules 10 CSR 20-8.110 through 10 CSR 20-8.500 for the planning and design of a treatment facility. It is not reasonable or practical to include all aspects of design in these standards. The design engineer may use other appropriate reference materials for these design aspects not addressed in this rule, which include but are not limited to: copies of all ASTM International and American Water Works Association (AWWA) standards pertaining to wastewater systems and appurtenances, design manuals such as Water Environment Federation's Manuals of Practice, Department prepared guides and other wastewater design manuals containing principles of accepted engineering practice. This rule specifies minimum standards for the design and construction of wastewater systems, in addition to engineering experience and judgement in accordance with standards of practice.

[(1) Definitions. Definitions as set forth in the Clean Water Law and 10 CSR 20-2.010 shall apply to those terms when used in this rule, unless the context clearly requires otherwise. Where the terms shall and must are used, they are to mean a mandatory requirement insofar as approval by the agency is concerned, unless justification is presented for deviation from the requirements. Other terms, such as should, recommend, preferred and the like, indicate discretionary requirements on the part of the agency and deviations are subject to individual consideration.]

[(2) Exceptions. This rule shall not apply to facilities designed for twenty-two thousand five hundred gallons per day (22,500 gpd) (85.4 m^3) or less (see 10 CSR 20-8.020 for the requirements for those facilities).]

[(3) Forms of Disinfection. Chlorine is the most commonly used chemical for wastewater disinfection. The forms most often used are liquid chlorine and calcium or sodium hypochlorite. Other disinfectants, including chlorine dioxide, ozone or bromine, may be accepted by the agency in individual cases. The chemical should be selected after due consideration of waste flow rates, application and demand rates, pH of the wastewater, cost of equipment, chemical availability and maintenance problems. If chlorination is utilized, it may be necessary to dechlorinate if the chlorine level in the effluent would impair the natural aquatic habitat of the receiving stream.]

[(4) Feed Equipment.

(A) Type. Solution-feed vacuum-type chlorinators are generally preferred for large chlorination installations. The use of hypochlorite feeders of the positive displacement type may be considered and are generally preferred when intermittent disinfection is required. The preferred method of generation of chlorine dioxide is the injection of a sodium chlorite solution into the discharge line of a solution-feed gas-type chlorinator with subsequent formation of the chlorine dioxide in a reaction chamber at a pH of four (4.0) or less. Ozone dissolution is accomplished through the use of conventional gas diffusion equipment, with appropriate consideration of materials. If ozone is being produced from air, gas preparation equipment (driers, filters, compressors) is required. If ozone is being produced from oxygen, this equipment may not be needed as a clean dry pressurized gas supply will be available.]

(B) Control.

1. Chlorination without dechlorination. Facilities with design flows of one million gallons per day (1.0 mgd) (3785 m^3/d) or greater shall be equipped with a chlorine rate control to feed the chlorine proportional to the flow of wastewater and the chlorine residual. Facilities with design flows between one (1.0) mgd (3785 m^3/d) and twenty-two thousand five hundred (22,500) gpd (85.4 m^3) should be equipped with a control system to feed the chlorine proportional to the flow of wastewater.

2. Chlorination with dechlorination. All facilities designed for dechlorination must be equipped to feed the chlorine proportional to the flow of wastewater and the chlorine residual. Dechlorination equipment shall be equipped to feed in proportion to the flow of wastewater.

3. Ozone. Facilities for disinfection with ozone should be equipped to feed the ozone in proportion to the flow of wastewater.

(C) Capacity. Required disinfection capacity will vary, depending on the uses and points of application of the disinfecting chemical. For disinfection, the capacity should be adequate to produce an effluent that will meet the coliform limits specified by the agency. For normal domestic sewage, the following may be used as a guide in sizing chlorination facilities.

Type of Treatment	*Dosage*
Trickling filter plant	*10 mg/l*
Activated sludge plant effluent	*8 mg/l*
Tertiary filtration effluent	*6 mg/l*
Nitrified effluent	*6 mg/l*

(D)Standby Equipment and Spare Parts. Standby equipment of sufficient capacity should be available to replace the largest unit during shutdowns. Spare parts shall be available for all

disinfection equipment to replace parts which are subject to wear and breakage.
*(E) Water Supply. An ample supply of water shall be available for operating the chlorinator. Where a booster pump is required, duplicate equipment should be provided**,** and**,** when necessary, standby power as well. Protection of a potable water supply shall conform to the requirements of 10 CSR 20-8.140(8)(B).]*

[(5) Chlorine Supply.
(A) General. The type of chlorine supply should be carefully evaluated during the planning process. Large quantities of chlorine are contained in ton cylinders and tank cars can present a considerable hazard to plant personnel and to the surrounding area should the containers develop leaks.
(B) Containers. The use of ton containers should be considered where the average daily chlorine consumption is over one hundred fifty pounds (150 lbs.) (68 kg). Both monetary cost and the potential residential exposure to chlorine should be considered when making the final determination.
(C) Tank Cars. At large chlorination installations consideration should be given to the use of tank cars, generally accompanied by gas evaporators. Both monetary cost and the potential residential exposure to chlorine should be considered when making the final determination. Liquid chlorine lines from tank cars to evaporators shall be buried and installed in a conduit and shall not enter below grade spaces. Systems shall be designed for the shortest possible pipe transportation of liquid chlorine.
(D) Scales. Scales for weighing cylinders shall be provided at all plants using chlorine gas. At large plants, scales of the indicating and recording type are recommended. At least a platform scale shall be provided. Scales shall be of corrosion-resistant material.
(E) Evaporators. Where manifolding of several cylinders or ton containers will be required to evaporate sufficient chlorine, consideration should be given to the installation of evaporators, to produce the quantity of gas required.
(F) Leak Detection and Controls. A bottle of fifty-six percent (56%) ammonium hydroxide solution shall be available for detecting chlorine leaks. Where ton containers or tankcars are used, a leak repair kit approved by the Chlorine Institute shall be provided. Consideration should be given to the provision of caustic soda solution reaction tanks for absorbing the contents of leaking ton containers where the containers are in use. At large chlorination installations, consideration should be given to the installation of automatic gas detection and related alarm equipment. For ozone installations, similar purpose equipment shall be provided.]

[(6) Ozone Generation. Ozone may be produced from either an air or an oxygen gas source. Generation units shall be automatically controlled to adjust ozone production to meet disinfection requirements.]

[(7) Piping and Connections. Piping systems should be as simple as possible, specifically selected and manufactured to be suitable for chlorine or ozone service, with a minimum number of joints. Piping should be well supported and protected against temperature extremes. The correct weight or thickness of steel is suitable for use with dry chlorine liquid or gas. Even minute traces of water added to chlorine results in a corrosive attack that can only be resisted by pressure piping utilizing materials such as silver, gold, platinum or Hasteloy C. Low pressure

lines made of hard rubber, saran-lined, rubber-lined, polyethylene, polyvinylchloride (PVC) or Uscolite materials are satisfactory for wet chlorine or aqueous solutions of chlorine. Due to the corrosiveness of wet chlorine, all lines designed to handle dry chlorine should be protected from the entrance of water or air containing water. For ozonation systems, the selection of material should be made with due consideration for ozone's corrosive nature. Copper or aluminum alloy should be avoided. Stainless steel with a corrosion resistance of at least equal to grade 304 L should be specified for piping containing ozone in nonsubmerged applications. Unplasticized PVC, Type 1, may be used in submerged piping, provided the gas temperature is below one hundred forty degrees Fahrenheit (140 °F) (60 °C) and the gas pressure is low.]

[(8) Housing.

(A) Separation. If gas chlorination equipment, chlorine cylinders or ozone generation equipment are to be in a building used for other purposes, a gas-tight room shall separate this equipment from any other portion of the building. Floor drains from the chlorine room should not be connected to floor drains from other rooms. Doors to this room shall open only to the outside of the building and shall be equipped with panic hardware. The rooms shall be at ground level and should permit easy access to all equipment. Storage area should be separate from the feed area. Chlorination equipment should be situated as close to the application point as reasonably possible.

(B) Inspection Window. A clear glass, gas-tight window shall be installed in an exterior door or interior wall of the chlorinator or ozone generator room to permit the units to be viewed without entering the room.

(C) Heat. Rooms containing disinfection equipment shall be provided with a means of heating so that a temperature of at least sixty degrees Fahrenheit (60 °F) (16 °C) can be maintained but the room should be protected from excess heat. Cylinders shall be kept at essentially room temperature. The room containing the ozone generation units shall be maintained above thirty-five degrees Fahrenheit (35 °F) (2 °C) at all times.

(D) Ventilation. With chlorination systems, forced, mechanical ventilation shall be installed which will provide one (1) complete air change per minute when the room is occupied. For ozonation systems, continuous ventilation to provide at least six (6) complete air changes per hour should be installed. The entrance to the air exhaust duct from the room shall be near the floor and the point of discharge shall be so located as not to contaminate the air inlet to any buildings or inhabited areas. Air inlets shall be so located as to provide cross ventilation with air and at a temperature that will not adversely affect the chlorination of ozone generation equipment. The vent hose from the chlorinator shall discharge to the outside atmosphere above grade.

(E) Electrical Controls. Switches for fans and lights shall be outside of the room at the entrance. A labeled signal light indicating fan operation should be provided at each entrance, if the fan can be controlled from more than more one (1) point.]

[(9) Respiratory Protection. Respiratory air-pac protection equipment, meeting the requirements of 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. Instructions for using, testing and replacing mask parts including canisters, shall be posted adjacent to the equipment. The units shall use compressed air, have at least thirty (30)-minute capacity and be compatible with the units used

by the fire department responsible for the plant.]

[(10) Application of Chlorine or Ozone.

(A) Mixing. The disinfectant shall be positively mixed as rapidly as possible, with a complete mix being effected in three (3) seconds. This may be accomplished by either the use of turbulent flow regime or a mechanical flash mixer.

(B) Contact Period. For a chlorination system, a minimum contact period of fifteen (15) minutes at peak hourly flow or maximum rate of pumpage shall be provided after thorough mixing. Consideration should be given to running a field tracer study to assure adequate contact time. If dechlorination is required after complete mixing of the effluent with the chemical, no further contact time is necessary. The required contact time for an ozonation unit varies with the type of dissolution equipment used. Certain high rate devices require contact times less than one (1) minute to achieve disinfection while conventional dissolution equipment may require contact times similar to chlorination systems.

(C) Contact Tank. The chlorine or ozone contact tank shall be constructed so as to reduce short-circuiting of flow to a practical minimum. Baffles shall be parallel to the longitudinal axis of the chamber with a minimum length to width ratio of forty to one (40:1) (the total length of the channel created by the baffles should be forty (40) times the distance between the baffles). The tank should be designed to facilitate maintenance and cleaning without reducing effectiveness of disinfection. Duplicate tanks, mechanical scrapers or portable deck level vacuum cleaning equipment shall be provided. Consideration should be given to providing skimming devices on all contact tanks. Covered tanks are discouraged.]

[(11) Evaluation of Effectiveness.

(A) Sampling. Facilities shall be included for sampling the disinfected effluent after contact. In large installations, or where stream conditions warrant, provisions should be made for continuous monitoring of effluent chlorine residual.

(B) Testing. Equipment shall be provided for measuring chlorine residuals using accepted test procedures. Automatic equipment required by subsection (4)(C) of this rule may be used to meet the requirements of this subsection. Equipment shall also be required for measuring fecal coliform using accepted test procedures as required by 10 CSR 20-9.010.]

(1) Applicability. Wastewater systems shall be designed based on criteria contained in this rule, published standards, applicable federal and state requirements, standard textbooks, current technical literature and applicable safety standards. To the extent of any conflict between the above criteria, the requirement in this rule shall prevail.

(A) This rule shall not apply to animal waste management systems. Regulations for these facilities are found in 10 CSR 20-8.300.

(B) This rule shall not apply to agrichemical facilities. Regulations for these facilities are found in 10 CSR 20-8.500.

(2) General.

(A) Emergency Power. Disinfection and dechlorination processes, when used, shall be provided during all power outages. For additional emergency power considerations, refer to 10 CSR 20-8.140(6).

(B) Secondary containment. Refer to 10 CSR 20-8.140(8)(A)2.

(C) Safety. For additional safety considerations, refer to 10 CSR 20-8.140(7).

(3) Chlorine Disinfection.

(A) Contact period. A minimum contact period of fifteen (15) minutes at design peak hourly flow or maximum rate of pumpage shall be provided after thorough mixing.

(B) Gaseous Chlorine Housing.

1. Feed and storage rooms shall –

A. Have chlorine gas feed and storage rooms constructed of fire and corrosion resistant material;

B. Provide a gas-tight room to separate equipment from any other portion of the building if gas chlorination equipment or chlorine cylinders are to be in a building used for other purposes;

C. Have smooth floor surfaces that are chemical resistant, impervious, and slip resistant. Floor drains are discouraged. Design floor drains, where provided, with the ability to be plugged and sealed;

D. Have doors to this room that only open to the outside of the building, and are equipped with panic hardware. Provide door locks to prevent unauthorized access, but do not need a key to exit the locked room using the panic hardware;

E. Be well-lit with lights that are sealed so that they will continue working during a chlorine leak. Comply with10 CSR 20-8.140(6)(B), requirements for Class I, Division 2, Group D locations when selecting lighting and electrical equipment;

F. Be at ground level and permit easy access to all equipment;

G. Separate storage areas for one (1)-ton cylinders from the feed area; and

H. Have designated areas for "full" and "empty" cylinder storage.

2. Heating and cooling.

A. Rooms containing disinfection equipment shall be provided with a means of heating and cooling so that a temperature of at least sixty degrees Fahrenheit (60° F) and no more than eighty six degrees Fahrenheit (86°F) can be maintained.

B. Heating or air conditioning equipment provided for the chlorinator room shall be separate from central heating and air conditioning systems to prevent chlorine gas from entering the central system and central heating or cooling ducts are not allowed to terminate or pass through a chlorinator room.

3. Ventilation shall conform to the following:

A. Install forced mechanical ventilation to provide one (1) complete fresh air change per minute when the chlorinator room is occupied. Construct fans of chemical resistant materials and have chemical proof motors. Squirrel cage type fans located outside the chlorinator room may be approved if the fan housings and ducting are airtight and made of chlorine and corrosion resistant material;

B. Locate the entrance to the air exhaust duct from the room no more than twelve inches (12") off the floor. Locate the point of discharge as not to contaminate the air inlet to any buildings or present a hazard at the access to the chlorinator room or other inhabited areas. Utilize louvers for air exhaust to facilitate airtight closure;

C. Locate air inlets as to provide cross ventilation. Place the outside air inlet at

least three feet (3') above grade. Utilize louvers for air inlets to facilitate airtight closure; and

D. Position the vent hose from the chlorinator to the outside atmosphere above grade. Provide passive vent screens.

4. Electrical controls. Switches for fans and lights shall be outside of the chlorinator room at the entrance.

5. Protective and respiratory gear. Respiratory air-pac protection equipment, that meets the requirements of the Department of Health and Human Services Centers for Disease Control and Prevention National Institute for Occupational Safety and Health *NIOSH Pocket Guide to Chemical Hazards*, as published September 2007, shall be available where chlorine gas is handled, and stored at a convenient location, but not inside any room where chlorine is used or stored. This standard is incorporated by reference in this rule, as published by U.S. Government Printing Office, P.O. Box 371954, Pittsburgh, PA 15250-7954. This rule does not incorporate any subsequent amendments or additions.

(C)Alarm System. The applicant shall conform to 10 CSR 20.8140(6)(C) and be responsible for specifying what the alarm requirements are necessary to assure consistent disinfection in compliance with the applicable bacteria limits and the disinfection residual limit in the effluent.

(D) Sampling. For sampling considerations, refer to 10 CSR 20-8.140(5)(B).

(4) Dechlorination.

(A) Containers. Dilution tanks and mixing tanks are required when using dry compounds and may be necessary when using liquid compounds to deliver the proper dosage.

(B) Mixing and Contact Requirements.

1. Mixing requirements. Solid dechlorination systems shall not be located in the chlorine contact tank.

2. Contact time. A minimum of thirty (30) seconds for mixing and contact time shall be provided at the design peak hourly flow or maximum rate of pumpage.

(C) Housing Requirements.

1. Feed and storage rooms. The requirements for housing sulfite gas equipment shall follow the same guidelines as for chlorine gas. Refer to subsection (3)(B) of this rule for specific details.

2. Protective and respiratory gear. See paragraph (3)(B)5. of this rule.

(D) Alarm System. See subsection (3)(C) of this rule.

(E) Sampling. For sampling considerations, refer to 10 CSR 20-8.140(5)(B).

(5) Ultraviolet Disinfection.

(A) Dosage and System Sizing.

1. General. The UV dosage shall be based on the design peak hourly flow, maximum rate of pumpage, or peak batch flow.

2. Batch discharges. If no flow equalization is provided for a batch discharger, the dosage shall be based on the peak batch flow.

3. Bioassay. The UV system shall deliver the target dosage based on equipment derating factors and, if needed, have the UV equipment manufacturer verify that

the scale up or scale down factor utilized in the design is appropriate for the specific application under consideration.

4. The design delivered UV dosage for a wastewater treatment facility shall be a minimum of thirty thousand microwatt seconds per centimeters squared (30,000 µW • s/cm^2) based on MS-2 phage inactivation.

(B) Design.

1. Open channel systems. The combination of the total number of banks shall be capable of treating the design peak hourly flow, maximum rate of pumpage, or peak batch flow.

2. Closed vessel systems. The combination of the total number of closed vessels shall be capable of treating the design peak hourly flow, maximum rate of pumpage, or peak batch flow.

3. Cleaning. Closed vessel systems utilizing medium-pressure lamps shall be provided with an automatic cleaning system in order to prevent algae growth.

(C) Monitoring and Alarms.

1. The UV system shall continuously monitor and display at the UV system control panel the following minimum conditions:

A. The relative intensity of each bank or closed vessel system;

B. The operational status and condition of each bank or closed vessel system;

C. The ON/OFF status of each lamp in the system; and

D. The total number of operating hours of each bank or each closed vessel system.

2. The UV system shall include an alarm system. Refer to 10 CSR 20-8.140(6)(C) for alarm system requirements.

(D) Electrical Controls. Refer to 10 CSR 20-8.140(6)(B) for electrical controls requirements.

(E) Sampling. Refer to 10 CSR 20-8.140(5)(B).

AUTHORITY: section 644.026, RSMo Supp. 1988. Original rule filed Aug. 10, 1978, effective March 11, 1979.*

**Original authority 1972, amended 1973, 1987, 1993.*