Title 15 - Mississippi State Department of Health

Part III – Office of Health Protection

Subpart 77 – On-site Wastewater

APPENDIX 11 DESIGN STANDARD: DISINFECTION

100 INTRODUCTION

100.01 The discharge of treated wastewater shall be disinfected when the effluent will be disposed of by means of a surface discharge (Overland Discharge or Spray Irrigation). Individual On-site Wastewater Disposal Systems that utilize surface discharge shall have an approved method of effluent disinfection prior to disposal.

The most common disinfect is chlorine. Other methods of wastewater disinfection are ultra-violet and ozone.

101 DEFINITIONS

101.01 Advanced Treatment System (ATS) – An Individual On-site Wastewater Disposal System that treats and complies with Section **41-67-10**. Section **41-67-2(a)**

101.02 Chlorine – a highly irritating, greenish-yellow gaseous halogen, capable of combining with nearly all other elements, produced principally by electrolysis of sodium chloride and used widely to purify water, as a disinfectant and bleaching agent, and in the manufacture of many important compounds including chloroform and carbon tetrachloride.

101.03 Chlorinator – a device that allows the treated effluent to pass around and over calcium hypochlorite tablets or the treated effluent is dosed with a specific amount of liquid chlorine by the use of an approved dispersal method.

101.04 Chlorine Contact Chamber –chamber designed to provide a minimum of 1 hour detention time at the peak design flow.

101.05 Chlorine (liquid) – an aqueous solution of calcium hypochlorite used as a disinfection agent.

101.06 Chlorine (tablet) – a solid form of calcium hypochlorite, a common disinfectant. These tablets dissolve in the wastewater, releasing the hypochlorite, which then becomes hypochlorous acid, the primary disinfectant.

101.07 Chlorine Residual – free chlorine remaining after the chlorination process has occurred.

101.08 Disinfection – treatment to destroy harmful microorganisms and viruses.

101.09 Feeder Tube – a device which holds Chlorine tablets in place in order to contact effluent.

101.10 Ozone – an unstable, poisonous allotrope of oxygen, O_3, which is formed naturally in the ozone layer from atmospheric oxygen by electric discharge or exposure to ultraviolet radiation, also produced in the lower atmosphere by the photochemical reaction of certain pollutants. It is a highly reactive oxidizing agent used to deodorize air, purify water, and treat industrial wastes.

101.11 Pathogen – An agent that causes disease, especially living microorganisms such as bacteria, viruses, or fungus.

101.12 Swimming Pool Chlorine – Chlorine made from Trichlorisocyanuric acid instead of calcium hypochlorite. **These tablets are not acceptable for use in On-site systems.** They do not dissolve as quickly as wastewater grade tablets and do not treat effluent as required. Also, if not continually immersed in water, these tablets can be explosive due to the release of nitrogen chloride gas.

101.13 Ultra-violet disinfection – disinfection device that uses ultra-violet light source to eliminate or destroy bacteria, viruses and other pathogenic organisms.

101.14 Ultra-violet light – radiation lying in the ultra-violet range; wave lengths shorter than light but longer than X-rays

102 DESIGN

It is important that wastewater be adequately treated prior to disinfection. The effectiveness of a disinfection system depends on the characteristics of the wastewater, the amount of time the microorganisms are exposed to the disinfectant, and the chamber configuration.

The design for each type of disinfection is as follows:

102.01 Chlorine Tablet or Liquid

1. The Chlorine Contact Chamber must meet the following requirements:

   a. Constructed from concrete, fiberglass or polyethylene in accordance with *Appendix 01*.

   b. Constructed to withstand the earth pressures encountered and able to withstand the chemical effects of chlorine and wastewater.

   c. Equipped with baffles or provided with an inlet to provide adequate mixing and contact of chlorine and effluent. The inlet and outlet must

be Schedule 40 PVC pipe, 4 inches in diameter with the outlet tee extending 6 inches from the bottom of the chamber. (Figure I)

d. Designed and located to have access a minimum of 6 inched above final grade.

e. Provide 65 gallons (minimum) capacity or 1 hour retention.

NOTE: If the chlorine contact chamber is an integral component part of the design of the Advanced Treatment System the efficiency shall be certified by the third party certifying entity.

f. Sealed (water-tight) to prevent the entry of surface or ground water. It is recommended that the outlet be placed above any seasonal water tables as indicated by gray mottles. An approved sealant shall be applied to the lid, inlet, outlet and access opening to prevent groundwater and surface water intrusion.

g. Consideration will be given to 2 flow-through units with common-wall construction so that each side satisfies the detention requirements. The chlorine feed rate will be proportioned in accordance with the flow and the chlorine demand of the wastewater. Adequate mixing during the chlorine contact period will be insured by the installation of adequate baffling.

h. Pumped periodically for sludge accumulation and properly disposed.

2. The feeder tube and liquid chlorinator dosing compartment must meet the following requirements:

a. Installed level on undisturbed earth or backfilled with sand.

b. Charged with a minimum of 3 calcium hypochlorite chlorine tablets or the dosing compartment is 1/2 filled with liquid chlorine.

c. Equipped with a method for removal. The method of removal must be within 3 inches of the chlorinator opening.

d. Constructed of Schedule 40 PVC pipe, 3 inches in diameter and provide removal of all chlorine tablets when feeder tube is removed from chlorinator. (Figure II)

e. Childproof and Tamper resistant, or limited access cover.

102.02 Ultra-violet

1. The main components of a ultra-violet disinfection system are mercury arc lamps, a reactor, and ballasts. The source of the ultra-violet radiation is either the low-pressure or medium-pressure mercury arc lamp with low or high intensities.

2. The optimum wavelength to effectively inactivate microorganisms is in the range of 250 to 270 nm. Low-pressure lamps emit essentially monochromatic light at a wavelength of 253.7 nm. Standard lengths with diameter of 1.5 – 2.0 cm. The ideal lamp wall temperature is between 95 and 122°F.

3. The effectiveness of a ultra-violet disinfection system depends on the characteristics of the wastewater, the intensity of the ultra-violet radiation, the amount of time the microorganisms are exposed to the radiation, and the reactor configuration.

   All ultra-violet disinfection must provide a flow either parallel or perpendicular to the lamps and have a ballast or control box which provides a starting voltage for the lamps and maintains a continuous current.

   There are two types of ultra-violet disinfection reactor configurations that exist:

   a. Contact

      This reactor contains a series of mercury lamps are enclosed in quartz sleeves to minimize the cooling effects of the wastewater. The lamps are placed parallel or perpendicular to the direction of the wastewater flow. Flap gates or weirs are used to control the level of the wastewater.

   b. Noncontact

      This reactor contains mercury lamps suspended outside the transparent conduit, which carries the wastewater to be disinfected.

4. The ultra-violet disinfection must provide the following:

   a. Necessary hydraulic properties for maximize exposure to ultra-violet radiation.

   b. Necessary intensity of ultra-violet radiation needed for effective inactivation of microorganisms.

c. Necessary radiation for peak flow condition, suspended or colloidal solids, initial bacterial density and any other physical and chemical parameters (i.e., hardness, iron, pH or TSS).

5. The ultra-violet disinfection system must ensure that sufficient radiation is transmitted to the organisms to render them sterile. All surfaces between the radiation and target organisms must be clean, and the ballast, lamps, and reactors must be functioning at peak efficiency.

6. The sleeves or tubes must be cleaned regularly by mechanical wipers, ultrasonics, or chemicals. The cleaning frequency is dependent upon the wastewater characteristics produced by the Advanced Treatment System.

7. The retention time for complete inactivation will be determined by size of reactor and lamp intensity.

8. All disinfection systems certified by *American National Standards Institute/National Sanitation Foundation International Standard 46* will be accepted for registration in Mississippi provided documentation is submitted with application.

9. All disinfection systems not certified by *American National Standards Institute/National Sanitation Foundation International Standard 46* must submit all documentation to determine compliance with 102.03 through 102.07.

102.03 Ozone

1. These products will be reviewed by the Division in accordance with design, construction and installation for the specific location and usage.

2. These products will only be approved by the Division after certification by a Professional Engineer registered in the State of Mississippi after having shown it can be constructed and installed by the Certified Installer.

3. This product will require that the Professional Engineer train and certify the Maintenance Provider in it routine operation and maintenance, as well as safety guidelines.

103 LOCATION/SETBACKS

103.01 The disinfection system shall not be located in an area that collects surface water.

103.02 The disinfection system shall be installed according to the following setbacks:

1. 5 feet from foundations, deck, out-building, etc

2. 10 feet from property lines

3. 50 feet from any public, private or individual potable water source

103.03 No vehicular traffic shall be allowed over the tank(s), disinfection system or any part of the Individual On-site Wastewater disposal System.

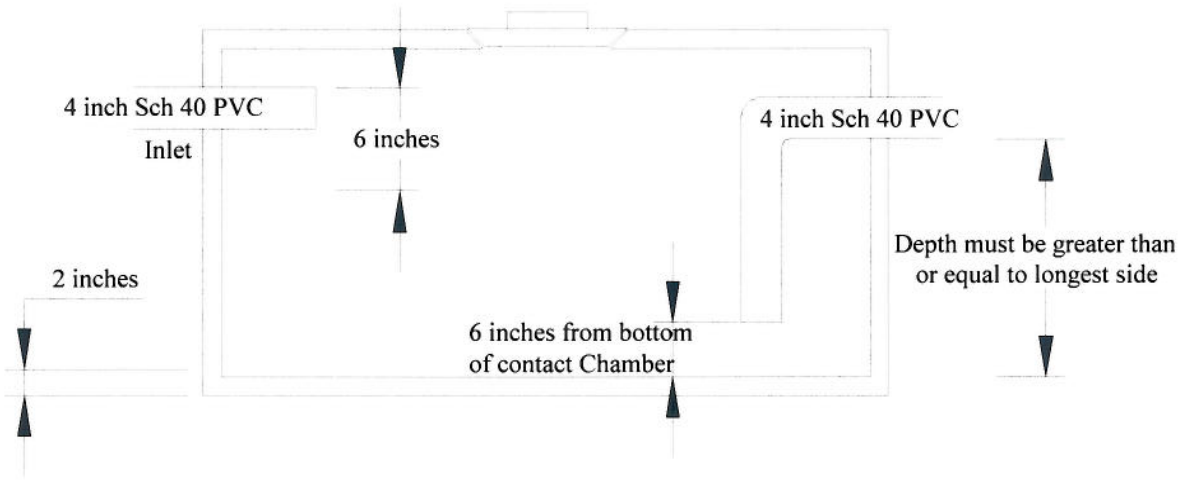
103.04 Tanks and disinfection system shall not be located under dwellings or other permanent structures.

104 TREATMENT

104.01 Tablets shall not be in contact with treated effluent except during times of flow. Other designs that meet the criteria of proper effluent contact will be considered suitable after review by the Division.

104.02 The level of chlorination is a chlorine residual of not less than 0.1 to no greater than 1 ppm (parts per million) or a maximum of 400 fecal colonies/100 ml.

Figure I Chlorine Contact Chamber
65 gallon minimum



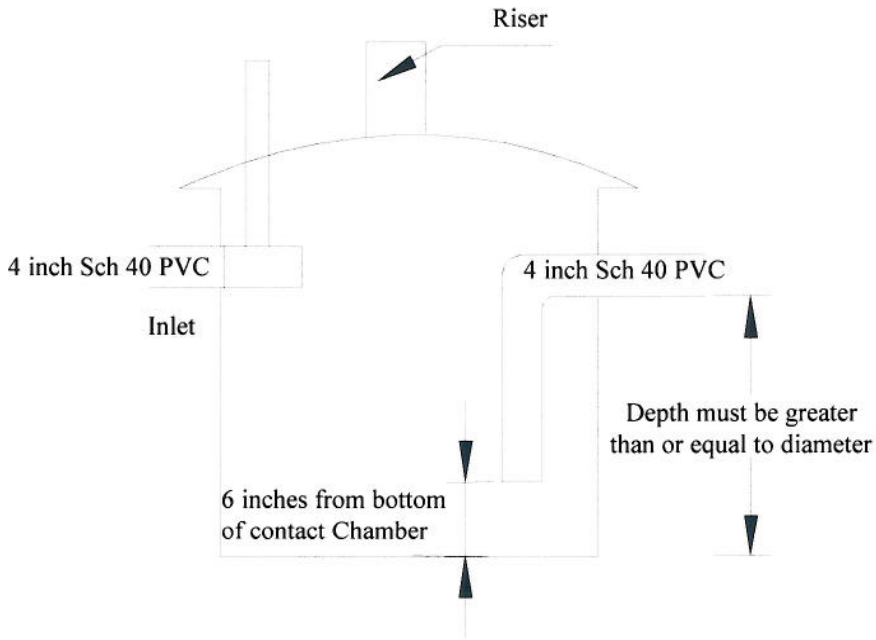


Figure II Cross Section of Chlorinator Feeder Tube