MINIMUM DESIGN CRITERIA
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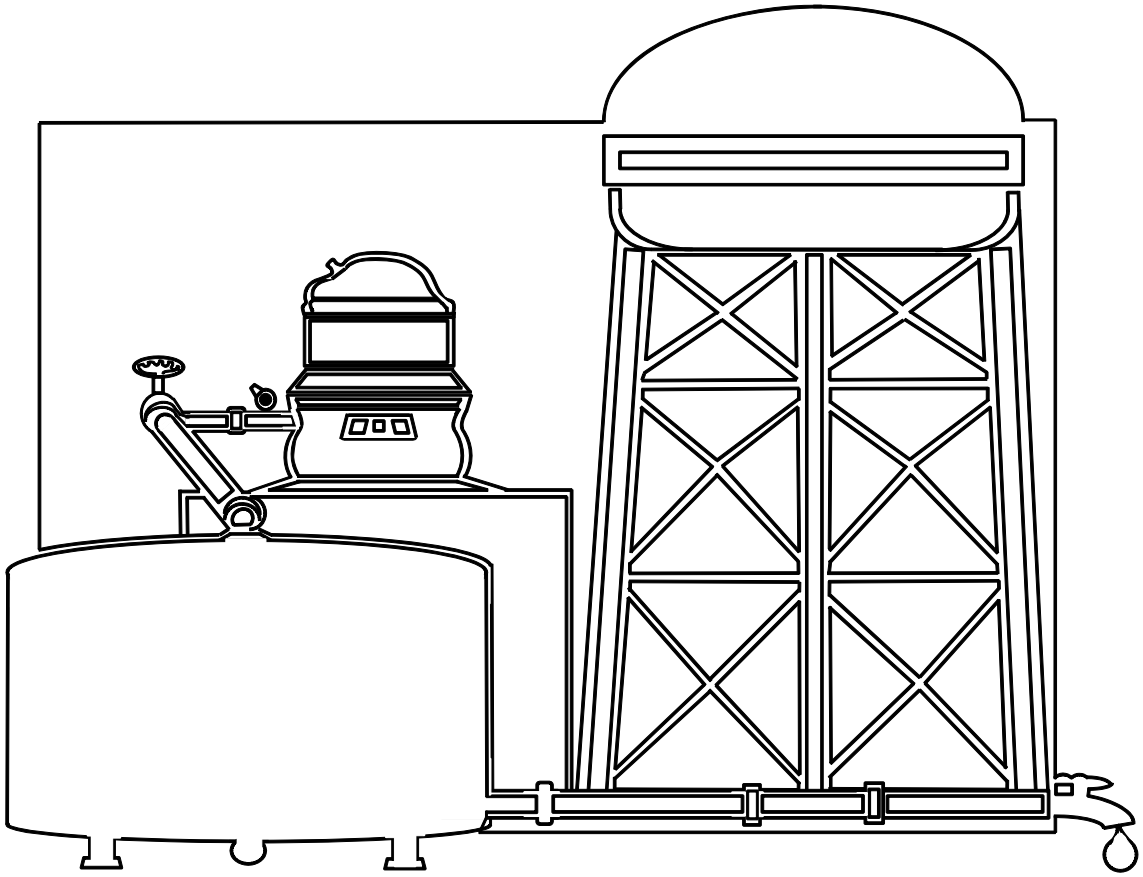

Mississippi State Department of Health
Bureau of Public Water Supply

June 2015 - Revision 2 (Draft)

MINIMUM DESIGN CRITERIA
FOR
MISSISSIPPI PUBLIC WATER SYSTEMS

Mississippi State Department of Health
Bureau of Public Water Supply

June 2015 - Revision 2 (Final Draft)

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Introduction

This document is a compilation of the minimum design criteria for public water systems in Mississippi. The purpose of these written standards is to serve as a guide to public water system officials, consulting engineers, Certified Waterworks Operators, and Bureau of Public Water Supply staff in designing new public water systems and in making modifications to existing public water systems.

It is recognized that every situation has not been addressed and that there may be situations where certain aspects of these criteria do not apply. These instances will be handled on a case by case basis. The limitations of these design criteria are not meant to limit the scope of engineering design. Conversely, the development of new methods and innovative engineering design is encouraged. However, any new developments must be demonstrated to be satisfactory before approval can be given. These cases will be considered on an individual basis.

The 1997 Mississippi Legislature passed legislation revising the Mississippi Safe Drinking Water Act. This new law went into effect on July 1, 1997. One of the key provisions of this new law is a requirement that the engineering plans and specifications for extensions or modifications to public water systems must be approved by the Mississippi State Department of Health prior to beginning construction. The purpose of this new requirement is to protect the public health of all Mississippians by ensuring that all extensions or modifications to public water systems are designed and constructed in accordance with this agency's minimum design criteria. Violations of this law are subject to administrative penalties not to exceed $25,000 per day of violation. Additional information concerning our policy regarding when MSDH approval is required can be found on page 1 of this manual.

Questions or comments concerning this document or recommendations for improvement should be provided to the following address:

Director
Bureau of Water Supply
P. O. Box 1700
Jackson, MS 39215
Phone - (601) 576-7518
FAX - (601) 576-7822

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Definitions

MSDH/BPWS – Mississippi State Department of Health, Bureau of Public Water Supply

MSDH – Mississippi State Department of Health

Bureau of Public Water Supply – a Bureau of the Office of Environmental Health, Mississippi State Department of Health

Public Water Supply or System – as defined in the Mississippi Regulations Governing Public Water Systems, promulgated under the Mississippi Safe Drinking Water Act

Shall or Must – these are used to denote a mandatory requirement

Should – this is used to denote a recommended or desirable condition in most cases

AWWA – American Water Works Association

U.S. EPA – United States Environmental Protection Agency

ASME – American Society of Mechanical Engineers

OSHA – Occupational Safety and Health Administration, U.S. Department of Labor

NSF – National Sanitation Foundation

ASTM – American Society for Testing and Materials

gpm – gallons per minute

ID – inside diameter

OD – outside diameter

psi – pounds per square inch

Consecutive Supplies – any public water system that receives water from another public water system for distribution

SSPC – Steel Structures Painting Council

USDA – United States Department of Agriculture

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References

1. American Water Works Association Standards

2. "Community Public Water Systems Design Criteria", Division of Management, Tennessee Department of Health and Environment

3. Ground Water and Wells, Johnson Division, UOP, Inc., 1975

4. Handbook of PVC Pipe Design and Construction, Uni-Bell Plastic Pipe Association, 5th Addition, December 17, 2012

5. "Recommended Standards for Water Works", Great Lakes - Upper Mississippi River Board of State Public Health & Environmental Managers, 2012

6. "Regulations Governing Public Water Supplies", Alabama Department of Environmental Management, December 2014

7. "Regulations Governing Public Water Systems", Mississippi State Board of Health, 1997

8. "Rules Governing Public Water Supplies", Section 0600 through 2500 of the North Carolina Administrative Code, Title 15A, Subchapter 18C, Department of Human Resources, Chapter 10, Health Services: Environmental Health, Subchapter 10D, Water Supplies

9. "State of Illinois Rules and Regulations", Title 35: Environmental Protection, Subtitle F: Public Water Supplies, Chapter II: Environmental Protection Agency, Parts 651-654, Technical Policy Statement

10. "State of the Art of Small Water Treatment Systems", U.S. Environmental Protection Agency, Office of Water Supply, Washington, D.C. 20460, August, 1977 **X**

11. Unpublished data, Bureau of Public Water Supply, Mississippi State Department of Health **X**

12. "Waterworks Operator Manual", Bureau of Public Water Supply, Mississippi State Department of Health

13. "Small Water Systems Serving the Public", Conference of State Sanitary Engineers, U.S. Environmental Protection Agency, July 1978 **X**

14. "National Secondary Drinking Water Regulations." 40 CFR 143.3. 1991

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Part I - Engineering Document Submission

A. Preconstruction Requirements

1. **Siting of Facilities (Preliminary)**

   Prior to the design or expansion of the source and treatment facilities of a public water system, the facility site plan should be submitted to the Bureau of Public Water Supply. Particular attention should be given to the location and protection from contamination of proposed new sources of water.

2. **Plans and specifications approval**

   a. Prior to beginning construction on a new public water system, or for extensions or modifications to an existing public water system, complete plans and specifications shall be approved in writing by the Bureau of Public Water Supply. It is strongly encourage that approval be obtained prior to advertising due to the possibility that the proposed design might be required to make additional modifications in order to secure approval by MSDH. The following general policy should be used to determine if MSDH approval is required for water supply extensions or modifications:

   MSDH approval is required for:

   - Water main extensions along public roads and any main extensions designed to serve more than one connection.
   - Water treatment modifications that will change the chemical or biological quality of the drinking water provided to the customers.

   If there are questions whether a water supply project must be approved, prior to employing a consulting engineer, system officials should submit a written description of the proposed project to this agency for review. Water Supply staff engineers will review the proposed project and determine if MSDH approval is required. If MSDH approval is required, a consulting engineer must then be employed to develop engineering plans and specifications that must be submitted to the agency for review and approval prior to beginning construction.

   b. Plans and specifications must be prepared, sealed and signed by a professional engineer licensed to practice in Mississippi in accordance with the requirements of

the Mississippi State Board of Registration for Professional Engineers and Land Surveyors.

c. The required Engineering Documents Transmittal Form must be signed by the submitting water system's Responsible Official or a letter from the water system stating they are aware of and agree to serve the proposed project.

d. Incomplete and/or illegible documents will delay the review and approval process.

e. Separately bound specifications shall be submitted for public water systems. Standard specifications for projects may be approved and kept on file.

f. If requested, the MSDH will maintain, on file, a public water system's MSDH approved standard set of specifications for public water systems. The public water system's consulting engineer may then reference these approved specifications when submitting engineering projects for review and approval.

g. Plans and specifications submitted for review must be in accordance with Appendix C, "Information Needed for Bureau of Public Water Supply Review and Approval of Engineering Plans and Specifications for Mississippi Public Water Supplies".

3. Hydraulic Calculations for projects

a. Depending on the project, the submission of hydraulic calculations may be required by the Bureau during plans and specifications review. Submittals where hydraulic calculations are particularly required include:

i. Elevated storage tanks where source and/or treatment facilities are not located on the same site. This is needed to prove that the tanks can fill in off peak times.

ii. Subdivisions or developments in remote locations without a nearby source or storage facilities.

iii. Fill hydraulics for booster station collector tanks

b. If submitted hydraulic calculations indicate that the proposed development and or subdivision will have negative effect to the existing area, the submitted project may not be approved.

B. Post Construction Requirements

When final approval is required, a letter of certification shall be submitted from the consulting engineer to the Bureau of Public Water Supply stating that the project was constructed in substantial compliance with the approved plans and specifications. Records of satisfactory microbiological results from an approved laboratory must be included with the certification. One set of as-built plans should be included if significant changes were made in the construction of the project. The Bureau of Public Water Supply, Mississippi State Department of Health must be notified of the final inspection in sufficient time to insure that a MSDH representative can be present. It strongly recommended that final approval be obtained by the consultant at project conclusion. This is especial necessary if project was constructed under the direction of an engineer not retained by the supplying water system.

C. Electronic Submissions

Electronic submissions may be accepted either on CD or USB drive in addition to one full size copy Arch D, Landscape (36.00 x 24.00 inches) for regional engineer review. The following guidelines are provided to aid in submissions. Electronic submission is an alternative to standard form a plan submission as outlined in Appendix C, "Information Needed for Bureau of Public Water Supply Review and Approval of Engineering Plans and Specifications for Mississippi Public Water Supplies".

1. Plans

   Plans submitted in electronic form should meet the following requirements:

   a. File Format: Portable Document Format (PDF)

   b. Paper Size: Arch D, Landscape (36.00 x 24.00 inches). This is a PDF attribute.

   c. Vector graphics are preferred because they minimize file size and are infinitely scalable.

   d. For non-vector (raster, bitmap) graphics, resolution should be 200 pixels per inch (ppi).

   e. Drawings should be scaled correctly with respect to the paper size.

   f. Plans in PDF form should include the signed stamp of the Professional Engineer in charge of the project.

2. Correspondence submitted in electronic form should meet the following requirements:
   a. File Format: Portable Document Format (PDF)
   b. Paper Size: US Letter, Portrait (8.50 x 11.00 inches). This is a PDF attribute.
   c. Text is preferred because it minimizes file size.
   d. For non-text documents (such as scans), resolution should be 300 pixels per inch (ppi).
   e. Changes to plans in response to Bureau comments may require re-submittal of plans via CD or USB Drive.

Part II – Water Usage Requirements

A. The anticipated usage for a proposed system should be based on actual data from similar systems, taking into account agricultural and industrial usage, lot size, degree of urbanization, water loss and other factors influencing water usage.

B. The water system should be designed to supply all existing homes and lots in the certificated area, whether or not they have requested service. A reasonable growth factor should be included.

C. In the absence of actual data, water systems should be designed to supply the demands in Table 1.

D. Fire flows should be based upon the requirements of the lending agency or other appropriate authority, such as the Mississippi State Rating Bureau.

Table 1 - Water Demands

Type of User	Average Usage (gallons per day per connection)	Peak Usage (gallons per day per connection)	Peak Demand (gallons per minute per connection)
Rural Homes	200	400	1
Urban Homes	400	600	1
Subdivisions	400	600	1
Rural Apartments/Trailers	133	267	2/3
Urban Apartments/ Trailers	276	400	2/3
Recreational Vehicles	100	200	1/2
Unmetered	150% of rural or urban, whichever applies		
Chickens		0.1 per chicken	Depends on waste system
Cattle or Hogs		15 per head	
Schools	15-20 per student	30-40 per student	

*For less than 100 connections or units, the design peak demand is given by the demand curve in Appendix E, "Minimum Flow Requirements for Small Water Systems Without Fire Protection". For apartments and trailers, the design peak demand is 2/3 of the demand curve. For recreational

vehicles, the peak demand is 50% of the demand curve. For unmetered connections, the design peak demand is 150% of the demand curve. For non-community water supplies refer to Appendix E.

Example Demand Calculation

A school with 900 students

The school has irrigation lines so it will be considered unmetered

Peak Demand (gpd)/400 gpcd = connections

Peak Demand = 40 gpd x 900 students = 36,000 gallons

36,000/400 = 90 connections

Since system is unmetered multiply connections by a factor of 1.5

therefore 90 x 1.5 = 135 connection

Therefore this school would be equivalent to a water system with 135 connections.

Part III - Wells

A. Well Driller Requirements

All wells for public water supplies shall be constructed by a water well contractor licensed by the Mississippi Department of Environmental Quality.

B. Well Permits

All wells shall be permitted as required by the Department of Environmental Quality. A copy of the well permit will be required for approval by the Bureau of Water Supply, Mississippi State Department of Health.

C. Location

Well sites shall be approved by the Bureau of Water Supply, Mississippi State Department of Health. The following criteria shall be considered in determining an acceptable well site:

1. Susceptibility of flooding - the top of the well casing shall be at least 1 foot above the 100 year flood or the highest year flood, whichever is higher. Documentation should be supplied with the submittal verifying these requirements are met.
2. Distance from existing wells (depends on characteristics of the formation)
3. Accessibility
4. Sources of pollution - Minimum distance of 100 feet. This includes abandoned wells that are not properly decommissioned.
5. Potential for development of the surrounding area
6. Proximity of roads, railroads, power lines, underground pipelines, cathodic protection systems and other possible causes of damage
7. Degree of natural protection from surface water.
8. The ability to obtain water that is free of sand and which meets the current U.S. EPA primary and secondary drinking water standards.
9. For wells that are less than 500 feet deep, the minimum distance from any source of pollution should be 200 feet.

D. Test Holes

Test holes are drilled primarily to locate the depth of the aquifers, determine their relative thickness and to take sand samples of the aquifers penetrated. All test holes which will be used subsequently as test wells should be a minimum of 8 inches in diameter. Upon completion of a successful test hole, the following information should be made available to all interested parties.

1. Sand samples of the aquifer taken at 10 foot intervals and for any change in formation.
2. Drillers log of the test hole.
3. Gamma ray log of the test hole.
4. Electric log.
5. Sieve analysis of the sand samples for each 10 foot interval of each aquifer penetrated.

A legible copy of each of the items listed above should be forwarded to the Bureau of Water Supply for the official record.

E. Test Wells

A test well is a small diameter, low capacity temporary well constructed in an attempt to determine or confirm the water quality of the target sand formation where the permanent well is expected to be constructed. Not all new well construction requires a test well. If other wells are in the immediate area and at the same approximate depth, then a decision by the Licensed Professional Engineer, the Owner and the MSDH/BPWS could result in deleting the test well. Each test well constructed in the same test hole should be considered a separate pay item. A test well shall not be removed from the test hole until authorized by the Licensed Professional Engineer.

1. If a test well is authorized, the chemical analysis of the water, sand interval screened and related pumping data shall be properly documented and included in the final submittal package. If multiple test wells are pulled from the same test hole, the documentation of each shall make it easy to determine which chemical analysis goes with which sand interval screened.

2. **Test Well Design.**
   a. Upper casing should have a minimum inside diameter of 6 inches to allow for pump clearance.
   b. Screens should be of wire wrap design with a minimum outside diameter of 4 inches and a minimum length of 40 feet unless the thickness of the water bearing sands are inadequate for 40 feet of TEST WELL screen to be installed. Slot size should retain from 45% to 60% of the aquifer material.
   c. Non-lead packers should be installed above and below the aquifer to limit the influence of other aquifers pierced by the test hole.
   d. The test well should be properly developed and water samples should be free of drilling mud and sand. **NOTE:** Only non-organic drilling mud should be utilized in the construction of water wells.
   e. The well should be pumped at a minimum rate of 75 gpm or 20% of the final design capacity.
   f. Drawdown measurements shall be made at regular intervals during the first 24 hours of pumping and afterward until the static water level in the well has recovered.

3. Physical and chemical analyses shall be made of the samples taken after the pumping test and analyzed by a Mississippi State Department of Health approved laboratory to determine the water's suitability for public water supply use. A legible copy of these analyses should be forwarded to the Bureau of Water Supply for the official record. Construction of the permanent well shall not begin until the Licensed Professional Engineer has reviewed and approved the physical and chemical analysis of the water.

F. Observation Wells

1. Observation wells for permanent use shall be properly protected from sources of contaminants in the same manner (requiring casing to be cemented) as permanent wells for a public water supply.

2. The casing should extend at least 1 foot above the expected 100 year flood and be provided with an overlapping, lockable cover with a lock.

G. Abandoned Holes, Test Wells and Wells

1. All abandoned wells, test wells, temporary observation wells and holes to or through any aquifer shall be filled with cement grout introduced at the bottom and pumped to the ground surface in one continuous operation.

2. A licensed Professional Engineer may be employed to design an alternate abandonment technique. Any alternate technique must be approved by the Bureau of Water Supply prior to its application. Written certification of completion from the licensed well driller in charge of the abandonment procedure is required to submit the original Well Decommissioning Form to MDEQ with copies to the Licensed Professional Engineer (if applicable) and the MSDH/BPWS. If the well being abandoned has a PWS ID tag, the tag shall be removed and returned to the MSDH/BPWS. The PWS ID number on the tag, if applicable, shall be included on the Well Decommissioning Form.

3. It is strongly recommended that if a public water supply has existing wells no longer in service, they have the well properly abandoned in accordance with MDEQ guidelines. This can be performed during the construction of new well at a potentially reduced cost.

H. Design of Wells Should Meet the Requirements of the Latest Revision of AWWA A100

1. **Capacity**

   A well or well field shall be designed to operate to prevent excessive depletion of the aquifer and to provide standby capacity.

2. **Well Casings**

   a. Well casings shall be installed to prevent the vertical migration or entrance of adjacent ground or surface water. They should be so constructed and installed to prevent corrosion by aggressive water. They should be sufficiently sized and installed to allow installation, maintenance, or measurements of the pump, water levels, lap pipe and screen. Table 2 indicates recommended casing sizes for various yields, taking into account pump efficiency, head losses and adequate clearance for proper installation of 1760 rpm vertical turbine pumps. In some cases, the casing may need to be larger than indicated by the table to allow for pump settings in the lap pipe. The use of submersible pumps requires additional clearance to prevent excessive head losses in the annulus between the motor and the casing.

Table 2 - Recommended Well Casing and Screen Diameters

Proposed well yield, gpm	Nominal size of pump bowls, inches	Optiumum size of well casing, inches	Maximum screen size for gravel packed wells
50-100	6	10 ID	6
100-700	8	12 ID	8
250-1500	10	16 OD	10
700-2400	12	18 OD	12
900-3000	14	20 OD	16
3000-4500	16	24 OD	20

b. An annular space on the outside of the casing of at least 2-1/2 inches shall be sealed with cement grout for the full length of the casing. The well casing shall be cemented in place by the Halliburton or other satisfactory method. The Halliburton method requires forcing cement grout in the annular space between the casing and the drill hole from the bottom of the well to the top, thus assuring exclusion of all the water above the water-bearing stratum from which the supply is taken. The grout should be neat cement weighing at least 14 lbs/gal (13 lbs/gal is acceptable if grout contains 8 % bentonite gel).

c. The top of the well shall be sealed to prevent the entrance of contaminants. Properly protected vacuum relief openings should be provided except in the cases where prevented by artesian head.

d. The casing should be provided with an access pipe which is at least 2 inches in diameter to allow for water level measurements. If this is also used as the casing vent, it must be screened and elbowed.

e. The same size casing shall extend from above the top of the foundation to the top of the water bearing stratum.

f. Steel casings shall meet the requirements of the latest revision of the applicable AWWA standard.

g. PVC casings may be allowed provided the justification for their use outweighs the risk of failure. PVC casings shall be designed to withstand the stresses of installation but shall be limited to the following depths (check manufacturers nominal internal diameters):

SDR*	**Depth, FT**
26	125
21	250
17	500

* Check manufacturers nominal internal diameters

h. The interior of a mild steel outer casing, the interior/exterior of the lap pipe, pump column and suction pipe in wells with corrosive water should be protected with an EPA or NSF approved coating to prevent corrosion or constructed of corrosion resistant material such as stainless steel. Special attention should be given to sealing the column pipe, coupling, threads and joints.

i. A water tight joint is required between well casing and pump head.
The pump head shall be connected to the outside casing by a water-tight threaded connection or by the outside casing being carried to a point not less than one inch above the concrete pump head foundation. Before setting the pump head casing, the contractor shall provide a vacuum seal between the foundation and pump head casing where a partial vacuum will be created. Where submersible pumps are used, a satisfactory water-tight mechanical seal shall be provided.

j. The pump head shall be mounted on a chamfered concrete foundation not smaller than 24 inches square at the top, extending not less than 18 inches into the solid ground and not less than 18 inches above the finished grade or the 100 year flood elevation.

3. **Well Screens**

Screens should be designed and installed in such a way as to maximize well efficiency, consistent with constraints of aquifer retention. Refer to Table 2.

a. Screen slot sizes should be designed based on the gradation of the adjacent gravel pack or aquifer material, as determined by sieve analysis.

b. Total open area of the screen should be such that the maximum entrance velocity is limited to 0.1 feet per second.

c. The screen shall be constructed of type 304 stainless steel, be rod-based and wire wrapped. Other materials when adequately justified will be considered on a case by case basis. Shutter screens are not acceptable.

d. The gradation of the gravel pack material should be based on the gradation of the adjacent aquifer material, as determined by sieve analysis. The thickness of the annular gravel envelope should be between 3 inches and 8 inches to allow complete development of the well.

e. The bottom of the screen should be fitted with a backwash valve if needed to permit washing of the screen and to prevent inflow of sand. This backwash valve should be brass or stainless steel to prevent corrosion.

4. **Lap pipe**

The lap pipe should extend into the casing a distance sufficient to assure concentric alignment of the screen and casing. This must be at least 60 feet for straight wall wells. For gravel packed wells, the lap pipe must be 60 feet or at least as long as the screen for alignment and for storage of additional gravel pack. The space between the lap pipe and the casing should be filled with specially graded gravel according to sieve analysis to prevent sand pumpage. Any deviation from these minimum lap pipe lengths must be approved by this agency prior to construction and will be considered strictly on a case-by-case basis.

5. Pumping equipment

a. The pumping equipment should be designed to deliver the required flow and pressure at the maximum efficiency available.

b. Appurtenances on wells shall include:

i. 3/4 inch sampling faucet installed between the pump discharge flange and chlorination - if it is installed upstream of the check valve, it should be a non-

hose bib design and should not be installed on the blind flange of the discharge tee.

ii. Provision for adequate shaft lubrication:

I. Water lubrication - line shaft vertical turbine pumps should be of the water lubricated type, if practical, to prevent problems resulting from the introduction of oil into the system.

a. The pre-lubricating water should be from an approved source of water, preferably the well itself. If a foot valve is used to hold the pump column full of water, a simple bypass around the check valve is sufficient.

b. The pre-lubricating water should not be allowed to run continuously into the well. A normally open solenoid valve should be used so that an electrical failure will not prevent the flow of lubricating water.

II. If oil lubricated, a non-petroleum based product meeting USDA H1 standards should be used.

ii. Test tee.

iii. Check and gate valve.

iv. Freeze protection where needed.

v. A master meter shall be provided for all public water supply wells. It shall be installed downstream of the check valve according to the manufacturers recommendations and be properly sized to accurately determine well capacity and amount of water pumped.

vi. Lightning and phase failure protection for all three-phase equipment

vii. Anti-reverse ratchet to prevent backspin and a time delay.

viii. An air release valve prior to the check valve.

ix. A screened and elbowed (double ell) casing vent. (For flowing wells a check valve should be installed on the vent.)

x. Casing access pipe of at least 2 inches in diameter and optional single piece non-plastic air line gauge for water level measurements.

c. The use of a submersible pump with a foot valve eliminates the need for item ii.

d. Corrosion resistant materials should be used for the pumping equipment if the corrosiveness of the water is expected to significantly reduce the life of mild steel components.

I. Well Construction

1. An electrical resistivity and spontaneous potential log should be completed on each drilled TEST HOLE and be evaluated in relation to other data prior to installation of the casing.
2. The well should be developed to its maximum practical efficiency and be free of visible sand and drilling mud. Turbidity due to the drilling process and/or construction of the well should not exceed 5 NTUs.
3. A pumping test of sufficient duration should be completed with the temporary pumping equipment on the final well to determine anticipated capacity and drawdown.
4. The permanent pump bowls should be set to maintain a 30 foot minimum submergence after pumping for 24 hours at open discharge.
5. After drawdown has stabilized on the well, the permanent pump should have step tests performed to determine capacity. The steps should be in increments no greater than 10 psi and should be from open discharge to shut-off head. Drawdown shall be measured after stabilization for each increment of pressure.
6. Well efficiency - should be minimum of 70% for wells utilizing at least 60% of formation.
7. Water samples from the Permanent Well shall be collected and submitted to the Mississippi State Department of Health or a state approved laboratory for chemical analysis. Chemical Analysis results shall be part of the final submittal package.

J. Disinfection

1. All water used in the drilling and construction process shall be obtained from sources of proven satisfactory quality and shall meet the primary standards of the Safe Drinking Water Act Regulations.
2. Gravel to be placed in a well should be disinfected with a solution of at least 50 mg/l free chlorine. A residual of no less than 5 parts per million of chlorine shall be maintained in any water used for development.
3. Upon completion of the well, the well and adjacent aquifer shall be disinfected as necessary using a solution of 50 mg/l free chlorine applied for 24 hours.
4. After disinfection, the well shall be pumped until two consecutive chlorine-free samples are collected from the well which show no coliform bacteria and no confluent growth. The samples shall be collected, submitted and analyzed according to the Mississippi State Department of Health requirements. The second sample shall be collected following at least two hours of continuous pumping after the first sample. A disinfectant must not be applied between samples. The person collecting the official microbiological sample(s) must be a representative of the Mississippi State Department of Health, the Licensed Professional Engineer for the project, or the Certified Waterworks Operator for the public water supply.
5. If water from a private well is used, microbiological samples shall be examined prior to use. Routine samples from public supplies may be used as a basis for determining if a supply is satisfactory.
6. The disinfection procedure should meet the current AWWA standard (C654). A solution strength of 50 mg/l free chlorine applied for 24 hours is recommended.
7. When a well has been repaired, such as lowering or replacing the pump, the well should be disinfected. At least two (2) microbiological water samples, taken 2 hours apart with the well pumping continuously, must be obtained prior to placing the well back in service. No coliform bacteria should be present in these samples. If coliform is present, the well should be re-disinfected and re-sampled.

8. Should the two (2) consecutive microbiological well clearing samples indicate coliform bacteria is present, the well may be put back into service if 4-Log inactivation of viruses can be performed on that specific well. 4-Log calculations will be provided by the Bureau of Public Water Supply.

K. Security

All permanent wells shall have a security fence around the perimeter. This fence should be at least 6 feet tall with barbed wire around the top.

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Part IV – Water Treatment

Treatment facilities shall be provided for all public water to the extent necessary to insure compliance with the Primary Drinking Water Standards established by the U.S. EPA. Treatment facilities should also be provided to the extent necessary to insure compliance with the Secondary Drinking Water Standards and to remove any other harmful or objectionable constituents or qualities. Refer to Appendix A and Appendix B.

A. Disinfection

Automatic chlorination equipment is required on all new public water supplies. Chlorination is required on all previously un-chlorinated public water supplies at such time that improvements or extensions are made. Chlorination shall be required on those systems that have been unable to meet the microbiological standards of the Safe Drinking Water Act. Disinfectants other than chlorine may be approved on a case by case basis.

1. Gaseous chlorinators shall be of the type with the regulator mounted directly on the chlorine cylinder, which will eliminate any pressure tubing.
2. Chlorination equipment shall have the capacity to feed approximately a 4 mg/l dosage of chlorine and provide a free chlorine residual after the initial chlorine demand has been satisfied.
3. Chlorine cylinders and chlorine pressure tubing should be isolated from electrical equipment, motors, pumps and other materials and chemicals subject to corrosion or oxidation.
4. Walk-in chlorinator and chlorine rooms shall have positive ventilation of at least one fresh air change per minute. Ventilation at the floor level should be provided for chlorinator and chlorine storage rooms.
5. Walk-in chlorine storage and chlorinator rooms shall not have locking restrictions when opening from the inside. The doors should swing open to the outside.
6. 100 and 150 lb. chlorine cylinders must be secured in an upright position.
7. Installation and controls for the chlorinator should be as indicated in Appendix H memo.
8. Chlorine contact time before the first customer should be considered.

B. Fluoridation

1. Fluoridation facilities shall be capable of maintaining a uniform fluoride concentration in the water between 0.7 mg/l and 1.3 mg/l.
2. To facilitate precise control, fluoridation equipment shall not have excessive capacity over that required to maintain the target of the fluoride concentration required.
3. Automatic controls shall be provided which prevent excessive feed rates. The fluoridation unit shall be wired so that it can run only when the well or service pump runs. Manual fluoridation controls are not acceptable.
4. The fluoridation systems shall be designed to prevent back-siphonage or uncontrolled flow of fluoride into the water supply.

C. Corrosion Control and Stabilization

1. Corrosion control plants should be capable of adjusting the pH to the CaCO3 stability point.
2. Sampling faucets prior to chemical addition must be provided on the degasifiers (aerators).
3. Aerators should reduce the CO2 content of the water to 10 mg/l or less.
4. The maximum loading rate should be 10 gallons per minute per square foot for natural draft aerators and 20 gallons per minute per square foot for induced draft and force draft aerators.
5. All aerators without subsequent filtration shall be screened with corrosion resistant material and properly protected from insects and other contaminants.
6. All natural draft aerators should have an alternate chlorine application point prior to the aerator distribution tray to allow periodic treatment with chlorine to control algae growth.
7. Corrosion control plants should have a minimum detention time of 30 minutes to allow for an adequate chlorine contact time and for dissolution of chemicals.
8. Re-carbonation basins should have a minimum detention time of 20 minutes.
9. Phosphates may be used for corrosion control on a case by case basis.

D. Clarification

This is a combination of the processes of mixing, coagulation, flocculation and sedimentation to remove unwanted solids and to reduce the filter loading. These processes may be carried out in a single unit, the upflow clarifier. Tube settlers may be used to enhance sedimentation efficiency. The treatment scheme should be based on the chemistry of the water and the degree of treatment required, with the aid of jar tests, bench tests and pilot plants. The following criteria should be used as guidelines:

1. Rapid Mix

a. Detention time: 10-60 seconds

b. Minimum velocity gradient: 300 ft./sec./ft.

Note: For surface water using metal coagulants, uniform mixing for less than ten seconds is recommended.

2. Flocculation

a. The basin should be designed to prevent short circuiting and destruction of floc.

b. Detention time: 30-45 minutes

c. Peripheral paddle speed: 0.5 - 3.0 ft./sec.

d. Flocculation and sedimentation basins should be as close together as possible. The velocity of flocculated water through pipes or conduits should be between 0.5 and 1.5 ft./sec.

3. Sedimentation

a. Conventional

i. Detention time: As determined by bench and pilot plant testing

ii. Velocity: 0.5 - 1.0 ft./min.

iii. Maximum overflow rate: 0.25 - 0.38 gpm/ft.2

iv. Outlet weir loading: 8 - 15 gpm/ft. The higher rates are for heavier floc such as that obtained from lime-soda softening.

b. Conventional (Specific to Surface Water)

i. Length to width ratio should be 4 to 1 minimum.

ii. Length to depth ratio should be 15 to 1 minimum.

iii. Detention Time should range from 1.5 to 4 hours.

c. Tube settlers - Tube settlers may offer advantages over conventional sedimentation in many cases. Proposals for tube settlers should be supported by adequate data from pilot plant or full scale demonstrations.

d. Sludge handling and disposal - Adequate provisions should be made for automatic removal and approved disposal of water treatment plant sludge. Alternative methods of water treatment and chemical use should be considered as a means of reducing sludge handling and disposal problems.

4. Upflow Clarifiers

These are acceptable for clarification or softening where water characteristics and flow rates are uniform.

1. Upflow rate - The maximum upflow rates used vary from 0.75 gpm/ft^2 to 1.25 gpm/ft^2. The lower rates are for iron removal and surface water and the higher rates are for heavier floc such as for softening.

2. Maximum weir loading.

   i. Clarification: 10 gpm/ft.

   ii. Softening: 20 gpm/ft.

3. A method of reducing "sludge age" at end of clarifier should be included to prevent "resuspending" especially if treatment facility utilizes enhanced coagulation.

E. Filtration

Filter units may be either gravity filters or pressure filters, depending on the degree of pre-treatment required. Pressure filters are normally used to remove small amounts of iron and manganese, where clarification is not economical or practical. Gravity filtration shall be used on all surface water sources. Filtration shall be required on all new spring or surface water supplies.

1. A bypass should be constructed on all single unit filters to allow for maintenance. Multiple units with no bypasses shall be used for surface water treatment.
2. Where potassium permanganate is used prior to filtration, the chlorine application point should be as far as possible upstream of the permanganate application point.
3. The influent water should be baffled to prevent upset of the media.
4. The filter tank should be of sufficient height to allow the necessary media expansion required for adequate backwashing without loss of media.
5. Air wash facilities should be provided where manganese zeolite filter media is used.
6. Surface wash facilities are required to be used on gravity filters treating surface water. Air scour system may also be used.
7. A sufficient quantity of water should be provided for a minimum backwash time of 20 minutes while still maintaining adequate flow to the system.
8. A means of measuring loss of head through the filter should be provided on each filter unit.
9. Filter to waste piping must be provided, along with provisions for automatically maintaining normal flow while filtering to waste.
10. A positive means of automatically controlling the backwash flow rate should be provided. A means of easy observation of the backwash water should be provided.
11. A means of sampling the influent and effluent of each filter unit shall be provided.
12. A means of monitoring filter effluent must be provided for each cell.
13. An automatic air release valve and a man hole which is at least 18 inches in the smallest dimension should be provided on pressure filters.
14. The filter media size, filter rate, backwash rate and media depth should be within the guidelines in Table 3. The higher filtration rates pertain to multimedia filters or anthracite filters with low solids loading. Dual media filters with 12 - 18 inches of anthracite are recommended.

15. In placing media in multimedia filters, each successive type of media shall be backwashed at least twice and skimmed to remove fine particles prior to placement of the next type of media.

16. The underdrains shall provide uniform backwash distribution over the entire area of the filter. They may be of the header and lateral type with graded gravel or they may be the false bottom type, with properly designed strainers in relation to the support and filter media proposed.

17. Settling ponds should be considered for backwash water and other waste discharges in order to meet Mississippi Department of Environmental Quality requirements.

18. Provisions should be considered for the recycling backwash water.

Table 3 - Filter Design Criteria

Parameter	**Media**		
	Sand	Anthracite	Mn Greensand
effective size, mm	0.45-0.55	0.7-1.2	
maximum uniformity coefficient	1.5	1.5	
filter rate, gpm/ft^2	2 - 4	2 - 4	2 - 4
backwash rate, gpm/ft^2	15 - 18	10 - 12	8 - 10
media depth, ft. * (excluding gravel)	2 - 3	2	1.5

* for single media filters

19. Granular activated carbon (GAC) - Granular activated carbon as a single media may be considered for filtration only after pilot or full scale testing and with prior approval of the Director. The design shall include the following:
    a. The media must meet the basic specifications for filter media as given in this Section and the latest revision of AWWA B604-12.
    b. There must be provisions for a free chlorine residual and adequate contact time in the water following the filters and prior to distribution.
    c. There must be means for periodic treatment of filter material for control of bacterial and other growth.
    d. Provisions must be made for frequent replacement or reactivation. Reactivation must meet the latest revision of AWWA B604-13.

20. Biologically active filters - Biologically active filtration, as used herein, refers to the filtration of surface water (or a ground water with iron, manganese, ammonia or significant natural organic material) which includes the establishment and maintenance of biological activity within the filter media. Considerations for biologically active include:
    a. Objectives of biologically active filtration may include control of disinfection byproduct precursors, increased disinfectant stability, reduction of substrates for microbial re-growth, breakdown of small quantities of synthetic organic chemicals, reduction of ammonia-nitrogen, and oxidation of iron and manganese.
    b. Biological activity can have an adverse impact on turbidity, particle and microbial pathogen removal, disinfection practices; head loss development; filter run times and distribution system corrosion.
    c. Design and operation should ensure that aerobic conditions are maintained at all times.
    d. Biologically active filtration often includes the use of ozone as a pre-oxidant/disinfectant which breaks down natural organic materials into biodegradable organic matter and granular activated carbon filter media which may promote denser biofilms.
    e. Biologically active filters may be considered based on pilot studies pre-approved by the Director.
    f. The study objectives must be clearly defined and must ensure the microbial quality of the filtered water under all anticipated conditions of operation.
    g. The pilot study shall be of sufficient duration to ensure establishment of full biological activity; often greater than three months is required. Also, the pilot study shall establish empty bed contact time, biomass loading, and/or other parameters necessary for successful operation as required by the Director.
    h. The final filter design shall be based on the pilot plant studies and shall comply with all applicable portions of this section.

F. Membranes

Design flow rate (including flux determination) for a membrane system shall be determined by pilot study on the particular raw water with expected pretreatment after 30 days of continuous operation at 20 degrees Celsius. Temperature correction shall be made at 3rd party

validation rate or 2.5 % per degree Celsius change from 20 degrees Celsius. If pilot study information is unavailable:

1. Pressure systems - Unless verified by challenge tests with exactly similar raw water – maximum design flux rate shall be:
   a. The flux rate at the lowest possible temperature encountered (usually 25 gfd or less), or
   b. The flux rate in similar (not exact) raw water conditions at 20 degrees Celsius after 30 days of continuous run time at manufacturers recommended flux.
2. Vacuum systems - Unless verified by challenge tests with exactly similar raw water – maximum design flux rate shall be:
   a. Flux rate at the lowest possible temperature encountered (usually 17 gfd or less), or
   b. Flux rate in similar (not exact) raw water conditions at 20 degrees Celsius after 30 days of continuous run time at manufacturers recommended flux.

   Note: flux rate declines with decreasing temperature and increased fouling. Determination of selection method must be approved by director in absence of pilot study results.
3. Ceramic Membranes – These membranes are much less susceptible to temperature variation than organic membranes and the maximum allowable flux rate is 10 to 15 times that of organic membranes. If the Director approves installation without pilot studies as stated above in sections 1 and 2, then the maximum approvable flux rate is:
   a. 175 gpf for systems seeking log credit for crypto (4 log), giardia (4 log), and virus (1 log) or 10 times the allowable rate for the comparable category of organic membrane.
   b. 375 gpf for groundwater systems not seeking log credit or 15 times the allowable rate for the comparable category of organic membrane.
   c. If choosing this membrane type, manufacturer shall declare pore size and flux rate or approval **shall not** be given.
4. The minimum recovery rates can be as low as 50% for highly challenged (fouling and cold) but generally average between a maximum of 85% and 95 % according to EPA guidance. Recovery rates for a membrane system shall be determined by pilot study on the particular raw water with expected pretreatment unless waved by the Director.

5. As temperature is the major factor determining flux rate along with fouling, system should be designed based on expected temperature ranges for the raw water to be treated. The following table gives an example of temperature effect on flux rate.

Table 4 - Temperature Correction for Membranes

Loss in flow associated with feed water temperatures below standard test conditions 25ºC (77ºF). This table assumes that trans-membrane pressure is held constant and only water temperature is changed.		
Temperature Degrees C	*Degrees F*	*Correction Factor*
25	77	1
22.5	72.5	0.93
20	68	0.86
17.5	63.5	0.80
15	59	0.74
12.5	54.5	0.69
10	50	0.64
7.5	45.5	0.60
5	41	0.55
2.5	36.5	0.51

6. Source water quality to be treated must be presented for review by the Bureau (see list of constituents to be evaluated below). Unless required/approved (in advance) by MSDH, the list will be those contained in the latest revision of AWWA B110-09.

Table 5 - Membrane Piloting Suggested Water Quality Sampling Schedule

	MF/UF			***NF/RO***		
Parameter[1]	***Feed***	***Concentrate***	***Filtrate***	***Feed***	***Concentrate***	***Filtrate***
Algae	***W***		***W***	***W***		
Color	***W***	***M***	***W***	***W***	***M***	***W***
HPC	***M***		***M***	***M***		***M***
Particle counts		***C***			***C***	
pH	***D***	***W***	***W***	***C***	***W***	***W***
SDI				***W***		
Taste & odor	***M***	***M***	***M***	***M***	***M***	***M***
Temperature	***C***			***C***		
TOC	***W***	***M***	***W***	***W***	***M***	***W***
Total coliform	***W***		***W***	***W***		
TSS	***M***	***M***	***M***			
Turbidity	***C***	***M***	***C***	***C***		***W***
UV-254	***W***	***M***	***W***	***W***		***W***
Alkalinity	***W***	***M***	***W***	***W***	***W***	***W***
Barium				***W***	***W***	***W***
Hardness	***W***		***W***	***W***	***W***	***W***
Iron	***W***		***W***	***W***	***W***	***W***
Manganese	***W***		***W***	***W***	***W***	***W***
Silica				***W***	***W***	***W***
Sulfate	***W***		***W***	***W***	***W***	***W***
TDS	***W***		***W***	***C***	***W***	***C***
HAAs /HAA5s[2]			***M***			***M***
TTHMs[2]			***M***			***M***

1 General surface water parameters – site specific parameters may be needed ie. groundwater

2 Must be simulated distribution

Key: Based on minimum 90 day pilot, decreased interval for shorter runs

C = Continuous; D = Daily; W = Weekly; M = Monthly

7. Required pretreatment with appurtenances designated (both included with system and external) which may include but are not limited to
    a. Bag or cartridge filters
    b. Direct coagulation
    c. Coagulation, flocculation, and sedimentation
    d. Conventional treatment
7. Recycled flows and treatment if any

8. Layout drawings showing all buildings, and appurtenances
9. Layout drawings showing controls and electrical system
10. Complete system description
11. Detailed dimensioned skid and layout drawings (see example at end of document)
12. Process flow diagram and flow balance
13. Process and instrumentation diagrams
14. Functional description of the system operation including backwash, CIP, CEB, and integrity test
15. Backwash - necessary cleaning method for trans-membrane pressure (TMP) reduction. Backwash may consist of several operations that may be used alone or in conjunction to reduce TMP.
    a. Air scrub (Every 15 -30 mins.)
    b. Forward flush (Every 15 -30 mins.)
    c. Reverse flush (Every 15 -30 mins.)
16. Clean in Place (CIP) – all systems need a method to chemically clean for the membrance for TMP to return to the original functional level.
    a. Consists of two phases: caustic clean and acid clean
    b. Typically performed once per month
17. Chemically enhanced backwash (CEB) – pilot study may reveal it to be necessary to apply a Enhanced Flux Maintenance (EFM) or Chemically Enhanced Backwash (CEB) to reduce fouling and maintain lower TMP.
    a. CEB is typically performed weekly, but sometimes as often as daily.
    b. During CEB, a solution of sodium hypochlorite is re-circulated through the module for up to 90 minutes.
    c. CEB is designed on case-by-case basis
19. Integrity Testing

a. Direct**:** A physical test applied to a membrane unit in order to identify and isolate integrity breaches.

   i. Pressure-based tests(e.g., pressure decay, diffusion flow, etc.)

   ii. Marker-based tests

      1) Significance: Must be used to verify removal efficiency in routine operation

Table 6 - Performance Criteria for Direct Integrity tests

Criterion	Definition	Value
Resolution	The smallest integrity breach that is detectable	3 microns
Sensitivity	The maximum LRV that is verifiable	Site-specific
Testing Frequency	How often a direct integrity test is conducted	once per day*

*an integrity test result (control limit) showing a loss of the verified log removal credit triggers a response which may include repair, CIP, or other cleaning response and/or a reporting requirements.

b. Indirect: A test primarily based on monitoring water quality as a surrogate of membrane integrity

   i. Turbidity monitoring

   ii. Particle count and particle monitoring - must be used for continuous integrity monitoring if direct method cannot monitor integrity continuously

      Continuous indirect integrity testing

      1) Continuous sampling interval < 15 min.

      2) Control limit for turbidity monitoring: < 0.15 NTU in a period of longer than 15 min.

      3) Incidents exceeding control limit trigger require direct integrity test

20. Valve schedule and operating position during each cycle of membrane operations

21. Clear delineation of block and bleed assembly or equivalent assembly equally or more protective against cross-connections

22. Operational protocol to assure backflow prevention during CIP (and CEB as necessary)

23. Filtrate sample locations to determine compliance and direct integrity testing

Predicted filtrate, permeate, or product quality based on required source water quality and operating parameter.

G. Water with Low Iron and Manganese Concentrations

Water with low iron and manganese concentrations (0.3 - 1.5 mg/l Fe, 0.05 - .30 mg/l Mn) may not require clarification prior to filtration. A detention time of 30 minutes should be provided to allow for complete oxidation, unless potassium permanganate is used as an oxidant.

H. Chemicals

1. Chemical containers should be labeled to provide the following information:
    a. Chemical name, purity and concentration
    b. Name and address of supplier
    c. Expiration date where applicable
1. Chemicals should meet the latest revision of the applicable AWWA standards and have NSF approval for use in potable water.
2. Chemical additions to the water shall be compatible under recommended dosages and should not impair the efficiency of disinfection.
3. In general, no "plug in" controls on chemical feed or hand controls that allow chemical feed to occur without plant (well) running.

I. Ozone

1. **F**eed gas preparation (In general, must meet latest version of applicable AWWA Standard) Feed gas can be air, oxygen enriched air, or high purity oxygen. Sources of high purity oxygen include purchased liquid oxygen conforming with AWWA Standard B-304; on site generation using cryogenic air separation; or temperature, pressure or vacuum swing (adsorptive separation) technology. In all cases, the design engineer must ensure that the maximum dew point of -76°F (-60°C) will not be exceeded at any time
    a. Air feed
        i. Air compression
            I. Air compressors shall be of the liquid-ring or rotary lobe, oil-less, positive displacement type for smaller systems or dry rotary screw compressors for larger systems.

II. The air compressors shall have the capacity to simultaneously provide for maximum ozone demand, provide the air flow required for purging the desiccant dryers (where required) and allow for standby capacity.

III. Air feed for the compressor shall be drawn from a point protected from rain, condensation, mist, fog and contaminated air sources to minimize moisture and hydrocarbon content of the air supply

IV. A compressed air after-cooler, entrainment separator, or a combination of the two (2) with automatic drain shall be provided prior to the dryers to reduce the water vapor.

V. A back-up air compressor must be provided so that ozone generation is not interrupted in the event of a break-down.

ii. Air drying

I. Dry, dust-free and oil-free feed gas must be provided to the ozone generator. Dry gas is essential to prevent formation of nitric acid, to increase the efficiency of ozone generation and to prevent damage to the generator dielectrics. Sufficient drying to a maximum dew point of -76°F (-60°C) must be provided at the end of the drying cycle.

II. Drying for high pressure systems may be accomplished using heatless desiccant dryers only. For low pressure systems, a refrigeration air dryer in series with heat-reactivated desiccant dryers shall be used.

III. A refrigeration dryer capable of reducing inlet air temperature to 40°F (4°C) shall be provided for low pressure air preparation systems. The dryer can be of the compressed refrigerant type or chilled water type.

IV. For heat-reactivated desiccant dryers, the unit shall contain two (2) desiccant filled towers complete with pressure relief valves, two (2) four-way valves and a heater. In addition, external type dryers shall have a cooler unit and blowers. The size of the unit shall be such that the specified dew point will be achieved during a minimum adsorption cycle time of sixteen (16) hours while operating at the maximum expected moisture loading conditions.)

V. Multiple air dryers shall be provided so that the ozone generation is not interrupted in the event of dryer breakdown

VI. Each dryer shall be capable of venting "dry" gas to the atmosphere, prior to the ozone generator, to allow start-up when other dryers are "on-line."

1. Air filters

I. Air filters shall be provided on the suction side of the air compressors, between the air compressors and the dryers and between the dryers and the ozone generators.

II. The filter before the desiccant dryers shall be of the coalescing type and be capable of removing aerosol and particulates larger than 0.3 microns in diameter. The filter after the desiccant dryer shall be of the particulate type and be capable of removing all particulates greater than 0.1 microns in diameter, or smaller if specified by the generator manufacturer.

2. Piping in the air preparation system can be common grade steel, seamless copper, stainless steel or galvanized steel. The piping must be designed to withstand the maximum pressures in the air preparation system.

b. Liquid oxygen feed gas system

i. Liquid oxygen storage system

I. The bulk oxygen storage system and associated equipment must comply with the latest standards including the latest AWWA version and all applicable local, state, and federal codes.

II. The liquid oxygen storage system must include the liquid oxygen storage tank and all related safety devices, appurtenances and equipment required for operation.

III. The liquid oxygen storage tanks must be horizontal or vertical tanks with double wall construction. The inner shell of the tank must be designed, fabricated, tested, inspected and stamped in accordance with the applicable ASME Code requirements and supported within the outer shell. The outer shell must be designed in accordance with applicable standards for exterior pressure due to full internal vacuum and must be carbon steel.

IV. The liquid oxygen storage tank must be provided with a mounting base and anchor bolts. Mounting base and support framing for the storage tank must be welded to the tank.

V. The internal vessel pressure relief must consist of both automatic primary and secondary relief devices and manual tank vent valves. External vessel pressure relief must consist of an automatic relief device.

VI. The tank must be insulated in the annular ring with a high vacuum packing or composite insulation, such that the tank boil off rate must not exceed 0.25 percent of the tank capacity by weight per day.

VII. The tank must be equipped with an economizer system to direct the boiled-off gaseous oxygen to the ozone generation feed-gas system rather than venting to atmosphere.

VIII. The tank must be equipped with a pressure building system to maintain the minimum pressure and maximum flow required for the ozone generation system.

ii. Liquid oxygen vaporization system

I. At least two ambient air vaporizers must be provided for the liquid oxygen vaporization system including all related safety devices, appurtenances and equipment required for operation.

II. The vaporizers must operate in a duty and defrost cycle mode of operation. The vaporizer equipment must be designed to provide continuous vaporization of liquid oxygen for design gaseous oxygen flow rate conditions at the minimum design ambient air temperature.

III. The vaporizers must be single module ambient vaporizers, factory assembled unit complete with bracing, lifting lugs, pressure safety relief valves, necessary internal manifold(ing), flanged connections, and suitable for outside installation and operation. The materials of construction must be suitable for the design conditions and oxygen compatible.

IV. The vaporizers must be equipped with automatic vaporizer valve controls to provide automatic switchovers to standby vaporizers on a timed or temperature basis to prevent vaporizer freeze-up.

iii. Piping and appurtenances

I. All piping between liquid oxygen storage tanks and vaporizers must be seamless copper pipe or stainless steel. All gaseous oxygen (GOX) piping,

valves and fittings between the vaporizers and the ozone generators must be stainless steel. All piping and valves must be suitable for cryogenic and oxygen gas service at the specified operating pressure. All liquid oxygen piping systems must be insulated in accordance with applicable standards.

II. Tank fill system must include a standard oxygen hose connector, check valve, pressure relief valve and drain valve. Fill system must be designed for appropriate connections.

III. A pressure regulating valve station must be installed downstream of the vaporizers to reduce gaseous oxygen pressure to the delivery pressure required for the ozone generation system. The valves must be certified for oxygen service.

IV. Gaseous oxygen cartridge-type particulate filter must be provided, complete with valves and appurtenances. The filter must be provided in the gaseous oxygen supply piping between the pressure regulating valve station and the ozone generators. The filter must retain particles as required by the manufacturer.

2. Ozone generator (In general, must meet latest version of applicable AWWA Standard)
   a. Capacity
      i. The production rating of the ozone generators shall be stated in pounds per day and kWhr per pound at a maximum cooling water temperature and maximum ozone concentration.
      ii. The design shall ensure that the minimum concentration of ozone in the generator exit gas will not be less than one (1) percent (by weight).
      iii. Generators shall be sized to have sufficient reserve capacity so that the system does not operate at peak capacity for extended periods of time resulting in premature breakdown of the dielectrics.)
      iv. The production rate of ozone generators will decrease as the temperature of the coolant increases. If there is to be a variation in the supply temperature of the coolant throughout the year, then pertinent data shall be used to determine production changes due to the temperature change of the supplied coolant. The

design shall ensure that the generators can produce the required ozone at maximum coolant temperature.

v. Appropriate ozone generator backup equipment must be provided.

b. Electrical.

The generators can be low, medium or high frequency type. Specifications shall require that the transformers, electronic circuitry and other electrical hardware be proven, high quality components designed for ozone service.

c. Cooling.

Adequate cooling shall be provided. The cooling water must be properly treated to minimize corrosion, scaling and microbiological fouling of the water side of the tubes. Where cooling water is treated, cross connection control shall be provided to prevent contamination of the potable water supply.

d. Materials.

To prevent corrosion, the ozone generator shell and tubes shall be constructed of Type 316L stainless steel.

3. Ozone contactors: (In general, must meet latest version of applicable AWWA Standard)

a. Bubble diffusers.

i. Where disinfection is the primary application, a minimum of two (2) contact chambers, each equipped with baffles to prevent short circuiting and induce countercurrent flow, shall be provided. Ozone shall be applied using porous-tube or dome diffusers.

ii. The minimum contact time shall be ten (10) minutes. A shorter contact time (CT) may be approved by the Department if justified by appropriate design and "CT" considerations.

iii. Where taste and odor control is of concern, multiple application points and contactors shall be considered.

iv. Contactors shall be separate closed vessels that have no common walls with adjacent rooms. The contactor must be kept under negative pressure and sufficient ozone monitors shall be provided to protect worker safety.

v. Contact vessels can be made of reinforced concrete, stainless steel, fiberglass or other material which will be stable in the presence of residual ozone and ozone in the gas phase above the water level. If contact vessels are made of reinforced concrete, all reinforcement bars shall be covered with a minimum of one and one-half (1.5) inches of concrete.

vi. Where necessary, a system shall be provided between the contactor and the off-gas destruct unit to remove froth from the air and return the other to the contactor or other location acceptable to the reviewing authority. If foaming is expected to be excessive, then a potable water spray system shall be placed in the contactor head space.

vii. All openings into the contactor for pipe connections, hatchways, etc. shall be properly sealed using welds or ozone resistant gaskets such as Teflon or Hypalon.

viii. Multiple sampling ports shall be provided to enable sampling of each compartment's effluent water and to confirm “CT” calculations.

ix. A pressure/vacuum relief valve shall be provided in the contactor and piped to a location where there will be no damage to the destruction unit.

x. The depth of water in bubble diffuser contactors shall be a minimum of eighteen (18) feet. The contactor shall also have a minimum of three (3) feet of freeboard to allow for foaming.

xi. All contactors shall have provisions for cleaning, maintenance and drainage of the contactor. Each contactor compartment shall also be equipped with an access hatchway.

xii. Aeration diffusers shall be fully serviceable by either cleaning or replacement.

b. Other contactors, such as the venturi or aspirating turbine mixer contactor, may be approved by the Department provided adequate ozone transfer is achieved and the required contact times and residuals can be met and verified.

4. Ozone destruction units (In general, must meet latest version of applicable AWWA Standard)

a. A system for treating the final off-gas from each contactor must be provided in order to meet safety and air quality standards. Acceptable systems include thermal destruction and thermal/catalytic destruction units.

b. The maximum allowable ozone concentration in the discharge is 0.1 ppm (by volume).

c. At least two (2) units shall be provided which are each capable of handling the entire gas flow.

d. Exhaust blowers shall be provided in order to draw off-gas from the contactor into the destruct unit.

e. Catalysts must be protected from froth, moisture and other impurities which may harm the catalyst.

f. The catalyst and heating elements shall be located where they can easily be reached for maintenance.

5. Piping materials: (In general, must meet latest version of applicable AWWA Standard)

   Only low carbon 304L and 316L stainless steels shall be used for ozone service with 316L preferred.

6. Joints and connections: (In general, must meet latest version of applicable AWWA Standard)

   a. Connections on piping used for ozone service are to be welded where possible.

   b. Connections with meters, valves or other equipment are to be made with flanged joints with ozone resistant gaskets, such as Teflon or Hypalon. Screwed fittings shall not be used because of their tendency to leak.

   c. A positive closing plug or butterfly valve plus a leak-proof check valve shall be provided in the piping between the generator and the contactor to prevent moisture reaching the generator.

7. Instrumentation: (In general, must meet latest version of applicable AWWA Standard)

a. Pressure gauges shall be provided at the discharge from the air compressor, at the inlet to the refrigeration dryers, at the inlet and outlet of the desiccant dryers, at the inlet to the ozone generators and contactors, and at the inlet to the ozone destruction unit.
b. Each generator shall have a trip which shuts down the generator when the wattage exceeds a certain preset level.
c. Dew point monitors shall be provided for measuring the moisture of the feed gas from the desiccant dryers. Where there is potential for moisture entering the ozone generator from downstream of the unit or where moisture accumulation can occur in the generator during shutdown, post-generator dew point monitors shall be used.
d. Air flow meters shall be provided for measuring air flow from the desiccant dryers to each of the other ozone generators, air flow to each contactor, and purge air flow to the desiccant dryers.
e. Temperature gauges shall be provided for the inlet and outlet of the ozone cooling water and the inlet and outlet of the ozone generator feed gas and, if necessary, for the inlet and outlet of the ozone power supply cooling water.
f. Water flow meters shall be installed to monitor the flow of cooling water to the ozone generators and, if necessary, to the ozone power supply.
g. Ozone monitors shall be installed to measure zone concentration in both the feed-gas and off-gas from the contactor and in the off-gas from the destruct unit. For disinfection systems, monitors shall also be provided for monitoring ozone residuals in the water. The number and location of ozone residual monitors shall be such that the amount of time that the water is in contact with the ozone residual can be determined.
h. A minimum of one ambient ozone monitor shall be installed in the vicinity of the contactor and a minimum of one shall be installed in the vicinity of the generator. Ozone monitors shall also be installed in any areas where ozone gas may accumulate.

8. Safety requirements (In general, must meet latest version of applicable AWWA Standard)

a. The maximum allowable ozone concentration in the air to which workers may be exposed must not exceed one-tenth part per million (0.1 ppm) by volume.

b. Noise levels resulting from the operating equipment of the ozonation system shall be controlled to within acceptable limits by special room construction and equipment isolation.

c. Emergency exhaust fans must be provided in the rooms containing the ozone generators to remove ozone gas if leakage occurs.

d. A sign shall be posted indicating "No smoking, oxygen in use" at all entrances to the treatment plant. In addition, no flammable or combustible materials shall be stored within the oxygen generator areas.

J. Chlorine Dioxide

1. Chlorine dioxide generators: Chlorine dioxide may be used for regulatory compliance for meeting log inactivation requirements of the surface water treatment rules or the disinfection byproducts precursor removal requirements. Chlorine dioxide used solely for aesthetic treatment will not be required to include the redundancy components, disinfection efficacy, or disinfection byproduct reduction. In all cases, disinfection byproduct formation must be addressed.

a. At minimum, bench scale testing must be conducted to determine chlorine dioxide demand and decay kinetics for the specific water being treated in order to establish the correct design dose for required log inactivation compliance (if required), oxidation reactions, and chlorite generation.

b. If chlorine dioxide is being employed for the reduction of disinfection byproducts in response to a violation, actual or simulated distribution system testing must be performed to assess the impact of chlorine dioxide addition on disinfection byproduct formation.

c. Chlorine dioxide generation equipment must be factory assembled pre-engineered units. All materials, construction, and associated testing shall be in accordance with the latest revision of the appropriate AWWA Standard.

d. Minimum yield requirements: (as determined by the latest revision of AWWA Standard Method 4500-ClO_2)

i. Hydrochloric acid and sodium chlorite systems must have a minimum yield of 80% across the proposed feed range. Unit must have maximum production limit of 30 lb per day.

ii. Gaseous chlorine and sodium chlorite systems must have a minimum yield of 95% across the proposed feed range. The excess free chlorine must not exceed five percent of the theoretical stoichiometric concentration.

iii. Gaseous chlorine and solid sodium chlorite systems must have minimum yield of 95% across the proposed feed range.

iv. Hydrochloric acid, Sodium chlorite, Sodium hypochlorite system must have a minimum yield of 90% across the proposed feed range. The excess free chlorine must not exceed five percent of the theoretical stoichiometeric concentration. (Note: *minimum yields may change subject to latest AWWA/Ten States revisions or industry update available at time of design)*

2. Chlorine Dioxide Feed system.
   a. Use fiberglass reinforced vinyl ester plastic (FRP) or high density linear polyethylene (HDLPE) tanks with no insulation.
   b. If centrifugal pumps are used, provide Teflon packing material. Pump motors must be totally enclosed, fan-cooled, equipped with permanently sealed bearings, and equipped with double mechanical seals or other means to prevent leakage.
   c. Provide chlorinated PVC, vinyl ester or Teflon piping material. Do not use carbon steel or stainless steel piping systems.
   d. Provide glass view ports for the reactor if it is not made of transparent material.
   e. Provide flow monitoring on all chemical feed lines, dilution water lines, and chlorine dioxide solution lines.
   f. Provide a means to verify calibrated feed flow to each application feed point.
   g. Control air contact with chlorine dioxide solution to limit potential for explosive concentrations building up within the feed facility.
   h. All chlorite solutions shall have concentrations less than 30%. Higher strength solutions are susceptible to crystallization and stratification.
3. Storage requirements (these are specific for a treatment plant employing chlorine dioxide, however they can be used in individual storage/use cases)
   a. Chlorine Dioxide Storage and Operating Area.
      i. The chlorine dioxide facility shall be physically located in a separate room from other water treatment plant operating areas.

ii. The chlorine dioxide area shall have a ventilation system separate from other operating areas.

iii. Provision shall be made to ventilate the chlorine dioxide facility area and maintain the ambient air chlorine dioxide concentrations below the Permissible Exposure Limit (PEL).

I. The ventilating fan(s) take suction near the floor, as far as practical from the door and air inlet, with the point of discharge so located as not to contaminate air inlets of any rooms or structures.

II. Air inlets are provided near the ceiling.

III. Air inlets and outlets shall be louvered.

IV. Separate switches for the fans are outside and near the entrance of the facility.

iv. The area housing chlorine dioxide facility shall be constructed of non-combustible materials such as concrete.

v. There shall be an ambient air chlorine dioxide sensor in the vicinity of the chlorine dioxide operating area. The ambient air chlorine dioxide readouts and alarm or warning light shall be audible and visible in the operating area and on the outside of the door to the operating area. The design shall include distinguishing audible alarms that are triggered by the ambient air chlorine dioxide sensor readings.

vi. There shall be observation windows through which the operating area can be observed from outside the room to ensure operator safety.

vii. Manual switches to the light in the operating area shall be located outside the door to the room.

viii. There shall be an emergency shower and eyewash outside and close to the door to the operating area.

ix. An emergency shutoff control to shut flows to the generator shall be located outside the operating area.

x. The design shall minimize the possibility of chlorite leaks.

xi. The chlorite tank and chlorine dioxide solution tank shall be vented to the outdoors away from any operating areas.

xii. Gaseous chlorine feed to the chlorine dioxide generator shall enter the chlorine dioxide facility area through lines which can only feed to vacuum.

xiii. The floor of the chlorine dioxide facility area shall slope to a sump.

xiv. There shall not be any open drains in the chlorine dioxide operating area.

xv. Provide secondary containments with sumps for chlorine dioxide storage, and chlorine dioxide solutions which can hold the entire volume of these vessels. This containment shall prevent these solutions from entering the rest of the operating area.

xvi. Provide wash-down water within the operating area.

xvii. The operating area shall be designed to avoid direct exposure to sunlight, UV light, or excessive heat.

b. Chlorine gas

i. Chlorinators should be housed in a room separate from but adjacent to the chlorine storage room.

ii. Both the chlorine gas feed and storage rooms should be located in a corner of the building on the prevailing downwind side of the building and be away from entrances, windows, louvers, walkways, etc.

iii. Chlorinator rooms should be heated to 60 degrees F, and be protected from excessive heat. Cylinders and gas lines should be protected from temperatures above that of the feed equipment.

iv. Chlorine gas feed and storage shall be enclosed and separated from other operating areas. Both the feed and storage rooms shall be constructed so as to meet the following requirements:

I. a shatter resistant inspection window shall be installed in an interior wall;

II. all openings between the rooms and the remainder of the plant shall be sealed;

III. doors shall be equipped with panic hardware, assuring ready means of exit and opening outward only to the building exterior;

IV. a ventilating fan with a capacity to complete one air change per minute when the room is occupied; where this is not appropriate due to the size of the room, a lesser rate may be considered;

V. the ventilating fan shall take suction near the floor and as great a distance as is practical from the door and air inlet, with the point of discharge located so as not to contaminate air inlets to any rooms or structures;

VI. air inlets with corrosion resistant louvers shall be installed near the ceiling;

VII. air intake and exhaust louvers shall facilitate airtight closure;

VIII. separate switches for the ventilating fan and for the lights shall be located outside and at the inspection window. Outside switches must be protected from vandalism. A signal light indicating ventilating fan operation shall be provided at each entrance when the fan can be controlled from more than one point;

IX. vents from chlorinator and storage areas must be screened and discharge to the outside atmosphere, above grade;

X. floor drains are discouraged. Where provided, the floor drains must discharge to the outside of the building and not be connected to other internal or external drainage systems, and;

XI. provisions must be made to chemically neutralize chlorine gas where feed and/or storage is located near residential or developed areas in the event of any measured chlorine release. The equipment must be sized to treat the entire contents of the largest storage container on site.

v. Chlorine gas feed systems shall be of the vacuum type and include the following:

I. vacuum regulators on all individual cylinders in service;

II. service water to injectors/educators shall be of adequate supply and pressure to operate feed equipment within the needed chlorine dosage range for the proposed system.

vi. Pressurized chlorine feed lines shall not carry chlorine gas beyond the chlorinator room.

vi. All chlorine gas feed lines located outside the chlorinator or storage rooms shall be installed in air tight conduit pipe.

vii. Full and empty cylinders of chlorine gas shall meet the following requirements:

I. housed only in the chlorine storage room;

II. isolated from operating areas;

III. restrained in position;

IV. stored in locked and secure rooms separate from ammonia storage, and;

V. protected from direct sunlight or exposure to excessive heat.

c. Acids and caustics

i. Acids and caustics shall be kept in closed corrosion-resistant shipping containers or bulk liquid storage tanks.

ii. Acids and caustics shall not be handled in open vessels, but should be pumped in undiluted form to and from bulk liquid storage tanks and covered day tanks or from shipping containers through suitable hoses, to the point of treatment.

d. Sodium Chlorite for chlorine dioxide generation shall meet AWWA Standard B303-10 or latest revision

i. Sodium Chlorite shall be stored by itself in a separate room and preferably shall be stored in an outside building detached from the water treatment facility. It shall be stored away from organic materials because many materials will catch fire and burn violently when in contact with sodium chlorite.

ii. The storage structures shall be constructed of noncombustible materials.

iii. If the storage structure must be located in an area where a fire may occur, water must be available to keep the sodium chlorite area cool enough to prevent heat induced explosive decomposition of the sodium chlorite.

iv. Care should be taken to prevent spillage.

v. An emergency plan of operation should be available for the clean up of any spillage.

vi. Storage drums must be thoroughly flushed to an acceptable drain prior to recycling or disposal.

vii. Positive displacement feeders shall be provided.

viii. Tubing for conveying sodium chlorite or chlorine dioxide solutions shall be Type 1 PVC, polyethylene or materials recommended by the manufacturer.

ix. Chemical feeders may be installed in chlorine rooms if sufficient space is provided or in separate rooms meeting the requirements of subsection v

x. Feed lines shall be installed in a manner to prevent formation of gas pockets and shall terminate at a point of positive pressure.

xi. Check valves shall be provided to prevent the backflow of chlorine into the sodium chlorite line.

e. Sodium hypochlorite:

i. Sodium hypochlorite shall be stored in the original shipping containers or in sodium hypochlorite compatible bulk liquid storage tanks.

ii. Storage containers or tanks shall be located out of the sunlight in a cool area and shall be vented to the outside of the building.
iii. Wherever reasonably feasible, stored sodium hypochlorite shall be pumped undiluted to the point of addition. Where dilution is unavoidable, deionized or softened water should be used.
iv. Storage areas, tanks, and pipe work shall be designed to avoid the possibility of uncontrolled discharges and a sufficient amount of appropriately selected spill absorbent shall be stored on-site.
v. Reusable sodium hypochlorite storage containers shall be reserved for use with sodium hypochlorite only and shall not be rinsed out or otherwise exposed to internal contamination.
vi. Positive displacement pumps with sodium hypochlorite compatible materials for wetted surfaces shall be used. To avoid air locking in smaller installations, small diameter suction lines shall be used with foot valves and degassing pump heads.
vii. In larger installations flooded suction shall be used with pipe work arranged to ease escape of gas bubbles.
viii. Calibration tubes or mass flow monitors which allow for direct physical checking of actual feed rates shall be provided.
ix. Injectors shall be made removable for regular cleaning where hard water is to be treated.

4. Miscellaneous

a. Provide secondary containment, a sump, wash-down water, and a shower and eyewash at the bulk delivery transfer point.
b. Finished water shall be used for chlorine dioxide generation.
c. The finished water line to the chlorine dioxide generator shall be protected with a high hazard assembly.
d. Provide a water supply near the storage and handling area for cleanup.
e. The parts of the chlorine dioxide system in contact with the strong oxidizing or acid solutions shall be of inert material.
f. The design shall provide the capability to shut off the chlorine dioxide operation remotely, i.e., from a location that is outside of the chlorine dioxide operating area.

K. UV Light

1. General This section shall apply to the public drinking water systems that use ultraviolet (UV) disinfection for inactivation of Cryptosporidium, Giardia, and virus. The Director may reduce the requirements on a case by case basis for the water systems that use UV as ancillary means of disinfection and do not claim credit for UV disinfection or for water

systems using UV without a SCADA system such as small non-community systems (see section n below).

Terminology used in this section is based on the definitions in the EPA Ultraviolet Disinfection Guidance Manual for the Final Long Term 2 Enhanced Surface Water Treatment Rule (2006 Final UVDGM). All covered items shall meet AWWA Standard F110-12 or latest revision.

a. Water systems using surface water or ground water under the influence of surface water shall not use UV as the sole means of disinfection. For these types of water systems, at least one alternative primary disinfectant must be used for virus disinfection, and a secondary disinfectant shall be provided to maintain a disinfectant residual in the distribution system.

b. The following requirements apply to the water systems that wish to receive credit for UV disinfection:

    i. The water system shall submit a UV plan which clearly identifies the dose monitoring strategy, such as the UV intensity set point approach, the calculated dose approach or an alternative approach.
    ii. The water system shall identify the goals for the UV facility as part of a comprehensive disinfection strategy, including target pathogens, target log inactivation, and corresponding required UV dose per the latest revision of EPA guidance documents.
    iii. The water system shall submit a UV reactor validation report in accordance with the latest revision of EPA guidance documents to the Director for review prior to installation of UV facility.
    iv. The water system must demonstrate that the reactor is delivering the required UV dose using a validated dose monitoring system and continue to comply with the monitoring and reporting requirements specified in the latest revision of EPA Guidance or Rule.

2. Validation Testing. - The Director may accept a validation report that was conducted based on the 2003 draft UV Disinfection Guidance Manual on a case-by-case basis.

   a. Each model and specific configuration of UV reactor must undergo off-site, full-scale validation testing by an independent third party test facility prior to being approved for use. The validation testing shall be conducted in qualified test facilities that are deemed acceptable by NSF, EPA, or the Director.

   b. Validation testing results shall provide data, including calculations and tables or graphical plots, on dose delivery by the UV reactor under design conditions of flow rate, UV transmittance (UVT), UV intensity, lamp status, power ballast setting, as well as consideration of lamp aging and lamp fouling. The validation report shall demonstrate that the monitoring algorithm is valid over the range expected with the application. The data is used to define the dose monitoring algorithm for the UV reactor and the operating conditions that can be monitored by a utility to ensure that the UV dose required for a given pathogen inactivation credit is delivered.

   c. The UV reactor validation report shall include:

      i. Description of the reactor and validation test set-up, including general arrangement and layout drawings of the reactor and validation test piping arrangement.
      ii. Description of the methods used to empirically validate the reactor.
      iii. Description of the dose monitoring equation for the reactor to achieve the target pathogen inactivation credit and related graphical plots showing how the equation was derived from measured doses obtained through validation testing under varying test conditions.
      iv. Range of validated conditions for flow, UVT, UV dose, and lamp status.
      vi. Description and rationale for selecting the challenge organism used in validation testing, and analysis to define operating dose for pathogen inactivation credit.

vii. Tabulated data, analysis, and Quality assurance/quality control (QA/QC) measures during validation testing.

viii. A licensed professional engineer's third party oversight certification indicating that the testing and data analyses in the validation report are conducted in a technically sound manner and without bias.

ix. The validation report shall be companied with completed Checklists 5.1 through 5.5 included in the EPA Ultraviolet Disinfection Guidance Manual for the Final Long Term 2 Enhanced Surface Water Treatment Rule (2006 Final UVDGM).

3. Unit Design Criteria

a. A water system considering UV disinfection shall gather sufficient water quality data prior to design. The water samples shall be representative of the source water to be treated by the UV facility. Frequent testing may be required if significant variation or seasonal trending in water quality is expected.

b. The following water quality parameters shall be considered in UV facility planning:

i. UV Transmittance or UV Absorbance

ii. Calcium

iii. Alkalinity

iv. Hardness

v. Iron

vi. Manganese

vii. Turbidity

viii. pH

ix. Oxidation-Reduction Potential (ORP)

x. Particle content and algae

c. The design flow rate and UVT used to size the UV system shall be selected to provide the required dose at least 95 percent of the time, accounting for seasonal variations of flow and UVT combinations. Specifying a matrix of flow and UVT conditions for the UV reactors may be necessary.

d. The water system may consider increasing the delivered dose beyond the required UV dose to provide flexibility and conservatism.

e. UV reactor inlet and outlet configurations shall meet the validated hydraulic distribution of flow conditions or be more hydraulically conservative.
f. The UV disinfection system shall be capable of applying the required design dose with a failed or out-of-service reactor. The design shall account for an on-line backup UV reactor or an operating scheme to apply the design dose with one reactor out of service.
g. It shall be possible to isolate each reactor for maintenance.
h. Signals and alarms shall be provided for the operation of the UV facility for the parameters necessary for dose monitoring algorithm, such as low UV dose, high flow rate, low UVT, UVT monitoring failure, UV sensor failure, off specification event, Ground Fault Interrupt (GFI), high water temperature, and low water level.
i. All materials used in constructing or coating the UV reactors that come in contact with water shall be certified NSF Standard 61 - Drinking Water System Components - Health Effects.
j. Any chemicals used in the cleaning of the UV reactor components in contact with the drinking water such as quartz sleeves shall be certified as meeting the ANSI/NSF Standard 60 - Drinking Water Treatment Chemicals - Health Effects.
k. A flow or time delay shall be provided to permit a sufficient time for tube warm-up, per manufacturer recommendations, before water flows from the unit upon start up. The flow or time delay shall be included in the design so they do not result in excessive off specification conditions.
l. A backup power supply of sufficient capacity shall be provided for the UV disinfection system. If power quality problems are anticipated, power conditioning equipment, such as uninterruptible power supply (UPS), shall be included in the design.
m. The design shall include a redundant disinfection mechanism that will apply an approved primary disinfectant to achieve the CT or log removal/inactivation required for compliance if a UV facility is off specification or offline within a maximum response time of 15 minutes. One example of such response is to shut down the off-specification UV train and either bring a parallel UV train on line or initiate a back-up

primary disinfection system within 15 minutes, so the continuous duration of an off-specification event is limited to no more than 15 minutes.

n. UV disinfection units for small unapproved non community, transient systems shall be certified as meeting the ANSI/NSF Standard 55, Class A, or other equivalent or more stringent validation or certification standards that are deemed acceptable by the Director.

o. The dose monitoring approach used for UV facility must be reviewed and accepted by the Director. Typically the calculated dose approach is suitable for large systems or systems with significant flow variation, and the UV intensity setpoint approach is for small systems or systems with fixed flow rate. The dose monitoring approaches need to be consistent with the guidelines stated in the 2006 Final UVDGM or latest revision.

p. If Programmable Logic Controller (PLC) or SCADA interface is used for UV reactor's process control, the programming shall be in accordance with the validated dose monitoring algorithm and the validated conditions. The algorithm shall use inputs of flow, UV intensity sensor readings, lamps status, and/or UVT equal to or more conservative than values measured during the operation of the UV system. If the measured UVT is above the validated range, the maximum validated UVT shall be used as the input to the dose algorithm. If the measured flow rate is below the validated range, the minimum validated flow rate shall be used as the input to the dose algorithm. If the dose algorithm uses relative lamp output determined from the UV intensity sensor readings as an input, the relative lamp output shall be based on the measured UVT, even if it exceeds the maximum validated UVT.

q. The UV reactor's PLC or microprocessor shall be programmed to record off specification events for the following conditions:

    i. Delivered UV dose less than the required dose,
    ii. Flow greater than the validated range,
    iii. UVT less than the validated range,
    iv. Lamp status outside the validated range,

v. Failure of UV sensors, flow meters, or on-line UVT monitors used in the dose calculation. Laboratory measurements of UVT may be used temporarily in the program until the on-line UVT monitor is repaired.

4. Operation and Maintenance – The operation and maintenance tasks and the frequency of performing them can be specific to the UV equipment installed. The water systems with approved UV installations should follow the manufacturer's recommendation or the operation and maintenance guidelines stated in Section 6.2 through 6.5 of the 2006 Final UVDGM or latest revision.
   a. Startup testing.
      i. The UV reactor manufacturer must provide a site-specific operation and maintenance manual, which shall include the procedure for starting up and shutting down the UV treatment system.
      ii. Provide schedules and performance standards for start-up testing and initial operation. Schedules shall include anticipated start-up date and proposed testing duration. Performance standards shall reference applicable regulations and specific equipment capabilities.
      iii. Operators shall receive site-specific training on the operation of the UV disinfection system.
   b. An incident plan shall be developed to address lamp breakage and release of mercury, response to alarms, power supply interruptions, activation of standby equipment, failure of systems, etc.
   c. To verify that the UV reactors are operated within the validated limits, selected parameters shall be monitored. The routine operation and maintenance shall include the monitoring and calibration requirements approved by the Director. For very small UV systems, the Director may consider granting exception to allow reduced monitoring and reporting on a case-by-case basis.

K. Disinfection of Treatment Facilities

The disinfection procedure should meet the current AWWA standard (C653). A solution strength of 50 mg/l free chlorine applied for 24 hours is recommended. The discharge of highly chlorinated water will require a permit from the Department of Environmental Quality, Office of Pollution Control. At least one clear microbiological water sample shall be collected by a representative of the Mississippi State Department of Health, the Licensed Professional Engineer in charge of the project, or the

Certified Operator for the public water supply. Samples with "No Coliform Present" shall constitute acceptable sample(s) when analyzed by the Mississippi State Department of Health or a laboratory certified by the State.

L. Other

1. Process diagrams may be required for certain complex treatment processes.
2. All plant piping should be color coded in accordance with recommendations published in "Recommended Standards for Water Works", 1992 issue.
3. All controls for sources, water levels, etc. should be accessible from the treatment plant.
4. An alternate power source should be considered in case of power loss.
5. Any discharges from water treatment facilities will be regulated by the Mississippi Department of Environmental Quality, Office of Pollution Control.
6. All Water Treatment Plant shall have a security fence around the perimeter. This fence should be at least 6 feet tall with barbed wire around the top.
7. All new or rehabilitated treatment facilities shall include the addition of a ¾ inch sampling faucet to be installed at a point where adequate mixing of finished water has occurred at a distance of no less than 100 feet from the last entry point where chemical(s) are introduced.
   a. It shall be tapped directly to the water main and be a non-hose bib design.
   b. It shall have its access limited to water system personnel only.

Part V – Water Distribution

A. Distribution System Design

1. Pressures

The distribution system should be so designed as to maintain a minimum dynamic pressure of 20 psi and a maximum static pressure of 80 psi. Higher pressures may be considered on a case by case basis provided individual pressure reducers are used on the services.

2. Pipe Sizes

All water mains should be designed based on hydraulic analysis using an appropriate friction coefficient.

a. The maximum Hazen-Williams C value to be used is 120.

b. The minimum main size shall be 4 inches regardless of the results of the hydraulic analysis. Smaller lines may be considered on a case by case basis.

c. The minimum main size supplying fire hydrants with pumper connections should be as determined by hydraulic analysis using fire flows, but not less than 6 inches. Flushing (2-way) hydrants may be installed on 4 inch lines if the hydraulic analysis demonstrates satisfactory pressure under fire flow conditions.

d. The maximum velocity in all source, treatment and distribution system piping should be limited to 5 feet per second to minimize friction loss.

3. Materials

All materials not specifically referenced in these guidelines shall be non-toxic and approved for use in potable water systems by AWWA, U.S. EPA, Underwriters Laboratory, National Sanitation Foundation or other appropriate organization.

a. Cast iron, ductile iron and steel pipes and fittings shall comply with the latest applicable standards issued by the American Water Works Association.

b. PVC pipe shall bear the National Sanitation Foundation seal for potable water and meet the requirements of ASTM D 1784 for Class 12454 A or 12454 B compounds. The pipe shall meet the latest revision of the applicable AWWA or Commercial

Standards. To provide a safety factor for the surges in PVC pipe using Commercial Standards the maximum pressure should be limited to one-half of the manufacturers pressure rating of the pipe.

c. For static pressures up to 80 psi, 160 psi pipe (SDR 26) may be used. For static pressures greater than 80 psi, 200 psi pipe (SDR 21) should be used.

d. Asbestos cement pipe will not be approved by this office and any existing asbestos cement pipe should be replaced.

4. Consecutive Water Systems

Water supplies which meter water through a master meter should use a compound meter unless flows are continually maintained at a rate which will register accurately on the meter.

B. Installation

1. Pipe Laying

Pipe installation should comply with generally accepted standards of good workmanship, including applicable AWWA and industry standards, along with, but not limited to the following:

a. A continuous uniform bedding should be provided, free of stones and debris within 6 inches of the pipe in the bedding and cover material.

b. There should be a minimum of 30 inches of cover.

c. While under construction, unattended exposed pipelines must have the ends capped. All materials to be used in construction shall be stored above the ground in a manner that will minimize the possibility of contamination.

d. Adequate separation from other utilities for maintenance and/or repair should be provided.

e. Detectable marking tape should be installed on all new pvc water mains to aid in the location of these lines in the future. It is recommended that the tape be blue in color.

2. Separation of Water and Sewer Mains

a. Water mains shall be located on opposite sides of the street from sewers where possible.

b. Adequate separation of water and sewer lines shall be based on the following factors:

   i. Materials and type of joints for water and sewer pipe.

   ii. Soil conditions.

   iii. Natural drainage and subsurface flow.

   iv. Any other local condition affecting the construction, maintenance or future integrity of the installation.

c. Water mains located near sewer lines.

   i. Water mains shall be laid at least 10 feet horizontally **and** 18 inches vertically from any sanitary sewer or manhole. The bottom of the water line should be at least 18 inches from the top of the sewer line. (Water lines should always be constructed above sewer lines. Under extraordinary circumstances, the Bureau of Public Water Supply may approve the construction of a sewer line above a water line provided the design engineer meets special construction requirements as determined by the Bureau.

   ii. Where local conditions prevent adequate horizontal and vertical separation, the Bureau of Public Water Supply may allow the water line to be laid closer to the sewer line if supported by adequate data from the design engineer. Each situation will be reviewed on a case by case basis. A detailed drawing shall be included in the plans for the water line construction submitted to the Bureau of Public Water Supply for review and approval. **Where adequate horizontal and/or vertical separation cannot be maintained, the following requirements shall apply:**

      I. If the 10 foot horizontal separation between water and sewer lines cannot be maintained then the water line should be ductile iron with water line joints located at the maximum distance possible from sewer line joints. PVC pipe may be used if it is protected by a steel casing. Also the water and sewer lines must be in separate trenches with

adequate space for maintenance. In some cases, special sewer line construction procedures may be required.

II. Where the 10 foot horizontal and 18 inch vertical separation cannot be maintained, condition I. must be met and the sewer line shall be constructed according to water main standards.

III. **NOTE:** Where water lines cross sewer lines, the above requirements will be waived if pipe segments are centered to provide maximum spacing of the joints of both water and sewer lines and a vertical separation of at least 18 inches (water over sewer) is maintained.

d. Water lines and sewer lines should be shown on the same layout sheet whether sewer lines are existing or proposed.

e. Potable water lines shall be clearly and permanently identified where pressure sewer systems exist or where sewers are constructed of water pipe.

3. Surface Water, Ditch and Roadway Crossings

a. Water lines crossing ditches and/or streams where less than 30 inches of cover is maintained should be ductile iron pipe or protected by a steel casing. Adequate support and anchorage should be provided on both sides of the ditch.

b. Exposed stream crossings should be above the 100 year flood.

c. PVC pipe crossing roadways should be protected by a steel casing. This office recommends ASTM A252 or ASTM A139 Grade B or better. Pipe should be 35,000 psi ultimate strength.

d. Casing size should be two diameter sizes larger than the pipe to allow for future expansion.

4. Disinfection

a. After completion of the construction and pressure testing of water distribution lines, they shall be flushed and disinfected using at least a 50 mg/l free chlorine solution for 24 hours or as described in the latest revision of AWWA C651. Large volume

disposal of this water may require a permit from the Department of Environmental Quality Office of Pollution Control.

b. After completion of the construction and disinfection of water distribution lines, the contractor shall arrange for at least one microbiological water sample to be collected by a representative of the Mississippi State Department of Health, the Licensed Professional Engineer in charge of the project, or the Certified Operator for the system from every dead-end line and every major looped line. Water being collected for testing shall not have a chlorine residual higher than is normally maintained in other parts of the distribution system. No chlorine shall be present which is a result of line disinfection. A sample showing "No Coliform Present" shall constitute a satisfactory sample when analyzed by the Mississippi State Department of Health environmental laboratory or a laboratory certified by the MSDH.

5. Cross Connections

There shall be no physical connection between a potable water system and a non-potable system whereby non-potable water or other liquid contaminants may be caused to enter.

a. An appropriate backflow prevention device shall be installed on each service connection where an existing or potential health hazard exists or where a hazardous hydraulic condition may be allowed to exist.

   i. Backflow prevention assemblies shall be installed in a location that provides adequate access for testing and repair of the assembly.

   ii. Reduced pressure principle backflow prevention assemblies and double check valve assemblies shall not be located in a pit below ground level.

b. Prior to service being connected to a public water system, all wells or water sources owned or used previously by the potential customer shall be physically disconnected from the plumbing to be supplied by the public water system.

c. Interconnections between approved water supplies to be used in emergencies may be allowed provided no hazardous or potentially hazardous hydraulic conditions would be created by the use of the interconnection.

i. A flow of 50% of the peak design flow may be used to assess the hydraulic conditions with the emergency connection in use.

ii. Bureau of Public Water Supply approval of the interconnection shall be obtained prior to installation.

iii. Two closed gate valves should be used to physically separate the two systems. A riser with a small, protected outlet should be installed to signify operation of the emergency connection or failure of one of the valves. A meter should be installed so records of water usage during an emergency may be determined.

iv. A formal resolution of the governing bodies of each of the water supplies shall be adopted prior to construction of the interconnection. This resolution shall clearly define the terms and conditions governing this interconnection of two public water systems.

6. Booster Stations

a. Booster stations should have the storage (collector) capacity, or inflow under peak hydraulic conditions to provide a peak flow for at least 200 minutes in rural areas.

b. A collector tank should be sized for equalizing storage, with a minimum detention time of 30 minutes based on the difference of influent and effluent for chemical contact.

c. Pumps should be sized to meet the demand of the customers past the booster station using the MSDH demand curve i.e. 50 customers would require 65 connections.

d. A provision for a bypass around the booster station should be installed to allow for bypassing the booster station with temporary facilities as needed for maintenance.

e. Chlorination facilities may be required to maintain adequate chlorine residuals beyond the booster station.

f. Hydraulics indicating peak flows and fill conditions should be included.

7. In-Line Booster Pumps

The use of in-line booster pumps to boost pressure and/or flow within a distribution system is generally not recommended. **In-line booster pumps will not be approved by the MSDH Bureau of Public Water Supply except in cases where it can be shown that the benefit gained will justify the inherent risk associated with pumps used in this manner.** Therefore, approval of in-line booster pumps will be issued on a case-by-case basis dependent upon system hydraulics, fire flow tests, line sizes, proximity to elevated storage, etc. Fire flow tests may not be used as a substitute for hydraulic calculations since pressure gauges are not routinely placed at the system's most vulnerable areas during the tests and dynamic pressures could potentially be dropping below 20 psi. In all instances where an in-line pump is proposed, adequate documentation must be submitted to MSDH by a professional engineer licensed to practice in the state of Mississippi for review and approval prior to installation. **In addition, the engineer must certify, in writing, that, in his professional opinion, the installation of the in-line booster pump will not result in a threat to public health due to low water pressure.** In all cases, a low pressure cut off switch will be required to shut the pump off in the event that the pressure on the inlet side of the pump drops to a predetermined value (The minimum setting for cut off switches shall be 20 psi).

8. Other

a. All water users should be individually metered.

b. A sufficient number of valves should be provided for line maintenance, repairs and isolation of fire hydrants.

c. Flushing hydrants should be installed on all dead end lines, low areas and in other places that might require flushing. They should be installed in areas where 2.5 ft/sec. velocity can be obtained for adequate flushing.

d. Pressure and leakage tests should be completed and conform to the current AWWA Standard C600 (see applicable section for the type of pipe being installed).

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Part VI – Water Storage

A. General

1. Construction Standards

All welded steel tanks should conform to the current "AWWA Standard for Welded Carbon Steel Tanks for Water Storage". All pressure tanks should conform to current AWWA standards and to the ASME Code for Unfired Pressure Vessels.

2. Overflows and Drains

Overflows and drains shall not be directly connected to sewers or storm drains.

3. Drainage of Surfaces

Surfaces of tanks, including hatch covers, should be sloped to drain.

4. Other Tank Materials

Tanks of materials other than welded steel will be considered on a case by case basis.

5. Coating

a. Paints, primers and sealers used on the interior of water tanks shall be NSF approved for contact with potable water.
b. Coal tar, wax, or bitumastic shall not be used in interior coatings for water tanks. Lead paint shall not be used on the interior or exterior of water tanks.
c. The Division strongly recommends that all painting projects be under the supervision of a licensed professional engineer.

6. Refurbishing/Removal of Coatings

a. Surface preparation - Refer to SSPC requirements. The interior should follow SSPC 10 and the exterior should follow SSPC 6.
b. Coating
    i. Interior - for interior coatings in contact with potable water we recommend a catalyzed epoxy system
    ii. Exterior - for exterior coating we recommend a polyurethane system
c. Lead abatement - Refer to SSPC guidelines.

7. Protection from Trespassers

Fencing, locks on access manholes and other necessary precautions shall be provided to prevent trespassing, vandalism, and sabotage. Consideration should be given to the installation of high strength, cut resistant locks or lock covers to prevent direct cutting of a lock.

8. Disinfection of Sampling

Prior to being placed into service after construction or maintenance, tanks and related piping shall be disinfected and sampled.

a. Prior to disinfection, all foreign material should be flushed from the tank.
b. The disinfection procedure should meet the current applicable AWWA Standard C652, or use water with 50 mg/l of free available chlorine for a contact time of 24 hours. Disposal of highly chlorinated water may require a permit from the DEQ/Office of Pollution Control.
c. Water samples for microbiological analysis must be collected by a representative of the Mississippi State Department of Health, the Licensed Professional Engineer for the project, or the Certified Operator for the public water system. Water being collected for testing should not have a chlorine residual higher than normally maintained in the water system. No chlorine should be present as a result of disinfection.
d. A sample showing "No Coliform Present" shall constitute a satisfactory sample. The sample shall be analyzed by the Mississippi State Department Health environmental laboratory or other State certified laboratory.

B. Hydropneumatic (Pressure) Tanks

1. Sizing

Pressure tanks should be sized in gallons at a minimum of 40 times the pump capacity in gallons per minute to provide a reasonable cycle and detention time.

2. Allowable Pressures

Maximum control pressure range: 20 psi

3. ASME Code Requirements

Tanks should be built to ASME code requirements.

4. Controls

Air volume and pump controls should maintain the water level between 1/3 and ½ diameter measured from the bottom of the tank. Controls should be designed to minimize release of air through the air release valve and maximize pump run time. The controls must sense both air pressure and the water level to maintain proper conditions for providing desired pump cycle, so a combination of pressure and electrode controls is recommended.

5. Piping

When the inlet and outlet are at the same end of the tank, the inlet should extend into the tank a minimum of 2/3 of its length to prevent short-circuiting.

6. Accessories

a. A sight glass should be provided to allow a visual indication of the water level. Valves should be provided to allow drainage of the sight glass.

b. A pressure relief valve shall be provided, set to discharge if the pressure in the tank exceeds normal working pressure. The pressure relief valve should meet ASME Code requirements.

c. A valved bypass line shall be provided so that the tank may be isolated for maintenance.

d. A drain with a resilient seat valve and a horizontal discharge should be provided on the bottom of the tank, sized to allow draining of the tank in a reasonable time.

e. Access to the tank should be provided in the bottom 1/3 diameter of the tank so that the gasket will remain submerged, sized at least 18 inches in the smallest dimension.

f. A weather proof pressure gauge should be mounted above the maximum water level, with an isolation valve.

g. Valved connections for air volume and pressure controls should be provided.

h. An air compressor should be provided to replenish the air being absorbed.

C. Elevated Tanks, Standpipes, and Ground Reservoirs

1. Sizing

a. Elevated storage capacity should be at least 50% of the daily demand. This allows up to two connections per source gpm provided the well operating time is 12 hours or less on peak demand days. Storage less than this requires additional source capacity to provide a peak flow of 1 gpm per connection for an equivalent number of minutes. **NOTE:** The Department of Health strongly encourages all public water systems to provide elevated storage equivalent to one day's normal usage (gallons).

b. Standpipes and reservoirs may be used as elevated storage where elevations allow. The volume of a standpipe above the level required to maintain at least 20 psi dynamic pressure at all connections, as demonstrated by a hydraulic analysis, may be considered elevated storage.

c. Ground level tanks used as pump reservoirs should be sized to provide routine storage plus reserve emergency storage.

d. Absent of hydraulic calculations indicating otherwise, the top 25 feet of a standpipe shall be considered elevated storage.

e. Excessive storage capacity should be avoided to prevent potential water quality deterioration problems.

2. Accessories

a. A water level gauge should be provided to allow a visual indication of the water level in the tank.

b. A screened vent as large as the inlet/outlet pipe shall be provided in accordance with current AWWA standards, to protect the tank from the entrance of insects, birds and other contaminants. The overflow pipe should not be considered a tank vent.

c. An overflow shall be provided in accordance with current AWWA standards.

d. A drain shall be provided, sized to allow draining of the tank in a reasonable period of time.

e. A provision should be made for isolating the tank for inspection and maintenance while maintaining water service.

f. Support columns should have drain plugs.

g. Ladders should be equipped with OSHA approved safety devices.

h. Access into the tank shall be provided according to current AWWA standards. The opening should have a curb at least 4 inches high and the cover should have a downward overlap of at least 2 inches.

i. A 3/4 inch sample faucet shall be provided on the tank riser near its bottom.

j. A manhole should be provided to allow for entrance into the riser. It should be at least 24 inches in diameter.

3. Pre-Owned (Used) Tanks

a. Prior to coating:

   i. Any pit greater than 1/8" should be welded.

   ii. Any pit less than 1/8" can be repaired using a NSF approved filler.

b. Extra care should be given to grind all welds. (Existing welds included).

c. The Department strongly recommends that all previously owned elevated tanks be inspected by qualified professionals prior to dismantling.

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Part VII - Hydraulics

Computerized hydraulic calculations should be provided for all project submittals to the MSDH involving the construction of subdivisions or significant water distribution system extensions. In addition, hydraulic calculations may be necessary for submittals on projects such as elevated tanks and wells where the influence of these system components must be ascertained.

Listed below are the minimum requirements that are needed for the submittal of hydraulic information to the MSDH/DWS:

A. Map of the Proposed System

1. Provide a Node Map that is clearly and accurately displayed.
2. The Node Map should include the node numbers and elevations, pipe numbers, the number of customers between each node and the location of each source, tank, booster station and pressure reducing valve. The pressure settings and flows should be indicated for each pressure reducing valve.

B. Selection of Fixed Gradient

1. In selecting the flow gradient of elevated tanks, the Mean Sea Level (MSL) of the overflow should be used.
2. In selecting the flow gradient of hydropneumatic tanks, use the middle range of the tank's operating pressure.
3. In selecting the flow gradient of wells, use the MSL of the overflow of the tank that the well pumps to.

C. Other Requirements

1. Use the MSDH/DWS "Demand Curve" on all lines where the flow is less than 100 gpm.
2. "Fill" hydraulics will be required to ascertain if wells have the capability of filling elevated tanks, standpipes, booster stations and collector tanks.
3. Submittal should include system input data as well as results.
4. Use demand factors as specified in Table 1, "Water Demands", in determining the correct demand for unmetered systems, apartments, trailers and recreational vehicles.

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Appendix A - Mississippi Primary Drinking Water Regulations

Title 15 - Mississippi Department of Health

Part 20: Bureau of Public Water Supply

Subpart 72: Public Water Supply

CHAPTER 1. MISSISSIPPI PRIMARY DRINKING WATER REGULATION

Subchapter 1. General Provisions:

Rule 1.1.1. **Legal Authority.** This regulation has been promulgated under the authority of and pursuant to the Mississippi Safe Drinking Water Act of 1997 (Section 41-26-1 through Section 41-26-101, Mississippi Code of 1972, Annotated).

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.1.2. Definitions

1. **Department** shall mean the Mississippi State Department of Health.

2. **Director** shall mean the Director of the Bureau of Public Water Supply of the Mississippi State Department of Health or his/her authorized agent.

3. **Municipality** shall mean a city, town, village, or other public body created by state law, or an Indian tribal organization authorized by law.

4. **Federal Agency** shall mean any department, agency, or instrumentality of the United States.

5. **Administrator** shall mean the Administrator of the U.S. Environmental Protection Agency or his authorized representative.

6. **Federal Act** shall mean the Safe Drinking Water Act of 1974, cited as Public Law 93-523, or any subsequent revisions thereto.

7. **Regulations** shall mean primary drinking water regulations promulgated by the administrator pursuant to the federal act.

8. **Backflow** shall mean the reversal of normal flow direction where water flows from the intended point of delivery towards the public water supply.

9. **Cross Connection** shall mean any direct interconnection between a public water system and a non-public water system or other source which may result in the contamination of the drinking water provided by the public water system. This

definition includes any arrangement of piping where a potable water line is connected to non potable water; it may be a pipe-to-pipe connection where potable and non potable water lines are directly connected or a pipe-to-water connection where the potable water outlet is submerged in non potable water. If the potable and non-potable source are separated by gate valves, check valves or devices other than the appropriate backflow preventer as outlined by this regulation, a cross connection exists. By-pass arrangements, jumper connections, swivel or change over assemblies, or other temporary or permanent assemblies through which, or because of which, backflow may occur are considered to be cross connections.

7. **Public water system** means a system for the provision to the public of water for Human consumption through pipes or, after August 5, 1998, other constructed conveyances, if such system has at least fifteen service connections or regularly serves an average of at least twenty-five individuals daily at least 60 days out of the year. Furthermore, two or more water systems that are adjacent, that are owned or operated by the same supplier of water, that individually serve less than 15 service connections or less than 25 persons but in combination serve 15 or more service connections or 25 or more persons, shall also be defined as a public water system. Such term includes: Any collection, treatment, storage, and distribution facilities under control of the operator of such system and used primarily in connection with such system; and any collection or pretreatment storage facilities not under such control which are used primarily in connection with such system. Such term does not include any "special irrigation district." Service connection, as used in the definition of public water system, does not include a connection to a system that delivers water by a constructed conveyance other than a pipe if:

   a. The water is used exclusively for purposes other than residential uses (consisting of drinking, bathing, cooking, or other similar uses);

   b. The Director or Administrator determines that alternative water to achieve the equivalent level of public health protection provided by the applicable national primary drinking water regulation is provided for residential or similar uses for drinking and cooking; or

   c. The Director or Administrator determines that the water provided for residential or similar uses for drinking, cooking, and bathing is centrally treated or treated at the point of entry by the provider, a pass-through entity, or the user to achieve the equivalent level of protection provided by the applicable national primary drinking water regulation.

   d. Special irrigation district means an irrigation district in existence prior to May 18, 1994, that provides primarily agricultural service through a piped water system with only incidental residential or similar use where the system or the residential or similar users of the system comply with the

exclusion provisions in Section 1401(4)(B)(i)(II) or (III) of the Federal Safe Drinking Water Act.

11. **Professionally installed** shall mean installed in a workmanlike manner with no apparent errors in installation.

12. **Significant deficiencies** cause or have the potential to cause the introduction of contamination into drinking water delivered to customers of a public water supply. This could include defects in design, operation or maintenance of the source, treatment or distribution systems.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.1.3. The definitions as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 141.2 are hereby adopted.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.1.4. **Coverage.** This regulation shall apply to each public water system in the State, except that it shall not apply to a public water system:

1. Which consists only of distribution and storage facilities which does not have

2. any collection and treatment facilities; and Which obtains all of its water from, but is not owned or operated by, a public water system to which such regulation applies; and

3. Which does not sell water to any person; and

4. Which is not a carrier which conveys passengers in interstate or intrastate commerce.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.1.5. **Variances and Exemptions.** Variances and exemptions may be issued by the Director in accordance with Sections 1415 and 1416 of the federal act. Treatment utilizing best available technology, as stipulated in Title 40 Code of Federal Regulations, Part 142, Subparts F and G, may be required in order to grant variances and exemptions under this regulation. Variances and exemptions shall not be issued if not allowed by the National Primary Drinking Water Regulations.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.1.6. **Preconstruction and Treatment Requirements**

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1. **Siting Requirements.** Before a person may initiate construction of a new community or non-transient non-community public water system or increase the capacity of an existing community or non-transient non-community public water system, he shall submit sufficient information to the Director for evaluation of the proposed site, to determine whether the site and design of the proposed construction or modification will enable the system to comply with this regulation.

2. **Plans and Specifications Approval.** Prior to advertising for bids and/or initiating construction of a new community or non-transient non-community public water system or making significant extensions or alterations to an existing community or non-transient non-community public water system which may effect the operation of that system, plans and specifications for the proposed construction shall be approved by the Director. Plans and specifications submitted to the Director for approval shall be prepared by a professional engineer licensed to practice in the State of Mississippi.

3. **Operation and Maintenance Plans.** Each applicant for a new community or non-transient non-community public water system shall submit an operation and maintenance plan for review and approval by the Director. The plan must be approved by the Director prior to beginning construction.

4. **Financial and Managerial Viability.** Each applicant for a new community or non-transient non-community public water system shall submit financial and managerial information as required by the Public Utilities Staff. Plans and specifications shall not be approved by the Director until written certification of the financial and managerial viability of the new water system is received from the Executive Director of the Public Utilities Staff.

5. **Changes to Existing Public Water Systems.** Plans and specification for changes to an existing community or non-transient non-community public water systems shall not be approved if the Director determines the changes would threaten the viability of the water system or if the changes may overload the operational capabilities of the water system.

6. **Non-Centralized Treatment Devices.** Public water systems may utilize point-of-entry devices to comply with maximum contaminant levels as stipulated in the National Primary Drinking Water regulations as published at Title 40 Code of Federal Regulations Sections 141.100 and 141.101.

7. **Ban of Use of Lead Products.** Any pipe, solder, or flux used in the installation or repair of any public water system, or any plumbing in a

residential or nonresidential facility providing water for human consumption which is connected to a public water system shall be lead free. Solders and flux are defined as "lead free" when they contain not more than 0.2 percent lead. Pipes and pipe fittings are defined as "lead free" when they contain not more than 0.25 percent lead. Plumbing fittings and fixtures intended by the manufacturer to dispense water for human ingestion are defined as “lead free” when they comply with standards established in accordance with 42 U.S.C. 300g-6(e).

8. **Lead Service Line Replacement.** It shall be the responsibility of each supplier of water to comply with the lead service line replacement requirements and lead service line reporting requirements as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.84 and 141.90.

9. **Overloaded Public Water Systems.** Public water systems that are serving customers in excess of the design capacity as determined by the Director shall be identified as overloaded and shall immediately, upon written notification by the Director, cease adding new customers. Public water systems identified as overloaded shall not add new customers until notified, in writing, by the Director that the system’s design capacity has been increased and that the water system can resume adding new customers.

SOURCE: Miss. Code Ann. §41-26-6

Subchapter 2. Maximum Contaminant Levels

Rule 1.2.1. **Microbiological.** All microbiological maximum contaminant levels shall apply to public water systems as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 41.52 and 141.63.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.2.2. **Inorganic Chemicals.** All inorganic chemical maximum contaminant levels and action levels shall apply to public water systems as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.6, 141.11, 141.23 (d & e), 141.51, 141.60, 141.62 (b, c & d) and 141.80.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.2.3. **Organic Chemicals.** All organic chemical maximum contaminant levels shall apply to public water systems as stipulated in the National Primary Drinking

Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.50, 141.60 and 141.61.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.2.4. **Turbidity.** The maximum contaminant levels for turbidity shall apply to public water systems as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.13, 141.73 and 141.173.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.2.5. **Radionuclides.** All radionuclide maximum contaminant levels and maximum contaminant level goals shall apply to public water systems as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.15, 141.16, 141.55 and 141.66.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.2.6. **Disinfectant Residuals.** Disinfection Byproducts, and Disinfection Byproduct Precursors. All disinfectant residuals, disinfection byproduct and disinfection byproduct precursor maximum contaminant levels, operational evaluation levels, best technologies, treatment techniques, and other means available for achieving compliance shall apply to public water systems as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.53, 141.54, 141.64, 141.65, 141.130, 141.620 and 141.626.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.2.7. **Miscellaneous Contaminants.** All maximum contaminant levels not previously referenced in this regulation shall apply to public water systems as stipulated in the latest revision of the National Primary Drinking Water Regulations.
SOURCE: Miss. Code Ann. §41-26-6

Subchapter 3. Monitoring, Analytical, And Treatment Technique Requirements

Rule 1.3.1. **Coliform Sampling and Analyses.** It shall be the responsibility of each supplier of water to comply with the Coliform Monitoring and Analytical Requirements as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 141.21 or any subsequent revisions thereto except that the following optional provisions of Title 40 Code of Federal Regulations Section 141.21 are not adopted:

1. The provision of Title 40 Code of Federal Regulations Section 141.21 (a)(2) concerning the reduction of the monitoring frequency for community water systems serving 1,000 or fewer persons;

2. The provision of Title 40 Code of Federal Regulations Section 141.21 (a)(5) concerning waiver of the time limit for sampling after a turbidity sampling result exceeds 1 NTU;

3. The provision of Title 40 Code of Federal Regulations Section 141.21 (b)(3) concerning collection of large volume repeat samples in containers of any size;

4. The provision of Title 40 Code of Federal Regulations Section 141.21 (d) concerning agents other than State personnel conducting sanitary surveys;

5. The provisions of Title 40 Code of Federal Regulations Section 141.21 (e)(2) with respect to waiver of fecal coliform or E.Coli testing on a total coliform positive sample; SOURCE: Miss. Code Ann. §41-26-6

Rule 1.3.2. **Inorganic Chemical Sampling and Analyses.** It shall be the responsibility of each supplier of water to comply with the inorganic chemical sampling/analysis requirements, analytical techniques, and water quality parameters as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.6, 141.23, 141.86, 141.87, 141.88 and 141.89 except that the following optional provisions of Title 40 Code of Federal Regulations are not adopted: Section 141.23 (a)(4) and Section 141.88(a)(1)(iv) which allow compositing of samples. The provisions of Title 40 Code of Federal Regulations, Section 141, Subpart I – Control of Lead and Copper are hereby incorporated by reference including any subsequent amendments and editions.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.3.3. **Organic Chemical Sampling and Analyses.** It shall be the responsibility of each supplier of water to comply with the organic chemical sampling and analysis requirements as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.6, 141.24, 141.30 and 141.40 except that the following optional provisions of Title 40 Code of Federal Regulations are not adopted: Sections 141.24 (f) (14) and (h) (10) and Section 141.40 (n)(9) which allow compositing of samples.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.3.4. **Radionuclides.** It shall be the responsibility of each supplier of water to comply with the radionuclide sampling and analysis requirements as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.25 and 141.26.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.3.5. **Turbidity and Source Water Sampling and Analyses.** It shall be the responsibility of each supplier of water to comply with the turbidity and source water sampling and analysis requirements and state notification procedures as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.22, 141.174, 141.560 – 141.564, 141.701 – 141.704, 141.707 and Appendix B to Subpart Q of Part 41.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.3.6. **Disinfectant Residuals, Disinfection Byproducts, and Disinfection Byproduct Precursors Sampling and Analyses.** It shall be the responsibility of each supplier of water to comply with the disinfection byproduct sampling, analysis and all other requirements as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.131, 141.132, 141.531, 141.600-605, 141.620-625, 141.627, and 141.628. Compliance with this section shall be determined as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.133 and 141.620.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.3.7. **Ground Water Microbial Sampling and Analyses.** It shall be the responsibility of each supplier of ground water to comply with the source microbial monitoring and analytical requirements and if requested, provide any information that will allow the state to perform a hydrogeologic sensitivity assessment as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.400 and 141.402.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.3.8. **Filtration and Disinfection.** It shall be the responsibility of each supplier of water to comply with the filtration and disinfection analytical and monitoring requirements as tipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.70, 141.73, 141.74, and 141.174.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.3.9. **Miscellaneous Contaminants.** It shall be the responsibility of the supplier of water to comply with the special monitoring requirements of the National Primary Drinking Water Regulation Title 40 Code of Federal Regulations Section 141.41 (special monitoring for sodium) and Section 141.42 (special monitoring for corrosivity characteristics). It shall also be the responsibility of the supplier of

water to comply with all other monitoring and analysis requirements not previously addressed in this regulation as stipulated in the National Primary Drinking Water Regulations.

SOURCE: Miss. Code Ann. §41-26-6

Subchapter 4. Sanitary Surveys.

Rule 1.4.1. **Surface Water Systems:** The Mississippi State Department of Health shall make periodic on-site surveys of each public surface water system for the purpose of determining the adequacy of the water source, facilities, equipment, watershed control program, operation and maintenance procedures and monitoring and compliance as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.522 and 141.723. These surveys include the right to inspect all records, take water quality samples, or verify procedures, to determine compliance with this regulation. Significant deficiencies, as determined by the Department utilizing current EPA guidance manuals, shall be identified by Department staff during the conduct of sanitary surveys. Public water systems shall, upon receipt of the sanitary survey report, provide a written response to all significant deficiencies identified in the report to the Department within 45 days of receipt of the report. In this written response, the public water system shall outline its plan to correct the significant deficiencies identified in the survey report. After reviewing the public water system's written response, the Director shall require, by means of a written order, that the public water system correct the significant deficiencies within a reasonable period of time as determined by the Department.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.4.2. **Ground Water Systems:** The Mississippi State Department of Health shall make periodic on-site surveys of each public ground water system for the purpose of determining the adequacy of the water source, treatment, distribution, storage, pumps, reporting, management and operator compliance as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 141.401. These surveys include the right to inspect all records, take water quality samples, or verify procedures, to determine compliance with this regulation. Significant deficiencies, as determined by the Department utilizing current EPA guidance, shall be identified by Department staff during the conduct of sanitary surveys. Public water systems shall, upon receipt of the sanitary survey report, provide a written response to all significant deficiencies identified in the report to the Department within 30 days of receipt of the report. In this written response, the public water system shall outline its plan to correct the significant deficiencies identified in the survey report. After reviewing the public water system's written response, the Director shall require, by means of a written order, that the public water system correct the significant

deficiencies within 120 days or within a reasonable period of time as determined by the Department.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.4.3. **Treatment Techniques.** It shall be the responsibility of each supplier of water to comply with the treatment techniques as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.76, 141.81, 141.82, 141.83, 141.110, 141.111, 141.135,141.403, and 141.404. Violations as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.403 and 141.404 are hereby incorporated.

SOURCE: Miss. Code Ann. §41-26-6

Subchapter 5. Reporting, Records, And Public Notification

Rule 1.5.1. **Reporting Requirements.**

1. The supplier of water shall provide the results of all water quality analyses to be utilized for compliance with this regulation to the Director as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.31, 141.35, 141.73, 141.75, 141.76, 141.90, 141.134, 141.173, 141.175, 141.405, 141.570, 141.601, 141.602, 141.629, 141.706, 141.710 and 141.712.

2. The supplier of water shall report to the Director the failure to comply with these regulations, including failure to comply with monitoring and analytical requirements, and failure to meet maximum contaminant levels as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.31, 141.35, 141.73, 141.75, 141.76, 141.173, 141.175 and 141.405.

3. The supplier of water shall provide proof of public notification to the Director as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.31(d), 141.90(f) and 141.405.

4. The supplier of water shall maintain records and submit to the Director copies of all required records as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.31 (e), 141.90, 141.91, 141.75, 141.76, 141.175, 141.405, 141.721 and 141.722.

5. The state shall be responsible for submitting to the Administrator all information stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 142.15.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.5.2. **Public Notification and Education.** Each supplier of water shall provide public notification or education as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.35, 141.71, 141.73, 141.74, 141.85, 141.90(f), 141.170-141.174, 141.201-141.211, 141.402(g) and (h), 141.403(d), 141.404(d), 141.500-141.553, 141.560-141.564 and Appendices A-C to Subpart Q of Part 141. Public notification of fluoride content is required of all public water suppliers as stipulated in Title 40 Code of Federal Regulations Section 143.5.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.5.3. **Record Maintenance.** Each supplier of water shall retain records and make such records available to the Director as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.33, 141.35, 141.75, 141.76, 141.134, 141.155, 141.175, 141.571, 141.601, 141.602, 141.629, and 142.62.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.5.4. **Records Kept by States.** Records of currently applicable or most recent tests, measurements, analyses, decisions, and determinations performed on each public water system, including all supporting information and an explanation of the technical basis of each decision to determine compliance with applicable provisions of the Mississippi Primary Drinking Water Regulations will be maintained in accordance with the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 142.14.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.5.5. **Laboratory Certification.**

1. The Director may prescribe minimum requirements for a laboratory to be certified by the Mississippi State Department of Health to perform water quality analyses required under this regulation.

2. Each supplier of water must utilize the services of certified laboratory or party approved by the state where applicable to complete all water quality analyses as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.28 and 141.705.

SOURCE: Miss. Code Ann. §41-26-6

Subchapter 6. Filtration and Disinfection - Surface Water Treatment Rule.

Rule 1.6.1. **General Requirements:** Each public water system that uses a surface water source or a ground water source under the direct influence of surface water must comply with the treatment technique requirements as stipulated in the National Primary Drinking Water regulations as published under Title 40 Code of Federal Regulations Section 141.70.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.6.2. **Criteria for Avoiding Filtration:** In order to avoid filtration, a public water system that uses a surface water source or a ground water source under the direct influence of surface water must comply with the criteria for avoiding filtration as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 141.71.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.6.3. **Disinfection:** A public water system that uses a surface water source or a ground water source under the direct influence of surface water must comply with the disinfection requirements as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 141.72.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.6.4. **Filtration:** A public water system that uses a surface water source or a ground water source under the direct influence of surface water and does not meet all of the criteria in Title 40 Code of Federal Regulations Section 141.71 for avoiding filtration must comply with the treatment requirements as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 141.73.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.6.5. **Recycle Provisions:** A public water system that uses a surface water source or a ground water source under the direct influence of surface water must comply with the recycle provisions as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 141.76.

SOURCE: Miss. Code Ann. §41-26-6

Subchapter 7. Enhanced Filtration and Disinfection - Surface Water Treatment Rule.

Rule 1.7.1. **General Requirements:** Each public water system that uses a surface water source or a ground water source under the direct influence of surface water must comply with the treatment technique and microbial protection requirements as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.170, 141.500-141.503, 141.510-141.511, 141.520, 141.700, 141.710 – 141.720.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.7.2. **Criteria for Avoiding Filtration:** In order to avoid filtration, a public water system that uses a surface water source or a ground water source under the direct influence of surface water must comply with the criteria for avoiding filtration as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.171 and 141.521.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.7.3. **Disinfection:** A public water system that uses a surface water source or a ground water source under the direct influence of surface water must comply with the disinfection, profiling and benchmarking requirements as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections141.172, 141.530-141.536, 141.540-141.544, 141.708 and 141.709.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.7.4. **Filtration:** A public water system that uses a surface water source or a ground water source under the direct influence of surface water and does not meet all of the criteria in Title 40 Code of Federal Regulations Section 141.171 for avoiding filtration must comply with the monitoring, reporting, records maintenance, assessment and treatment requirements as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Sections 141.173, 141.550-141.553, and 141.560-141.564. A public water system that uses a surface water source or a ground water source under the influence of surface water shall arrange for the conduct of a comprehensive performance evaluation by the Department or a third party approved by the Department within 30 days of exceeding the filter performance triggers stipulated by the National Primary Drinking Water Regulations published under Title 40 Code of Federal Regulations Section 141.175 (b)(4). Based upon the results of this comprehensive performance evaluation, the public water system shall arrange for the completion of a composite correction program developed in accordance with current EPA guidance documents. This composite correction program shall be submitted to the Department for review and approval prior to actual implementation. The Director, after reviewing and approving the composite

correction program, shall, by means of a written order, require the public water system to implement the approved composite correction program on a time schedule approved by the Department as stipulated in Title 40 Code of Federal Regulations Section 142.16(g)(1) and 142.16(j)(1).

SOURCE: Miss. Code Ann. §41-26-6

Subchapter 8. Cross Connections

Rule 1.8.1. **Cross Connections Prohibited.** No person shall install, permit to be installed or maintain any cross connection between a public water system and any other non-public water system or a line from any container of liquids or other substances, except as specifically authorized by this regulation, unless a backflow prevention assembly is installed between the public water system and the source of contamination. Direct connections between a public water supply and sewer or storm sewer are prohibited.

SOURCE: Miss. Code Ann. §41-26-14

Rule 1.8.2. **Low Hazard Cross Connection.**

1. A connection between a public water system and a service or other water system not hazardous to health but not meeting established water quality standards for public water systems and not cross connected within its system with a potentially dangerous substance shall be considered a low hazard category cross connection. An appropriate backflow prevention assembly or device recommended by the Department for low hazard cross connections shall be installed except as provided in section 104.02(2).

2. Pursuant to Section 41-26-14(2)(b) of the Mississippi Code of 1972, as amended, the following cross connections shall be considered as low hazard posing a very low risk and shall not be required to have a backflow preventer device:

    a. Any lawn sprinkler system or lawn irrigation system that is connected to a public water system and was professionally installed regardless of whether the system is underground or above ground or whether the system has pop-up sprinkler heads.

    b. Any swimming pool that is connected to a public water system and was professionally installed or any swimming pool that is connected to a public water system and has a fill line with an anti-siphon air gap.

    c. Any water fountain or cooler that provides drinking water for human consumption that is connected to a public water system and was professionally installed.

d. Any fire sprinkler system that contains only water or a dry pipe and no chemicals that is connected to a public water system and was professionally installed.

e. Any commercial establishment that is connected to a public water system that contains no cross connections directly with a dangerous or hazardous substance or material.

SOURCE: Miss. Code Ann. §41-26-14

Subchapter 9. High Hazard Cross Connection.

Rule 1.9.1. A connection between a public water system and a non-public water system or other source of contamination which has or may have any material in the water dangerous to health, or connected to any material dangerous to health, that is or may be handled under pressure, or subject to negative pressure, shall be considered a high hazard category cross connection. The cross connection shall be eliminated by air gap separation or shall be protected by the installation of an appropriate backflow prevention assembly or device recommended by the Department for high hazard cross connections.

SOURCE: Miss. Code Ann. §41-26-14

Rule 1.9.2. Any lawn sprinkler system or lawn irrigation system that is connected to a public water system and either injects or stores lawn chemicals or is connected to a wastewater supply shall be considered a high hazard cross connection and shall be protected by the installation of a backflow prevention assembly or device.

SOURCE: Miss. Code Ann. §41-26-14

Rule 1.9.3. Additional backflow prevention assemblies or devices shall not be required for carbonated beverage dispensers if 1) the water supply connection to the carbonated beverage dispenser is protected against backflow by a backflow prevention assembly or device that conforms to ASSE 1022 or by an air gap, and 2) the backflow prevention assembly or device and the piping downstream from the device are not affected by carbon dioxide gas.

SOURCE: Miss. Code Ann. §41-26-14

Rule 1.9.4. **Distinction Between Low and High Hazard Cross Connection.** The distinction between low hazard cross connection and high hazard cross connections shall be made by an authorized representative of the public water system subject to review by the Department.

SOURCE: Miss. Code Ann. §41-26-14

Subchapter 10. Responsibility Of Public Water Systems To Establish Cross Connection Control Programs

Rule 1.10.1. **Cross Connection Control Program.** All public water supplies shall adopt and enforce a cross connection control policy or ordinance that is no less stringent than the provisions of this regulation; however, the adopted policy or ordinance shall not be more stringent than the provisions of House Bill 692 enacted by the 2001 Mississippi Legislature, as codified in Section 41-26-14 et. seq. of the Mississippi Code of 1972, Annotated. This policy or ordinance shall establish a cross connection control program consisting of the following:

1. Locating and eliminating unprotected cross connections.

2. Preventing the occurrence of new cross connections with the public water system.

3. Maintaining records pertaining to the location of existing backflow prevention assemblies, type and size of each assembly and results of all tests of backflow prevention assemblies by a tester certified by the Department.

SOURCE: Miss. Code Ann. §41-26-14

Rule 1.10.2. **Cross Connection Surveys.** It shall be the responsibility of each public water system to conduct surveys and on-site visits as necessary to locate existing cross connections. Single family dwellings and multi-family dwellings shall not be included in this survey unless the officials of the public water system have reason to believe that a cross connection exists. This survey shall be performed by an authorized representative of the public water system utilizing established written guidelines as published by the Department.

SOURCE: Miss. Code Ann. §41-26-14

Rule 1.10.3. Each public water system shall complete an initial cross connection survey by December 31, 2000.

SOURCE: Miss. Code Ann. §41-26-14

Rule 1.10.4. Upon completion of the required cross connection survey, the responsible official of each public water system shall certify to the Department, on forms provided by the Department, that the required survey has been properly completed in accordance with the written guidelines published by the Department.

SOURCE: Miss. Code Ann. §41-26-14

Subchapter 11. Installation of Backflow Preventers

Rule 1.11.1. Across connection is identified, the public water system shall require that the property owner eliminate the cross connection or install the proper type backflow prevention assembly.

SOURCE: Miss. Code Ann. §41-26-14

Rule 1.11.2. When a cross connection is identified, the public water system shall notify the property owner, in writing and within ten (10) days, of the existence of the cross connection and that the cross connection must be eliminated or protected.

SOURCE: Miss. Code Ann. §41-26-14

Rule 1.11.3. If the public water system determines that the cross connection is a high hazard category cross connection, it shall be eliminated or protected by the appropriate backflow preventer by June 30, 2001. If a public water system identifies an existing high hazard cross connection after June 30, 2001, the high hazard cross connection shall be eliminated or protected by the property owner within ninety (90) days of written notification by the public water system. If the property owner has an existing backflow preventer, the public water system shall allow the backflow preventer to remain in place until it fails to function properly.

SOURCE: Miss. Code Ann. §41-26-14

Rule 1.11.4. If the public water system determines that the cross connection is a low hazard cross connection, it shall be eliminated or protected by the property owner by installing an appropriate backflow preventer by June 30, 2004. If an existing low hazard cross connection is identified by a public water system after June 30, 2004, the cross connection shall be eliminated or protected by the property owner by installing an approved backflow preventer within one (1) year of written notification by the public water system. If the property owner has an existing backflow preventer, the public water system shall consider the backflow preventer approved and shall allow the installed backflow preventer to remain in place until the backflow preventer fails to function properly.

SOURCE: Miss. Code Ann. §41-26-14

Rule 1.11.5. **Public Water System Enforcement Actions.** In the event a customer refuses to comply with the cross connection control provisions of this regulation, the public water system is authorized to discontinue water service to the customer until such time as the customer complies with this regulation.

SOURCE: Miss. Code Ann. §41-26-14

Subchapter 12. Recommended Backflow Preventers

Rule 1.12.1. **List of Recommended Backflow Preventers.** The Department shall prepare and publish a list of backflow prevention assemblies recommended for use in the State of Mississippi. The Department shall routinely update this list as necessary.

SOURCE: Miss. Code Ann. §41-26-14

Rule 1.12.2. **Recommended Devices for High Hazard Cross Connections**

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1. Reduced Pressure Principle Backflow Prevention Assemblies. Backflow prevention assemblies recommended to protect high hazard cross connections shall include reduced pressure principle backflow prevention assemblies.

2. Pressure Vacuum Breaker Assemblies. Backflow prevention assemblies recommended to protect high hazard cross connections shall include pressure vacuum breaker assemblies. Pressure vacuum breaker assemblies shall not be used in locations where the vacuum breaker may be subject to back pressure and shall not be used in locations where the vacuum breaker is not higher than all downstream connections.

3. Atmospheric Vacuum Breakers. Backflow prevention devices recommended to protect high hazard cross connections shall include atmospheric vacuum breakers. Atmospheric vacuum breakers shall not be installed in locations that may be subject to back pressure, shall not be installed in locations where the vacuum breaker is not higher than all downstream locations, shall not be installed in locations with valves downstream and shall not be installed in locations of continuous use.

SOURCE: Miss. Code Ann. §41-26-14

Rule 1.12.3. **Low Hazard Cross Connections.** Backflow prevention assemblies recommended to protect low hazard cross connections shall include reduced pressure principle assemblies, pressure vacuum breaker assemblies, atmospheric vacuum breaker assemblies, and double check valve assemblies. Pressure vacuum breaker assemblies shall not be used in locations where the vacuum breaker may be subject to back pressure and shall not be used in locations where the vacuum breaker is not higher than all downstream connections. Atmospheric vacuum breakers shall not be installed in locations that may be subject to back pressure, shall not be installed in locations where the vacuum breaker is not higher than all downstream locations, shall not be installed in locations with valves downstream and shall not be installed in locations of continuous use.

SOURCE: Miss. Code Ann. §41-26-14

Subchapter 13. Installation Requirements.

Rule 1.13.1. Reduced pressure principle backflow prevention assemblies, double check valve assemblies, and pressure vacuum breaker assemblies shall be installed in a location that provides adequate access for testing and repair of the assembly.

SOURCE: Miss. Code Ann. §41-26-14

Rule 1.13.2. Reduced pressure principle backflow prevention assemblies and double check valve assemblies shall not be subject to possible flooding. Reduced pressure principle backflow prevention assemblies and double check valve assemblies shall not be located in a pit below ground level.

SOURCE: Miss. Code Ann. §41-26-14

Subchapter 14. Testing Of Backflow Prevention Assemblies

Rule 1.14.1. **Testing By Certified Tester.** When a reduced pressure principle backflow prevention assembly, double check valve assembly, or pressure vacuum breaker assembly is installed to protect a public water system against the possibility of a backflow from a customer's water service, inspection and testing of the assembly, where required by this regulation, shall be performed by an individual who has been licensed as a Certified Tester by the Department.

SOURCE: Miss. Code Ann. §41-26-14

Rule 1.14.2. Each backflow prevention assembly shall be inspected and tested by a Certified Tester after installation and before use by the customer. Reduced pressure principle backflow prevention assemblies and pressure vacuum breakers shall be inspected and tested at least once a year by a Certified Tester.

SOURCE: Miss. Code Ann. §41-26-14

Rule 1.14.3. The Certified Tester shall provide the property owner and the public water system with a written report of the inspection and test results on each assembly tested. This written report shall be on a form provided by the Department. The report shall be prepared and submitted by the Certified Tester making the inspection and test. The Certified Tester and the public water system shall retain all backflow prevention assembly test and inspection results for at least five (5) years from the date of test and inspection.

SOURCE: Miss. Code Ann. §41-26-14

Rule 1.14.4. Reduced pressure principle backflow prevention assemblies and pressure vacuum breaker assemblies that fail to function properly or fail the routine required test shall be repaired or replaced within thirty (30) days of identification of the failure.

Double check valves that fail to function properly shall be repaired or replaced within ninety (90) days of identification of the failure.

SOURCE: Miss. Code Ann. §41-26-14

Rule 1.14.5. **Licensing of Certified Testers.** Each Certified Tester shall be licensed by the Department. All tester training shall be submitted to the Department for approval at least 45 days prior to the scheduled date of training. The Department shall review the instructors and course curriculum for all proposed tester training. The Department shall approve proposed tester training if it determines that the proposed training program and instructor(s) meets the Department's minimum guidelines. The Department shall develop and administer the backflow tester certification test at the conclusion of each approved tester training program. A minimum score of 70% on the Department's written examination and successful performance of prescribed tests on a reduced pressure principle backflow prevention assembly, double check valve assembly, and pressure vacuum breaker assembly will be required for certification. Any applicant not successfully completing both the written and performance tests must attend a Department approved tester training program before taking the certification tests again. Under special circumstances and upon receipt of a written request by the applicant, the Department may allow an applicant to take the written and performance tests without attending a Department approved tester training program.

SOURCE: Miss. Code Ann. §41-26-14

Rule 1.14.6. The Department may issue, solely at its discretion and without testing, certification to a Tester possessing certification from a nationally recognized backflow prevention assembly tester certification program.

SOURCE: Miss. Code Ann. §41-26-14

Rule 1.14.7. Each Tester's certification will expire three (3) years from the date issued. To become re-certified, the Tester must successfully complete a recertification examination developed by the Department and administered by the Department or an authorized representative of the Department.

SOURCE: Miss. Code Ann. §41-26-14

Rule 1.14.8. The Certified Tester shall maintain the accuracy of the testing equipment to be used to test backflow prevention devices. The testing equipment shall be checked for proper calibration and shall be recalibrated, as needed, in accordance with the recommendations of the manufacturer. Only properly trained individuals shall perform calibration adjustments or repair or testing equipment. Calibration standards utilized in the testing or repair of this testing equipment shall have their accuracy checked and adjusted to within allowable tolerances against standard

instruments traceable to the National Institute for Standards and Technology (NIST).

SOURCE: Miss. Code Ann. §41-26-14

Subchapter 15. Suspension or Revocation of Tester's Certificate.

Rule 1.15.1. A Tester's Certificate may be revoked or suspended by the Department for just cause. Causes include, but are not limited to, the following:

1. Fraud, deception, or misrepresentation of a material fact to either the public or the Department;

2. Misfeasance, malfeasance or nonfeasance;

3. Failure to file any official reports required by the Department;

4. Failure to maintain all official records required by the Department;

5. Failure to respond to any official correspondence from the Department;

6. Failure to obey a lawful order of the Director or any duly appointed Administrative Hearing Officer of the Department;

7. Failure to exercise reasonable care or judgment in the testing of backflow prevention devices;
8. Failure to comply with the terms of a suspension of a certificate issued by the Department;

SOURCE: Miss. Code Ann. §41-26-14

Rule 1.15.2. No Tester's Certificate will be suspended or revoked without notice to the Certificate holder and an opportunity for a hearing. Hearings shall be held in conformity with Sections 41-26-17 and 41-26-21 Mississippi Code of 1972 Annotated.

SOURCE: Miss. Code Ann. §41-26-14

Rule 1.15.3. Notwithstanding the requirement for a hearing, the Director may, if he determines that public health is threatened, issue any such orders as are deemed necessary to protect the public health, including, but not limited to, orders to individual(s) to cease all actions as a Certified Tester of backflow prevention devices in the State of Mississippi.

SOURCE: Miss. Code Ann. §41-26-14

Subchapter 16. Cross Connection Control Waivers

Rule 1.16.1. **Waivers.** The Director may issue a waiver to a public water systemto any part or parts of the cross connection control provisions of this regulation if the Department deems such waiver to be appropriate and will not potentially jeopardize public health.

SOURCE: Miss. Code Ann. §41-26-14

Subchapter 17. Application And Fees For Certified Tester

Rule 1.17.1. **Filing Application.**

1. A tester desiring certification shall file an application with the Department on forms provided by the Department.

2. The Department shall review the application and supporting documents, determine the eligibility of the applicant, and issue a certificate when the minimum requirements are met.

SOURCE: Miss. Code Ann. §41-26-14

Rule 1.17.2. **Backflow Prevention Assembly Tester Certification Fees.**

1. An initial fee of fifty dollars ($50.00) shall be charged for certification as a Backflow Prevention Assembly Tester. The Department shall invoice each applicant for the $50 fee and the certificate will not be issued until the fee is received by the Department.

2. A fee of thirty dollars ($30.00) shall be charged for the renewal of a certificate. The Department shall invoice each applicant for the $30 fee and the renewal certificate will not be issued until the fee is received by the Department.

SOURCE: Miss. Code Ann. §41-26-14

Subchapter 18. Consumer Confidence Reports

Rule 1.18.1. **Purpose and Applicability.** Each community public water system shall prepare and deliver to their customers an annual consumer confidence report as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 141.151.

1. Effective Dates. The effective dates for community public water supplies to prepare and deliver annual consumer confidence reports shall be as stipulated in

the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 141.152.

2. Content of the Reports. The content of the Consumer Confidence Reports prepared by community public water supplies shall be as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 141.153.

3. Required Additional Health Information. It shall be the responsibility of each community public water supply preparing a consumer confidence report to include the required additional health information as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 141.154.

4. Report Delivery. Delivery of Consumer Confidence Reports prepared by community public water supplies shall be as stipulated in the National Primary Drinking Water Regulations as published under Title 40 Code of Federal Regulations Section 141.155.

SOURCE: Miss. Code Ann. §41-26-6

Subchapter 19. Emergency Conditions And Enforcement

Rule 1.19.1. **Emergency Conditions.** The Director is authorized to develop and implement a plan for the provision of safe drinking water in emergency circumstances for any public water system.

SOURCE: Miss. Code Ann. §41-26-6

Rule 1.19.2. **Enforcement.** Violations of any requirement of this regulation shall be subject to the enforcement provisions of the Mississippi Safe Drinking Water Act of 1997 as found at Sections 41-26-1 through 41-26-101, Mississippi Code of 1972, Annotated.

SOURCE: Miss. Code Ann. §41-26-6

Chapter 2. REGULATION GOVERNING THE CERTIFICATION OF MUNICIPAL AND DOMESTIC WATER SYSTEM OPERATORS

Subchapter 1. General Provisions

Rule 2.1.1. **Legal Authority.** This regulation has been promulgated under the authority of and pursuant to the Municipal and Domestic Water and Wastewater System Operator's Certification Act of 1986, Sections 21-27-201 through 21-27-221, Mississippi Code of 1972. Annotated.

SOURCE: Miss. Code Ann. §§21-27-207 and 41-26-6

Rule 2.1.2. **Definitions**

1. **Association** shall mean the Mississippi Water and Pollution Control Operators Association, Inc.

2. **Available** shall mean a certified operator employed by the water system holding an operator's certificate equivalent or higher than the class of the public water system, whose principle residence is no more than fifty (50) miles from the water system. The water system must be able to contact this certified operator at all times by telephone, pager or other reliable mode of communication acceptable to the Mississippi Department of Health to address system needs and problems as they occur.

3. **Board** shall mean the Mississippi State Board of Health.

4. **Bureau** shall mean the Bureau of Public Water Supply of the Mississippi Department of Health.

5. **Community Water System** shall mean any water system serving piped water for human consumption to fifteen (15) or more individual service connections used year-round by consumers or regularly serving twenty-five (25) or more individual consumers year-round, including, but not limited to, any collection, pretreatment, treatment, storage and/or distribution facilities or equipment used primarily as part of, or in connection with such system, regardless of whether or not such components are under the ownership or control of the operator of such system.

6. **Department** shall mean the Mississippi Department of Health.

7. **Director** shall mean the director of the Bureau of Public Water Supply at the Mississippi Department of Health or his/her designated representative.

8. **Distribution System** shall mean all water mains, repumping facilities, and appurtenances past treatment.

9. **Non-transient non-community water system** shall mean a public water system that is not a community water system and that regularly serves at least 25 of the same persons.

10. **Operator** shall mean the certified waterworks operator who directly supervises and is personally responsible for the daily operation and maintenance of a community or non-transient non-community public water system.

11. **Part-time operator** shall mean any certified waterworks operator who is employed as the certified waterworks operator for a public water system and is not considered a full-time employee of the public water system. This definition shall include certified waterworks operators who are serving as the certified waterworks operator for public water systems through privately owned operating companies.

12. **Person** shall mean the state or other agency or institution thereof, any municipality, political subdivision, public or private corporation, individual, partnership, association or other entity, and includes any officer or governing or managing body of any municipality, political subdivision, or public or private corporation, or the United States or any officer or employee thereof.

13. **Responsible Charge** shall mean a certified operator, holding a Department waterworks operator's license at a class equivalent to or higher than the class of the water system, who is officially designated by the owner or responsible official of the water system as the operator responsible for making all decisions regarding the daily operational activities of the public water system including all components of the water system such as treatment plants, water wells, distribution systems, etc. Under special circumstances, the Department may authorize a water system to have more than one operator in responsible charge.

SOURCE: Miss. Code Ann. §21-27-203

Rule 2.1.3. **Certificates.** Effective July 1, 1987, all municipal and domestic community water systems must be operated by persons who are certified by the Mississippi Department of Health as qualified to operate such facilities. Effective July 1, 1998, all non-transient non-community public water systems must be operated by persons who are certified by the Department to operate such facilities.

1. Certificates of competency will be issued by the Bureau only after the applicant has passed the appropriate examination and has met the minimum requirements as specified in Rule 2.2.7.

2. Certificates issued in accordance with section 21-27-213 (Grandfather Clause) of the Municipal and Domestic Water and Wastewater System Operator's Certification Act of 1986, shall be valid only for the particular public water system operated by the applicant at the time the certificate was issued, and then only so long as the system remains in the same or lower classification as at the time the application was filed.

3. Certificates shall be valid for three (3) years from the date of issuance, unless suspended or revoked for cause.

4. In the event of temporary loss of an operator, notice shall be immediately given to the Bureau and the continued operation of such system, without a certified operator, may proceed on an interim basis for a period not to exceed one hundred eighty (180) days, except for good cause shown upon petition to the Bureau.

5. Certificates may be issued, without examination, in a comparable classification to an operator who holds a certificate in any state, territory, or possession of the United States or any country that has entered into a reciprocity agreement with the Bureau.

6. Any person allowed to actually make physical changes on a public water system that impact water quality or quantity must hold a waterworks operator's license issued by the Bureau at a class equivalent to or higher than the class of the public water system.

SOURCE: Miss. Code Ann. §§21-27-205 and 21-27-211

Subchapter 2. Classification of Public Water Systems & Operator in Responsible Charge

Rule 2.2.1. **Classes of Water Systems.** Water systems shall be classified in accordance with criteria outlined below. Special systems which do not fall within these guidelines shall be considered as individual cases and be classified by the Bureau. All public water systems shall be under the direct supervision of a Department licensed waterworks operator who is designated by the owner or responsible official of the system as the operator in responsible charge of the water system. In those situations where a public water system contracts with a private operating company to operate the public water system, the responsible official of the public water system may authorize the private company to designate an operator employed by the company as the operator in responsible charge of the water system. In either case, the water system shall identify, by means of the Public Water System Annual Report submitted each year to the Department, the certified operator in responsible charge of the public water system.

1. **Class E.** Water systems that purchase water only and do not provide additional treatment. This classification shall also apply to waterworks operators whose only job responsibility is the operation and maintenance of distribution system(s). The certified operator in responsible charge shall be available 24 hours a day to address system needs and problems as they occur.

2. **Class D.** Water systems with no treatment other than chlorination and/or fluoridation or direct chemical feed such as polyphosphate. The certified operator in responsible charge shall be available 24 hours per day to address system needs and problems as they occur.

3. **Class C.** Water systems with aeration, pH adjustment, corrosion control or closed pressure filtration treatment facilities including zeolite softening or iron removal. The certified operator in responsible charge shall be available 24 hours per day to address system needs and problems as they occur.

4. **Class B.** Water systems with two (2) or more Class C treatment facilities of different types, or with iron or manganese removal facilities breaking pressure or requiring flocculation and/or sedimentation. The certified operator in responsible charge shall be available 24 hours per day to address system needs and problems as they occur.

5. **Class A.** Systems with surface water treatment, lime softening, or coagulation and filtration for the removal of constituents other than iron or manganese. A licensed class A operator shall be onsite whenever the treatment plant for a Class A public water system treating surface water is in operation. The certified operator in responsible charge shall be available 24hours per day to address system needs and problems as they occur.

SOURCE: Miss. Code Ann. §21-27-205

Subchapter 3. Operator Qualifications. Qualification for Each Class Operator:

Rule 2.3.1. **Class A.** The applicant must have at least a bachelor's degree in engineering or applied sciences from an accredited college or university, at least one years of experience in a Class A water plant, and pass the written examination required by the Bureau, or the applicant must be a graduate of an accredited high school or possess an equivalent (GED), have at least six (6) years experience in a Class A or B water plant, of which at least one year must be in a Class A plant, and pass the written examination required by the Bureau.

SOURCE: Miss. Code Ann. §21-27-205

Rule 2.3.2. **Class B.** The applicant must have graduated from an accredited high school or possess an equivalent (GED), have at least three (3) years of experience in a Class A, B, or C water plant, of which one year must be in a Class A or B plant, and pass the written examination required by the Bureau.

SOURCE: Miss.Code Ann. §21-27-205

Rule 2.3.3. **Class C.** The applicant must have graduated from an accredited high school or possess an equivalent (GED), have at least two (2) years of experience in a Class A, B, C, or D water plant of which one year must be in a Class A, B, or C water plant, and pass the written examination required by the Bureau

SOURCE: Miss. Code Ann. §21-27-205

Rule 2.3.4. **Class D.** The applicant must have graduated from an accredited high school or possess an equivalent (GED), and the applicant must have at least one year of experience in the same class facility as being applied for or a higher level. In addition, the applicant must pass the written examination required by the Bureau.

SOURCE: Miss. Code Ann. §21-27-205

Rule 2.3.5. **Class E.** The applicant must have graduated from an accredited high school, or possess an equivalent (GED) and the applicant must have at least one year of experience in the same class facility as being applied for or a higher level. In addition, the applicant must pass the written examination required by the Bureau.

SOURCE: Miss. Code Ann. §21-27-205

Subchapter 4. General Qualifications for all Certified Waterworks Operators

Rule 2.4.1. One year of the required experience must be earned under the direct supervision of a certified waterworks operator who holds a valid non-restricted certificate issued by the Department at a class equivalent to or higher than that for which certification is being requested. The year of supervision must be obtained in a public water system of a class equivalent to or higher than the class certificate being requested. The supervising operator must sign a certification statement verifying the successful completion of the required period of supervision. In addition, two Department certified waterworks operators, other than the operator who provided this supervision, must sign a certification statement recommending the applicant for certification. Under special circumstances, the Department may waive the requirements of this section based upon written evidence of good cause.

SOURCE: Miss. Code Ann. §21-27-205

Rule 2.4.2. To be eligible to serve as the certified operator for a community or non-transient non-community public water system, an operator's principal residence must be no more than fifty (50) miles from the system. Under special circumstances, an operator may apply to the Bureau in writing for a waiver of the 50 mile requirement.

SOURCE: Miss. Code Ann. §21-27-205

Rule 2.4.3. An individual whose operator's license has been expired for 24 months or less shall be eligible to receive a new waterworks operator's license at a level no higher than the license previously issued by the Bureau if he/she successfully passes the written examination required by the Bureau. To be eligible to retake the examination, the operator must comply with the provisions of Rule 4.1.5 of this regulation. The provisions of Rule 2.3.1 of this regulation shall be waived for applications received under this section. Operators whose license has been

expired more than 24 months must successfully pass the written examination required by the Bureau and comply fully with the provisions of section 2.3.1.

SOURCE: Miss. Code Ann. §21-27-205

Rule 2.4.4. Operators who have received special vocational training, such as special schools, short courses, correspondence courses, etc., may be given credit for some portion of the deficiency in their experience. Special vocational training programs shall be approved in writing and in advance of the training. Approval shall be at the discretion of the Bureau. After a specific program of special vocational training has been approved, the Bureau shall award credit for experience using the following criteria:

1. Eight (8) weeks of classroom instruction will be equivalent to one year experience.

2. One week of on-the-job training will be equivalent to one week experience.

3. Special vocational training programs that have combinations of classroom instruction and on-the-job training will be evaluated by first separating classroom instruction from on-the-job training. Credit will be for experience on the basis of the two previous criteria. The total credit awarded for the program will be the sum of the two parts.

4. Each year of college successfully completed in engineering, biological sciences, mathematics, chemistry, or physics will be considered the equivalent of two (2) years experience.

5. At least one year of water system experience is required in all classes. This one year of experience cannot be substituted by special vocational training programs or college education.

SOURCE: Miss. Code Ann. §21-27-205

Subchapter 5. Application and Fees

Rule 2.5.1. **Filing Application**

1. Applicants for licensure as a certified waterworks operator shall file an application with the Bureau on a form provided by the Bureau.

2. The Bureau will review the application and supporting documents, determine the eligibility of the applicant, and issue a certificate when the applicant meets the minimum requirements of the class requested.

SOURCE: Miss. Code Ann. §21-27-205

Rule 2.5.2. **Fees**

1. A fee of fifty dollars ($50.00) shall be charged for initial certification or reactivation of an expired certificate in any classification and must be paid to the Bureau prior to actual issuance of the certificate.

2. A fee of thirty dollars ($30.00) shall be charged for the renewal of an active certificate and must be paid to the Bureau prior to actual issuance of the renewal certificate.

3. All application fees must be received within fifteen (15) days of being invoiced by the Department. Application fees received after fifteen (15) days will be returned to the applicant and the applicant must reapply to the Department for certification or renewal.

SOURCE: Miss. Code Ann. §21-27-207

Subchapter 6. Examinations

Rule 2.6.1. **Written Examinations**

1. The Bureau shall prepare written examinations to be used in determining knowledge, ability, and judgment of operators.

2. Examinations shall be held at places and times set by the Bureau.

3. An individual who passes an examination must be certified within three (3) years following the date the examination was taken. Otherwise, the individual will be required to pass another written examination in order to be certified.

4. Examination papers will not be returned to the individuals.

5. To be eligible to take a written examination, an individual must satisfactorily demonstrate to the Bureau that he/she has attended a Bureau sponsored waterworks operators' short course within the previous 12 months.

SOURCE: Miss. Code Ann. §21-27-215

Rule 2.6.2. **Renewal of Waterworks Operator Certificates**

1. Certificates may be renewed without examination. An application for renewal of a waterworks operator's certificate of competency must be physically received by the Bureau within thirty (30) days following the date the certificate expires. This application must be accompanied by proof of completion of the continuing education requirements found in Rule 2.8.2. Upon approval of the renewal

application, the applicant will be invoiced for the renewal fee of $30.00. The Bureau must receive this renewal fee prior to issuing the new waterworks operator's certificate of competency. Certified operators who file renewal applications more than thirty (30) days after expiration of their certificate will be denied renewal of their certificate and must pass the appropriate written examination and apply for a new certificate.

2. Operators who have been continuously licensed by the Bureau less than nine (9) years must complete at least forty-eight (48) hours of related continuing education (CEUs) per three (3) year certificate renewal period with at least 12 hours of these CEUs in Bureau approved "Regulation and Compliance" training programs. Operators who have been continuously licensed by the Bureau for nine (9) years or more are required to obtain 24 hours of CEUs in the three year certificate renewal period with at least twelve (12) hours of these CEUs in Bureau approved "Regulation and Compliance" training programs. All continuing education requirements must be met prior to the expiration date of the certificate. These CEUs must be appropriate for the classification held by the operator and may only be obtained by attending training sessions approved by the Bureau. All training, correspondence courses, etc., shall be approved in writing and in advance of the training. Approval shall be strictly at the discretion ofthe Bureau. Training will be evaluated by the Bureau on an hour for hour basis for continuing education credit.

SOURCE: Miss. Code Ann. §21-27-207

Rule 2.6.3. Mississippi Department of Environmental Quality approved wastewater training programs will be awarded CEU credit by the Bureau at the rate of (1) water CEU hour for every 2 wastewater CEU hours earned.

SOURCE: Miss. Code Ann. §21-27-207

Rule 2.6.4. Each certified operator is responsible for maintaining all necessary records to document the completion of the required hours of continuing education. Original documentation of the completion of the required continuing education must be submitted with the application for renewal of the operator's certificate of competency. Copies of CEU certificates are not acceptable. Any waterworks operator who is issued a restricted (grandfather) license by the Department after May 2000, in order to qualify for renewal of this license, shall attend a Department sponsored short course during the 3 year restricted (grandfather) license period. This short course must be at the level of classification of the water system or higher.

SOURCE: Miss. Code Ann. §21-27-207

Subchapter 7. Certified Waterworks Operator Job Performance, Record Keeping and Reporting Requirements

Rule 2.7.1. **Annual Reporting Requirements**

1. Each certified waterworks operator and responsible official shall sign the certification statement on the Public Water System Annual Report for each public water system for which he/she is the designated certified waterworks operator in responsible charge of the public water system as required by Mississippi State Law. If a public water system fails to provide a completed Public Water System Annual Report to the Bureau within 45 days of this Report being mailed to the water system by the Bureau, the Department shall officially declare the public water system to be without a certified waterworks operator and the water system shall be in violation of this regulation and Mississippi State law.

2. Each certified waterworks operator, or his/her representative(s), shall maintain an approved Public Water System Operations Log Book documenting all activities completed on the public water system where he serves as the official certified waterworks operator. This log book must be available for inspection by Bureau staff. The Public Water System Operations Log Book is the property of the public water system and must remain as part of the official records of the Public Water System.

SOURCE: Miss. Code Ann. §21-27-207

Rule 2.7.2. **Job Performance:** Each certified waterworks operator shall abide by the current edition of the Minimum Job Performance Guidelines booklet published by the Bureau of Public Water Supply. This booklet presents the minimum duties and responsibilities for Department certified waterworks operators in the State of Mississippi.

SOURCE: Miss. Code Ann. §21-27-207

Rule 2.7.3. **Presence of Certified Waterworks Operator during Sanitary Surveys and Inspections:** The certified waterworks operator for a public water system shall be present for the conduct of sanitary surveys and inspections by Bureau staff when requested by Bureau staff and when provided at least 24 hours notice of the survey or inspection. Under special circumstances, this requirement may be waived provided the certified operator arranges for someone to represent him/her during the survey or inspection.

SOURCE: Miss. Code Ann. §21-27-207

Rule 2.7.4. **Waterworks Operator Licensure Waiver:** The Director may waive any part or parts of this regulation if the Director determines that such waiver will not potentially jeopardize public health.

SOURCE: Miss. Code Ann. §21-27-207

Subchapter 8. **Suspension and Revocation of Certificates.** Criteria for Suspension or Revocation of a Waterworks Operator's Certificate

Rule 2.8.1. A waterworks operator's certificate of competency may be revoked or suspended by the Department for just cause. Causes include, but are not limited to, the following:

1. Fraud or deception;

2. Misfeasance, malfeasance or nonfeasance;

3. Violation of any provision of the "Mississippi Municipal and Domestic Water and Wastewater System Operators' Certification Law of 1986," or any rule or regulation of the Department promulgated there under;

4. Violation of any provision of the Federal Safe Drinking Water Act or the Mississippi Safe Drinking Water Act; or any rule or regulation, federal or state, promulgated under these laws;

5. Failure to file any official reports required by the Department;

6. Failure to maintain all official records required by the Department;

7. Failure to respond to any official correspondence from the Department;

8. Failure to obey a lawful order of the Director or any duly appointed Administrative Hearing Officer of the Department;

9. Failure to exercise reasonable care or judgment in the operation of a public water supply or in the performance of official duties;

10. Failure to comply with the terms of a suspension of certificate issued by the Department.

SOURCE: Miss. Code Ann. §21-27-219

Rule 2.8.2. No certificate of competency will be suspended or revoked without notice to the waterworks operator and an opportunity for a hearing. Hearings shall be held in conformity with Sections 21-27-219 and 21-27-221 Mississippi Code of 1972 Annotated.

SOURCE: Miss. Code Ann. §§21-27-219 and 21-27-221

Rule 2.8.3. Notwithstanding the requirement for a hearing, the Department may, if it determines that public health is threatened, issue any such orders as are deemed necessary to protect the public health, including, but not limited to, orders to individual(s) to cease all actions as a certified waterworks operator in the State of Mississippi.

SOURCE: Miss. Code Ann. §§21-27-217 and 21-27-219

Subchapter 9. Enforcement and Appeals Procedures

Rule 2.9.1. **Procedures:** Enforcement and appeals shall be in accordance with the Municipal and Domestic Water and Wastewater System Operator's Certification Act of 1986.

SOURCE: Miss. Code Ann. §§21-27-217 through 21-27-221

Chapter 3 REGULATION GOVERNING FLUORIDATION OF COMMUNITY WATER SUPPLIES

Subchapter 1 GENERAL PROVISIONS

Rule 3.1.1 **Coverage**

1. This regulation shall only apply to community water systems (CWS) serving a population of at least two thousand (2,000).

2. Each CWS shall be required to acquire and install fluoridation treatment equipment capable of maintaining fluoride levels within the optimal range as defined in this regulation, and shall comply with all requirements of this regulation for the purpose of protecting the dental health of the citizens of this State. No System shall be required to comply unless sufficient funds are identified by the Department, whether by appropriation, capital outlay, grants or similar means or source of funds, as available to that system for the cost of acquiring and installing fluoridation equipment, and the cost of material required to fluoridate said system for at least one year from the date of initial installation

.

SOURCE: Miss. Code Ann. § 41-26-6

Rule 3.1.2 **Definitions.**

1. **Adjusted fluoridated water system** shall mean a public water system that adjusts the fluoride concentration in the drinking water to the optimal level for consumption (within the recommended control range).

2. **Community Water System (CWS)** shall mean any water system serving piped water for human consumption to fifteen (15) or more individual service

connections used year-round by consumers or regularly serving twenty-five (25) or more individual consumers year-round, including, but not limited to, any collection, pretreatment, treatment, storage and/or distribution facilities or equipment used primarily as part of, or in connection with such system, regardless of whether or not such components are under the ownership or control of the operator of such system.

3. **Department** shall mean the Mississippi State Department of Health.

4. **Entry point** shall mean a location following one or more finished (fluoridated) water sampling points but prior to the beginning of the distribution system of the public water system.

5. **Natural fluoride** content shall mean the concentration of fluoride in milligrams per liter (mg/L) that is present in the water source from naturally occurring fluoride sources.

6. **Optimal fluoride level** in Mississippi shall mean the amount of fluoride in water that is found naturally or adjusted within a recommended control range of 0.7-1.3 parts per million fluoride (ppm) with the optimal fluoride level being 0.8 ppm.

7. **Parts per million** shall mean a unit of measurement that is equivalent to 1 milligram per liter (mg/L) where the density of the liquid measured is 1.0 gram per cubic centimeter (the density of water is 1.0).

8. **Public water system (CWS)** means a system for the provision to the public of water for human consumption through pipes or, after August 5, 1998, other constructed conveyances, if such system has at least fifteen service connections or regularly serves an average of at least twenty-five individuals daily at least 60 days out of the year.

9. **Raw water** is defined as water that has not been treated or had fluoride injected into it by the CWS and that contains only naturally occurring levels of fluoride.

SOURCE: Miss. Code Ann. § 41-26-6

Subchapter 2 ADJUSTED FLUORIDATED WATER SYSTEM REQUIREMENTS

Rule 3.2.1 **Testing.**: A minimum of three (3) water samples shall be taken by designated CWS personnel on different days each week at all entry points and analyzed for fluoride content. At least once each month at each entry point, designated CWS personnel shall divide (split) one sample (hereinafter referred to as the split sample) and have one portion analyzed for fluoride by designated CWS personnel and the other portion analyzed by the Department's laboratory or a private lab certified by the Department for fluoride testing.

SOURCE: Miss. Code Ann. § 41-26-6

Rule 3.2.2 **Verification.**: Designated CWS personnel shall use water sample fluoride content results to compare with a calculated fluoride dosage to verify fluoridation program operation. The calculated dosage is defined as the calculated amount of fluoride that has been added to a water system. The calculation is based on the total amount of fluoride (weight) that was added to the water system and the total amount of water (volume) that was produced plus the naturally occurring fluoride at the source.

SOURCE: Miss. Code Ann. § 41-26-6

Subchapter 3 Optimal Fluoridation Requirements

Rule 3.3.1 **Monitoring**

1. The monthly average fluoride content of all water samples requested in section 101.01 shall have fluoride content within the optimal fluoride control range defined in section 100.02.

2. The designated CWS personnel shall collect no less than 13 water samples per month from each entry point for analysis for fluoride and at least 90% of collected samples shall have fluoride content within the optimal fluoride control range defined in section 100.02.

3. The split sample result determined through analysis by designated CWS personnel shall agree with the result analyzed by the Department within a range of +/- 0.2 ppm in at least nine of 12 months during the calendar year.

4. Designated CWS personnel shall submit a report of the results of required water sample testing each month to the Department and shall include the type of fluoride chemical used.

SOURCE: Miss. Code Ann. § 41-26-6

Rule 3.3.2 **Quality Assurance**

1. MSDH Bureau of Water Supply will assess each system's compliance with this policy on a monthly basis and send letters to the Responsible Official and Operator if the system is not compliant.

2. MSDH will prepare a compliance progress report on a monthly basis that will be made available to interested parties.

3. Each CWS that complies with the optimal fluoridation requirements during the calendar year to the satisfaction of the Department shall be recognized by the Department pursuant to its health promotion policies and guidelines.

SOURCE: Miss. Code Ann. § 41-26-6

Subchapter 4 Compliance

Rule 3.4.1 **Compliance**

1. CWS that fluoridate shall list in the Consumer Confidence Report the number of months in the previous calendar year that average sample results from a certified laboratory were within the optimal range.

2. Each CWS that fluoridates shall list in the Consumer Confidence Report the percentage of all samples collected in the previous calendar year that sample results were within the optimal range.

SOURCE: Miss. Code Ann. § 41-26-6

Subchapter 5 AUTHORITY TO REQUEST RAW WATER SAMPLE

Rule 3.5.1 **Verification.**: The Department shall have the authority to request samples of the CWS raw water source seasonally for fluoride content analysis at the Department's laboratory.

SOURCE: Miss. Code Ann. § 41-26-6

Chapter 4 REGULATION GOVERNING DRINKING WATER QUALITY ANALYSIS FUND

Subchapter 1 General Provisions:

Rule 4.1.1. **Legal Authority.** This regulation has been promulgated under the authority of and pursuant to the Mississippi Safe Drinking Water Act of 1997 (Section 41-26-1 through Section 41-26-101, Mississippi Code of 1972, Annotated).

SOURCE: Miss. Code Ann. §41-26-23

Subchapter 2 Assessment and Collection of Fees

Rule 4.2.1. **Fees.** The department annually shall assess and collect fees for water quality analysis and related activities as required by the federal Safe Drinking Water Act, as amended, which shall not exceed Two Dollars and Eighty Cents ($2.80) per connection or Forty Thousand Dollars ($40,000.00) per system, whichever is less. The department annually shall adopt by rule, in accordance with the

Administrative Procedures Law and following a public hearing, a fee schedule to cover all reasonable direct and indirect costs of water quality analysis and related activities as required by the federal Safe Drinking Water Act, as amended. In adopting a fee schedule, the department shall consider the recommendations of the advisory committee created in this section, if those recommendations are made in a timely manner as provided.

SOURCE: Miss. Code Ann. §41-26-23

Rule 4.2.2. **Advisory Committee.** An advisory committee is created to study the program needs and costs for the implementation of the water quality analysis program and to conduct an annual review of the needs and costs of administering that program. The annual review shall include an independent recommendation on an equitable fee schedule for the succeeding fiscal year. Each annual review report shall be due to the department by May 1. The advisory committee shall consist of one (1) member appointed by the Mississippi Rural Water Association, one (1) member appointed by the Mississippi Municipal Association, one (1) member appointed by the Mississippi Association of Supervisors and one (1) member appointed by the Mississippi Water and Pollution Control Operators Association, Inc.

SOURCE: Miss. Code Ann. §41-26-23

Rule 4.2.3. **Payments and Penalties.** All suppliers of water for which water quality analysis and related activities as required by the federal Safe Drinking Water Act, as amended, are performed by the State Department of Health shall pay the water quality analysis fee within forty-five (45) days following receipt of an invoice from the department. In the discretion of the department, any supplier of water required to pay the fee shall be liable for a penalty equal to a maximum of two (2) times the amount of fees due and payable plus an amount necessary to reimburse the costs of delinquent fee collection for failure to pay the fee within ninety (90) days following the receipt of the invoice. Any person making sales to customers of water for residential, noncommercial or nonagricultural use and who recovers the fee required by this section or any portion thereof from any customer shall indicate on each statement rendered to customers that these fees are for water quality analyses required by the federal government under the Safe Drinking Water Act, as amended.

Appendix B - Environmental Standards

Public Water System Secondary Drinking Water Standards

Secondary standards are set for, and the Secondary Maximum Contaminant Level (SMCL) is applied to, those contaminants that affect the aesthetic quality (such as taste, odor, or color) of the water. Water that exceeds the SMCL for these contaminants may not be pleasant to drink, but will cause no health problems.

The Secondary Maximum Contaminant Levels for public water systems are as follows:

Contaminant	Level
Aluminum	0.05 to 0.2 mg/l
Chloride	250 mg/l
Color	15 Color Units
Corrosivity	Non-corrosive
Copper	1.0 mg/l
Fluoride	2.0 mg/l
Foaming Agents	0.5 mg/l
Iron	0.3 mg/l
Manganese	0.05 mg/l
Odor	3 Threshold Odor Number (TON)
pH	6.5 - 8.5
Silver	0.10 mg/l
Sulfate	250 mg/l
TDS	500 mg/l
Zinc	5 mg/l

Reference:

"National Secondary Drinking Water Regulations." 40 CFR 143.3. 1991

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Appendix C - Information For Review/Approval of Engineering Plans & Specifications

A. Plans (standard size sheets - 24 x 36 inches, preferably folded) -

1. Title sheet indicating the name of the project.
2. Location and a vicinity map showing certificated area to be reviewed in relation to existing certificated areas. (Mississippi County)
3. Major water lines from the water source (well or storage tank) need to be shown (with sizes and lengths) to the areas to be served.
4. Layout sheet to show location, length and size of water lines, location of sewer lines, lot numbers, location and type of existing potential users.
5. Layout sheet to show design points, contour lines, and/or pertinent elevations, water courses, and other pertinent features.
6. Layout sheet to show locations of valves, fire hydrants, flushing hydrants and service connections.
7. Water detail sheet showing thrust blocking, hydrants, valves, service line connections, etc.
8. If included in the project, the well, storage tank, chlorination and other treatment equipment details need to be shown, including all piping and valving arrangements.
9. Prior to approval of any new extensions or major construction, installation of a master meter on wells or treatment plants will be required if one does not already exist.
10. Alternatively, consultant may send the plans electronically in pdf form via CD or USB drive in addition to the one 24 x 36 inch set used by the regional engineers in their review. The electronic version should be stamped and signed within the pdf document.

B. Specifications

1. General

a. Statement on disinfection procedures for wells, storage tanks and distribution lines as applicable.
b. Statement on separation of water and sewer lines.
c. Statement on cover depth.
d. Statement on pressure testing of piping.
e. Statement on microbiological testing and acceptance of system.

f. Complete specifications on pipes, valves, hydrants, etc.
g. Construction methods, including protection of distribution lines from gross contamination during construction.
h. Contract proposal.
i. A transmittal sheet will be required and should be signed by the Responsible Official. For subdivisions and apartment complexes, the number of lots or units should be specified.

2. Well

a. Capacity and head.
b. Anticipated depth and water quality.
c. Casing materials, sizes and lengths.
d. Screen size and lengths.
e. Coating.
f. Pump head foundation size and design.
g. Cementing of casing.
h. Lap pipe and/or seal.
i. Back pressure valve.
j. Venting of casing.
k. Pump information - setting, speed, head, etc.
l. Piping arrangements such as sizes, valves, sampling bib, etc.
m. Provision of a master meter.
n. Controls and operations.

3. Chlorinator and Other Treatment Facilities

a. Type and meter size.
b. Booster pump information such as head, capacity, etc.
c. Piping and valving arrangements.
d. Housing information such as insulation, ventilation, etc.
e. Provision of test kits.

4. Hydropneumatic Tank

a. Size, pressure rating and standards.
b. Coating inside and out.

c. Sight gauge, manhole and drain.
d. Air volume controls and pressure relief valves.
e. Sizes and arrangement of piping and valves.
f. Bypass piping arrangements.

5. Elevated and Ground Storage Tanks

a. Size, type, material and height.
b. Standards to be met, coating inside and out.
c. Height of high and low levels.
d. Overflow arrangement and heights.
e. Drain size and arrangement.
f. Piping and valve size and arrangement of each.
g. Manhole, venting and screening.
h. Controls.

6. Booster Stations

a. Service pump information such as head and capacity.
b. Collector tank size, coating, etc.
c. Pressure tank information (as given above).
d. Information on orifice to fill collector tank.
e. Insulation of pipes.
f. Controls for service pump.

C. Hydraulic Computations

Needed from source to system and throughout the system if it is deemed critical.

D. Administrative Needs

1. Plans and specifications must be prepared by a professional engineer licensed to practice in Mississippi and submitted with the engineer's seal affixed. A minimum of two complete sets of plans and specifications should be submitted for administrative purposes, plus the number the engineer requires for his purposes.
2. If obtaining water from a municipality, rural water association or other MSDH approved public water system, a copy of the agreement from the supplier indicating their willingness to serve this area must be submitted.

3. Separate specifications should be bound, sealed and the name of the project shown. If reference is made to standard specifications, a current copy must be on file with the Bureau of Water Supply.
4. If one or more additions or parts are to be added to a project at a later date, an overall layout sheet must be submitted. The original design should be compatible with the proposed addition without excessive duplication of lines or interruption of service. For distribution extensions, an overall layout map should be submitted.
5. Where sewage or sewage treatment facilities are involved, the Mississippi Department of Environmental Quality, Office of Pollution Control must approve these facilities before the water system can be formally approved. A copy of the Office of Pollution Control's approval must be submitted.
6. Subdivisions where individual onsite sewage treatment and disposal systems are proposed shall meet the requirements of the "Regulation Governing Individual Onsite Wastewater Disposal Systems" and the Mississippi State Department of Health policies and procedures related to this regulation.
7. The Mississippi Public Service Commission should be contacted for approval of certificated areas. For new public water systems, the Public Utilities Staff must evaluate the financial and managerially capabilities of the proposed water system and the Department of Health must receive written certification from the Executive Director of the Public Utilities Staff that the proposed new public water system is financially and managerially viable. The Department of Health is prohibited by law from approving new public water systems until this certification from the Executive Director of the Public Utilities Staff is received.
8. A transmittal sheet will be required and should be signed by the Responsible Official.

Appendix D - Procedure for Approval of Water Source(s) for Food Production Facilities & Restaurants

This procedure is set for the purposes of approving any water supply source that will be used for the sole purpose for the production of any food or drink that is meant for consumption. Examples of facilities may include but are not limited to bottled water and breweries.

Preliminary Engineering Report

A. A preliminary engineering report prepared by a registered engineer licensed to practice in Mississippi should be submitted to the Bureau of Public Water Supply in order to facilitate the approval of the proposed water source for the food production facility. This report should include:

1. Proposed site location
2. Information regarding the vulnerability of the water source to contamination
3. Summary and evaluation of results of water quality analyses
4. Recommendation concerning need for water treatment and protection of the water source

Additional information may be required depending upon the specific water source for which approval is requested.

Site Inspection

B. The preliminary engineering report should include the results of a site inspection of the geographical area within the proximity (at least 2 mile radius) of the proposed water supply source. The purpose of this site inspection is to locate any landfills, garbage dumps, industrial sites, oil exploration sites and any other potential contaminant sources that may affect the water source. The proposed location of the water source should be carefully reviewed to determine if it is susceptible to contamination by surface runoff.

Preliminary Water Quality Analyses

C. The preliminary engineering report should include the results of water quality samples collected from the potential water source. The water analyses should include all Safe Drinking Water Act required analyses and a general chemical and physical analysis to

determine if treatment of the source will be required prior for use in the food production. These analyses should be completed by an environmental laboratory certified to complete Safe Drinking Water Act analyses for public water supplies. If requested, the Mississippi State Department of Health environmental laboratory will complete the full battery of required water quality analyses for a fee.

D. The preliminary engineering report should be submitted to the Mississippi State Department of Health, Bureau of Public Water Supply for review and comment. After completion of the review and resolution of any noted problems, the Bureau will issue a letter of concurrence with the report.

Completion of Final Plans and Specifications

E. Final plans and specifications of construction for the water source should be provided to the Bureau of Public Water Supply for review and comment.

F. After any noted problems with the submitted plans and specifications have been resolved, the Bureau will issue a letter of approval for construction.

Construction of Water Source

G. Construction of the water source may then be initiated. After construction is completed, the consulting engineer shall certify to the Bureau the project has been constructed according to the approved plans and specifications.

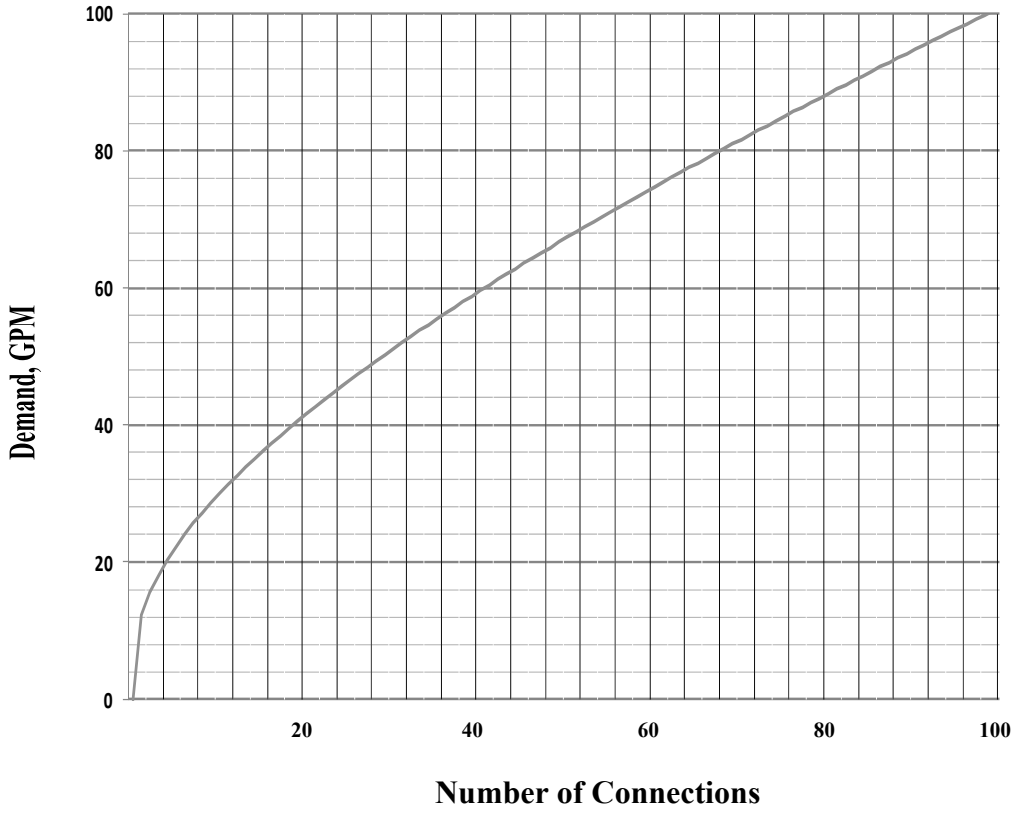
Final Water Quality Analyses

H. A final complete set of required water quality analyses should be completed on the water source. After review of this water quality analyses and based upon the consulting engineer's certification that the project was constructed according to approved plans and specifications, the Bureau will issue a letter of final approval of the water source.

Issuance of Operating Permit

I. The owner of the proposed food production facility can then move forward, working with the Mississippi Department of Health, Milk and Bottled Water Division to meet all additional requirements for the issuance of a permit to operate a food production facility in the State of Mississippi.

Appendix E – Minimum Flow Requirements



Demand Curve

Based on Formula: GPM = $(10)^{10^{\wedge 0.1325\log(conns) + 0.037}}$

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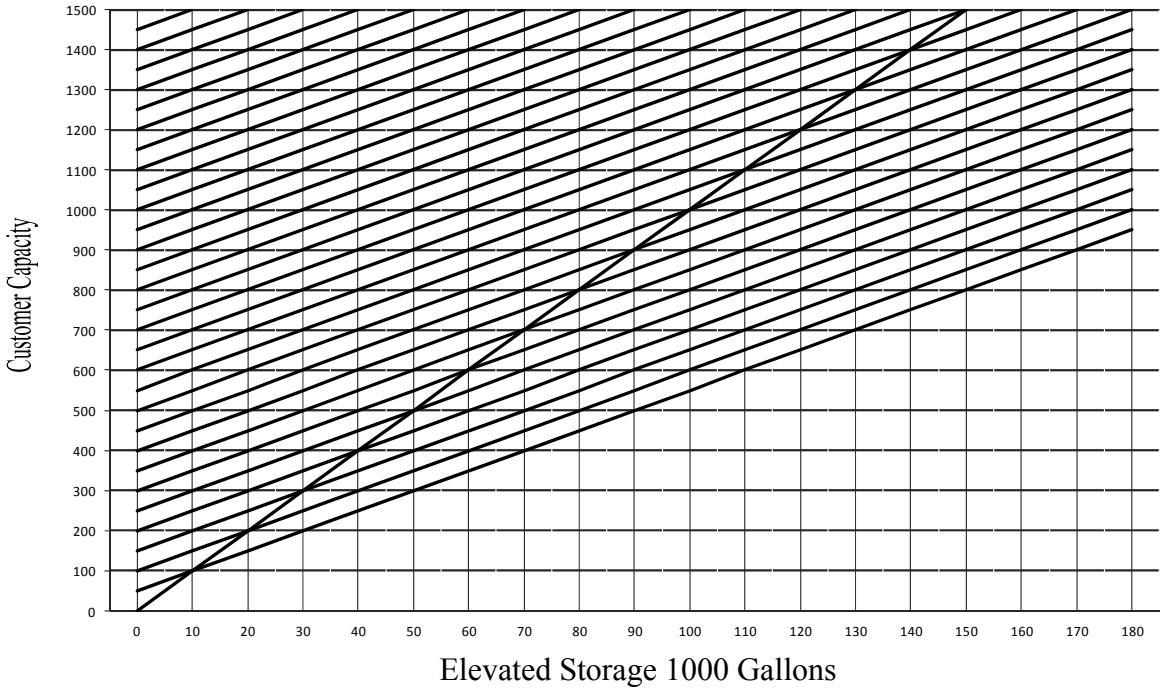
Appendix F – Customer Capacity based on Elevated Storage



C = W + (S/200)

where

C = Customer Capacity

W = Source Capacity, gpm

S = Elevated Storage, gal

Based on the ability to supply peak flow of 1 gpm/connection for 200 minutes.

Consistent with the requirement for 25% of peak daily demand of 400 gal/connection to allow customer capacity of twice the source capacity in gpm.

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Appendix G - Guide for Estimating Average Daily Water Requirements

Type of Establishment **(The unit is per person unless otherwise stated)**	**Average Daily Use** **(gpd)**
Airport (per passenger)	3 - 5
Assembly Halls (per seat)	2
Camps - Children, overnight, central facilities - Construction - Migrant Labor - Day type, no meals served	40 - 50 50 35 - 50 15
Churches (per member)	1
Cottages, season occupancy	50
Clubs - Residential - Non residential	100 25
Factories (sanitary uses, per shift)	15 - 35
Food Service - Restaurants - With bars - Fast food	7 - 10 9 - 12 2
Highway Rest Areas	5
Hotels (2 persons per room)	60
Institutions - Hospitals (per bed) - Nursing Homes (per bed) - Others	250 - 400 150 - 200 75 - 125
Office Buildings	15 - 30
Laundries, self service (per customer)	50
Motels (per bed)	60
Parks - Day use (with flush toilets) - Mobile homes (per unit) - Travel trailers (per unit)	5 200 90 - 100
Picnic Areas (with flush toilets)	5 - 10
Residential Communities - Multi family (per bedroom) - Rooming house and tourist homes type (per bedroom)	120 120 400

- Single family type (per house)	
Resort Motels and Hotels	75 - 100
Retail Stores (per toilet room)	400
Schools - Day (no showers or cafeteria) - Day (with cafeteria) - Day (with showers and cafeteria) - Residential types	15 20 25 75 - 100
Shopping Centers (per sq. ft. sales area)	0.16
Swimming Pools and Beaches	10
Theaters - Drive in (per car) - Others (per seat)	3 - 5 3

Appendix H - Special Requirements for Chlorinator Installations

In certain situations, it is necessary to install gaseous chlorinators that are controlled by solenoid valves rather than booster pumps. Whenever it is necessary to use solenoid valves to control the gaseous chlorinator, the following procedures **must** be followed:

1. Place a wye strainer in the piping upstream of the solenoid valve to ensure that no trash can clog the valve. If a plastic wye strainer is used, it **must** be schedule 80.

2. The solenoid valve should always be the "fail closed" type of valve so that, if power is lost, the valve would be normally in the closed position.

3. Directly wire the solenoid (**i.e. no plug-in connections**) so that no power is on the valve when the well is not pumping water. This requires a direct connection to the starter at the well.

4. If a bypass is provided around the solenoid valve, the bypass **must** remain closed at all times unless the system is being tested or repaired. The bypass should **never** be left open and unattended.

5. If the outlet water level is below the solenoid valve, a corrosion resistant vacuum breaker must be placed after the injector at a level higher than the solenoid valve.

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Appendix I – Special Requirements for Ozone Installations

Because of its relatively short half-life, ozone is always generated on-site by an ozone generator. The two main principles of ozone generation are UV-light and corona-discharge. Ozone generation by corona-discharge is most common nowadays and has most advantages. Advantages of the corona-discharge method are greater sustainability of the unit, higher ozone production and higher cost affectivity.

UV-light can be feasible where production of small amounts of ozone is desired (e.g. laboratories). An ozone production unit with corona-discharge consists of the following parts: oxygen source, dust filters, gas dryers, ozone generators, contacting units and torch destruction. In the ozone generator, the corona-discharge element is present, which provides a capacitive load. The ozone is produced from oxygen as a direct result of electrical discharge. The corona-discharge ruptures the stable oxygen molecule and forms two oxygen radicals. These radicals can combine with oxygen molecules to form ozone. To control and maintain the electrical discharge, a dielectric is present, carried out in ceramic or glass. The excessive heat of the electrodes is often cooled by cooling water, or by air (figure 1).

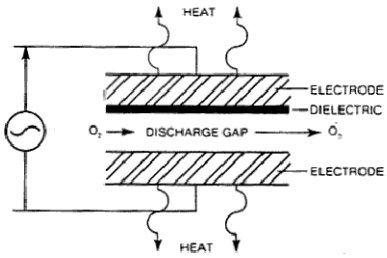

Figure 1: outline corona-discharge generator

For the production of ozone, ambient air can be used (supplied by a compressor) or pure oxygen (supplied by an oxygen generator, or sometimes by oxygen bottles). To condition this air, air dryers and dust filters are used.

To break down the remaining ozone after use, ozone destructors are applied. The mechanism of an ozone destructor can be based on different principles. Usually a catalyst is applied, which accelerates the decomposition of ozone into oxygen (e.g. magnesium oxide).

The generation of ozone is very energy-intensive, with some 90 % of the power supplied to the generator being utilized to produce light, sound and primary heat. Important factors that influence ozone generation are: oxygen concentration in the inlet gas, humidity and purity of

inlet gas, cooling water temperature and electrical parameters. To minimize the energy that is used at a high ozone yield, it is important that these factors are optimal.

Cooling water temperature

Ozone generation is accompanied by heat formation. This makes it important to cool the generator. An ozone reaction is reversible and this increases when temperatures rise. As a result, more oxygen molecules are formed:

$$3O_2 \overset{-\Delta T}{\underset{+\Delta T}{\rightleftharpoons}} 2O_3$$

Figure 2 illustrates the relation between cooling water temperature and the yield of ozone generation. This figure shows that an increasing cooling water temperature results in a decreasing ozone production. To limit the decomposition of ozone, the temperature in the discharge gap should not be higher than 25 °C. The general advice is that cooling water may increase 5 °C to 20 °C maximally. It is important that the temperature of the inlet air is not too high.

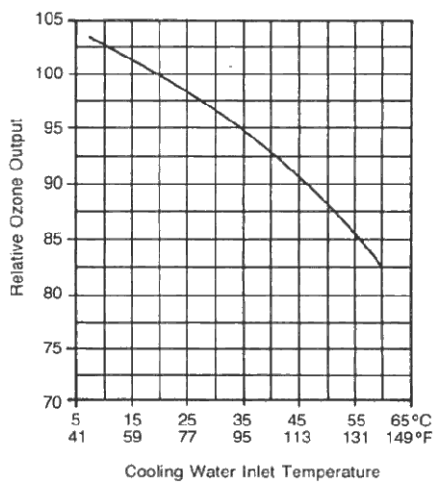

Figure 2: influence of water cooling on ozone generation efficiency

Humidity inlet air

Before the feed gas enters the ozone generator, air dryers should dry the air. Ambient air contains moisture, which reacts with ozone. This leads to a reduction of the ozone yield per kWh. An additional problem of high humidity is that undesired reactions occur in the corona unit. When increased amounts of water vapor are present, larger quantities of nitrogen oxides are formed when spark discharge occurs. Nitrogen oxide can form nitric acid, which can cause corrosion. Furthermore, hydroxy-radicals are formed that combine with oxygen radicals and with ozone. All of these reactions reduce the capacity of the ozone generator.

Figure 3 shows the influence of the humidity on the capacity of an ozone generator. The two descending lines illustrate the capacity of the generator: 'oxygen' for an oxygen-fed generator and 'air' for an air-fed generator. At a dew point of -10 °C, the capacity of the air-fed generator is only 60% of the total achievable capacity. For ozone generators that are oxygen-fed, this capacity is higher; about 85%.

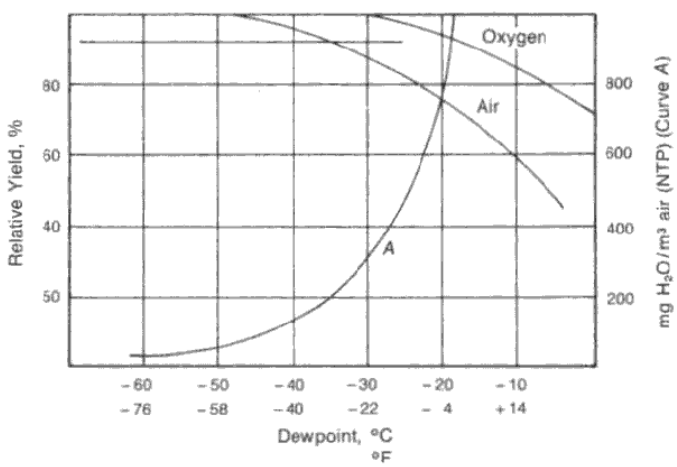

Figure 3: influence humidity inlet air on efficiency of ozone production

To prevent these side-reactions, inlet air first passes a drying chamber before ozone is generated. For drying, an aluminum compound can be used, comparable with silica gel. In an ozone generator two or more drying chambers are used alternately. When a drying chamber is used for a certain period of time, humid air is directed to the other drying chamber, while the first is regenerated.

Purity of gas (inlet)

The presence of organic impurities in gas feed must be avoided, including impurities arising from engine exhausts, leakages in cooling groups, or leakages in electrode cooling systems. The gas supply of the generator must be very clean. An example is given in figure 4, where the concentration of hydrocarbons is related to the ozone yield. This figure shows that at a hydrocarbon concentration of about 1%, the ozone generation nearly approaches zero [5].

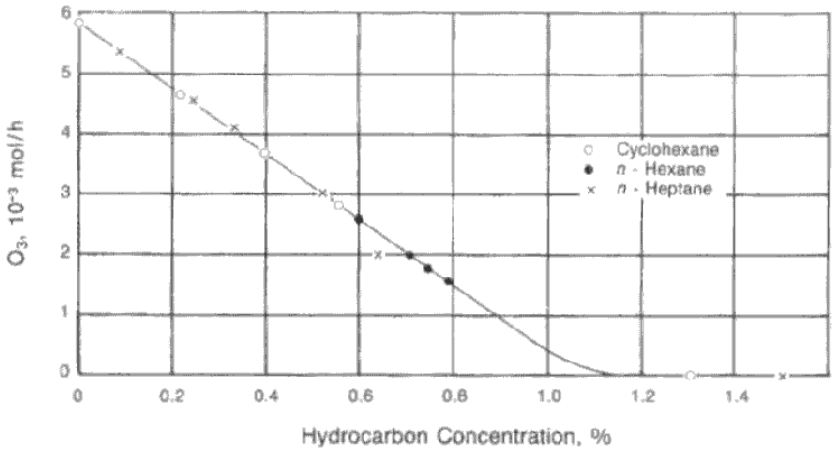

Figure 5: influence of hydrocarbons on the generation yield of ozone

Produced amount of ozone versus oxygen concentration of inlet air

Ozone is produced from oxygen, so it can be produced from ambient air (21 % oxygen) or nearly pure oxygen (e.g. 95 %). Pure oxygen can be generated from ambient air by an oxygen generator. The ozone concentration an ozone generator delivers is dependent on the oxygen concentration (among other things). This is clarified by figure 4, where the oxygen concentration is outlined against the ozone concentration. The diverse lines demonstrate the ozone generators with different energy use. According to the chart, ozone production increases by a factor 1.7 to 2.5 when pure oxygen is used, at constant electrical power.

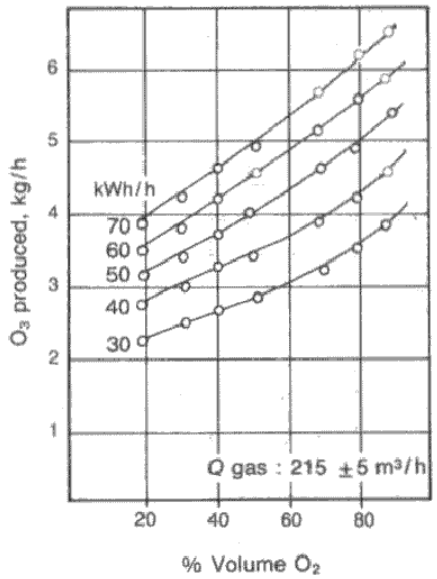

Figure 4: influence of oxygen concentration on ozone production at different electrical current

Typical ozone generation by the corona discharge method(CD)

The following figures show typical corona discharge schematics for vertical and horizontal tubes:

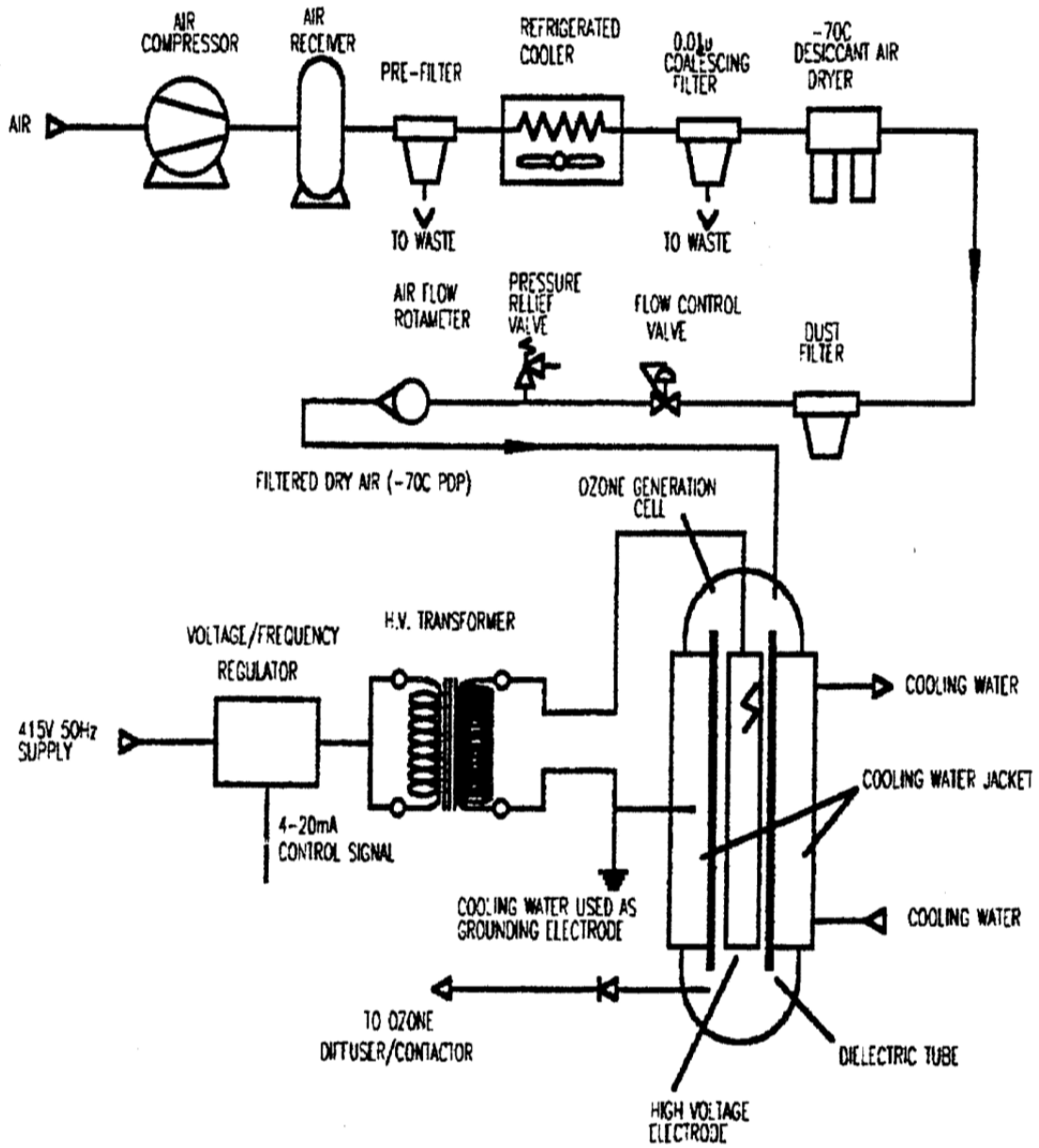

Fig. 1 – Typical Vertical Tube Ozonator Process Flow Schematic

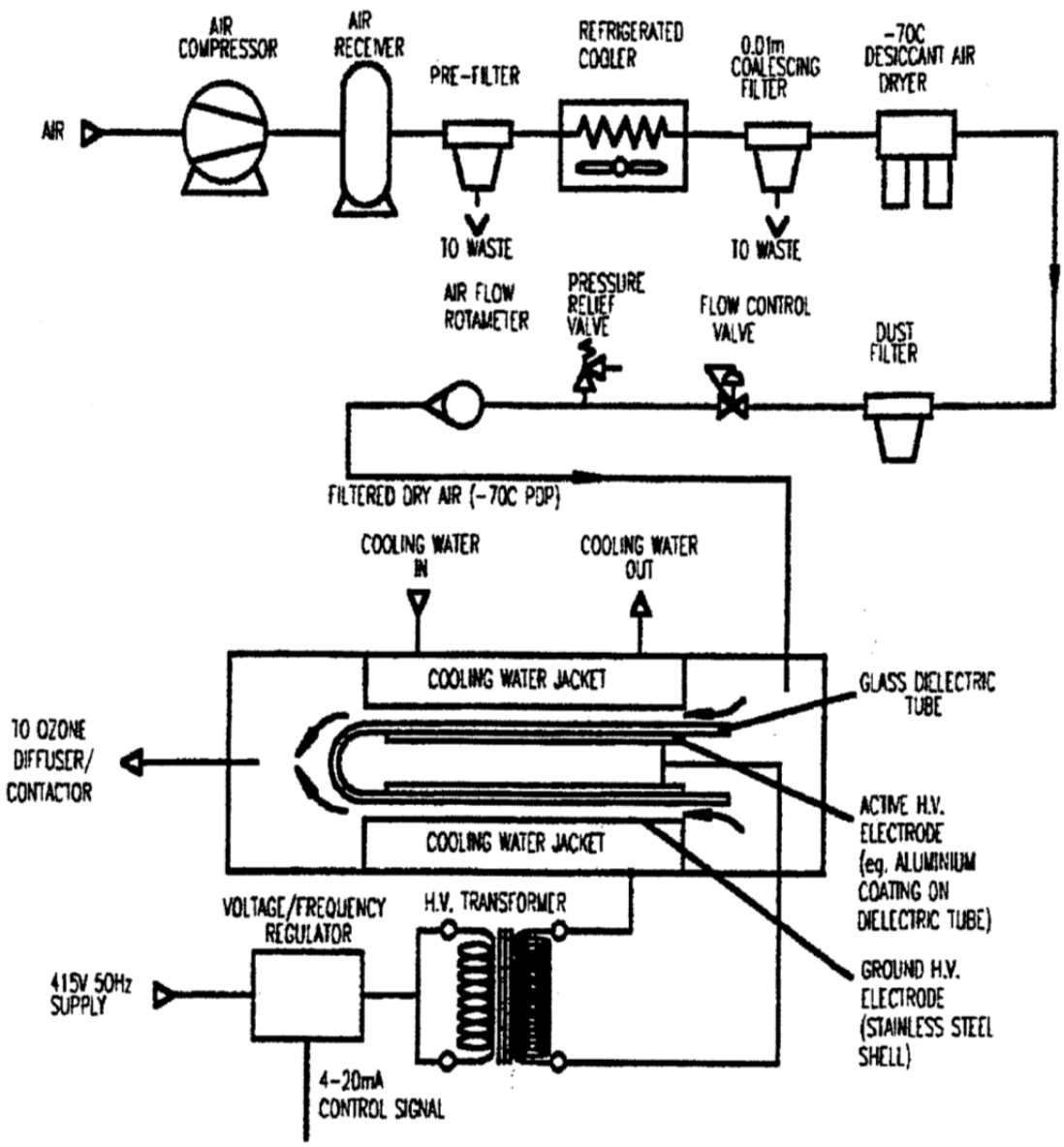

Fig. 2 – Typical Horizontal Tube Ozonator Process Flow Schematic

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Appendix J - Determination of Design Capacity for Public Water Systems

The maximum number of customers that a water system is designed to serve is known as the Customer Design Capacity for that system. The Customer Design Capacity is a calculated value based upon several factors. These factors include, but are not limited to, the following: Well capacity (gallons per minute), service pump capacity (gallons per minute), storage capacity (gallons), distribution system capacity and water treatment capacity (gallons per minute). If a system has exceeded the calculated Customer Design Capacity, it is declared by the MSDH/DWS to be "overloaded".

It is important that officials of public water systems know the Customer Design Capacity of the systems they manage. This information is critical in planning for future water system improvements. By comparing the current customer load to the calculated value of Customer Design Capacity, water system officials and their consulting engineers can make intelligent decisions regarding the timing of needed improvements. Clearly, the Customer Design Capacity calculation is a tool which should be utilized by system officials and their consulting engineers to help identify critical needs before the system becomes "overloaded" and customers are adversely affected.

It is a violation of the Mississippi Safe Drinking Water Act and the regulations of the Mississippi State Board of Health for a public water system to serve customers in excess of its design capacity. A public water system that is serving customers in excess of its design capacity is classified as overloaded by the Mississippi State Department of Health. Public water systems, after officially being notified by the MSDH that they are overloaded, are prohibited from adding any additional customers until the overloaded condition is corrected by the construction of appropriate improvements. Public water systems, after receiving notification from the MSDH that they are overloaded, are required to immediately begin planning to make the necessary improvements to eliminate the overloaded condition.

The procedure which is outlined on the following page has been developed to provide officials of public water systems and their consulting engineers a systematic method of determining the Customer Design Capacity. Please remember that this procedure is based primarily on the adequacy of the water source in determining if the public water system is "overloaded." Other factors such as very small water distribution mains or inadequate water storage will also cause a public water system to be overloaded.

If there are questions regarding the use of this standardized procedure to determine Customer Design Capacity or if there are questions concerning other factors that may cause a public water system to be "overloaded," please contact the Mississippi State Department of Health, Bureau of Public Water Supply at 601/576-7518.

STANDARD PROCEDURE FOR DETERMINING CUSTOMER DESIGN CAPACITY OF A PUBLIC WATER SYSTEM

TYPE #1 - Water Systems with wells only Pumping Directly into the Distribution System

Design capacity (# connections) = well capacity (gpm) + $\frac{\text{elevated storage (gallons)}}{200}$

NOTE: Design capacity is limited to twice (2x) well capacity(gpm) unless excess elevated storage is usable (See Note 5 below). Water systems with wells pumping into pressure tanks will have a design capacity equal to the total well capacity (gpm).

TYPE #2 - Water Systems with Clear Wells

Step #1 - Determine the limiting factor(lessor of): well capacity (gpm) _____, treatment capacity (gpm) _____, service pump capacity (gpm) ____

Limiting factor = _____ NOTE: If service pump capacity is limiting factor, skip to step # 3.
[In this situation, usable service pump capacity = service pump capacity]

Step #2 - Determine usable service pump capacity (gpm)

usable service pump capacity (gpm) = limiting factor _____ + $\frac{\text{clearwell volume (gallons)}}{200}$

usable service pump capacity (gpm) = _____ gpm

Step #3 - Determine Customer Design Capacity (CDC)

CDC = useable service pump capacity (gpm) _____ + $\frac{\text{elevated storage (gallons) (see Note \# 5 below)}}{200}$

Customer Design Capacity (maximum # connections) = _____

TYPE #3 - Water Systems where the MSDH does not have Water Well Capacity (gpm) Information

Well Casing Size	Design Capacity (meters)	Design Capacity (no meters)
2 inch	1 connection	1 connection
4 inch	29 connections	13 connections

NOTE: Above design capacity (# connections) is based on a normal capacity of 50 gpm for 4 inch casing and 15 gpm for 2 inch casing wells (MSDH residential water demand curve is used). If well capacity is documented, this value should be used in conjunction with MSDH residential water demand curve.

DESIGN NOTES:

Note 1: Water systems with standpipes can use top 25 feet as elevated storage

Note 2: Customers served by booster station(s) are not included in the total customers served by the water system unless any water system well(s) must pump more than 12 hours per day.

Note 3: Run time for public water system wells is limited to 12 hours per day.

Note 4: Clear Wells and booster stations must be refilled in 6 hours or less.

Note 5: For excess elevated storage to count as useable, the water system must be capable of refilling elevated tank in 6 (six) hours (based on MSDH approved hydraulic calculations).

Name of Public Water System: _____ PWS ID #: _____

Capacity Determined by: _____ Date: _____/_____/_____
Name (Please Print or Type)

If there are questions regarding this procedure, please contact the Bureau of Public Water Supply at 601/576-7518.

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