

On-site wastewater treatment systems

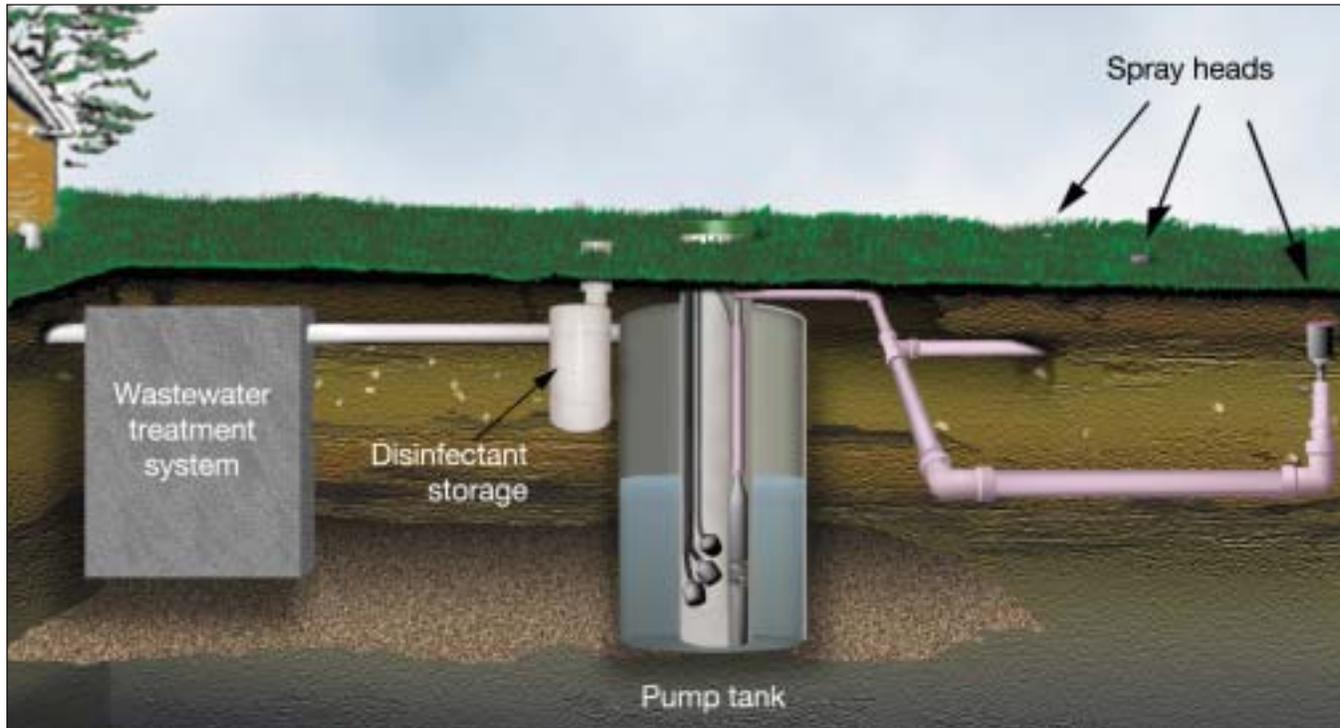


Figure 1: A liquid chlorination system for residential wastewater treatment.

Liquid chlorination

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Before treated wastewater can be distributed to lawns, it must be disinfected to remove disease-causing organisms. The three primary disinfecting agents used are chlorine, ultraviolet light and ozone. The most common method of disinfection for on-site wastewater treatment systems is chlorination.

Chlorine is highly effective in reducing odors and disinfecting water. It is usually dispensed in one of three forms: tablet (calcium hypochlorite), liquid (sodium hypochlorite, which is household bleach) or gas (Cl_2 , which is liquid when pressurized).

For residential wastewater treatment systems, the two main forms used are tablet and liquid chlorine. Gaseous chlorine is very dangerous and requires skilled operation, which limits its use to municipal systems.

This fact sheet focuses on liquid chlorination. For more information

about tablet chlorination, please see Extension publication L-5344, “Tablet Chlorination.”

The process

Before chlorination, wastewater leaves the home and passes through an advanced pretreatment system such as an aerobic treatment unit, sand filter or media filter. These advanced pretreatment systems remove most of the organic matter and suspended solids from the wastewater.

The organic matter and suspended solids must be removed from the wastewater first; otherwise, the chlorine will react with these materials instead of disinfecting the target organisms. Also, these materials will provide physical barriers to protect the pathogens.

Once treated, the effluent collects in a pump tank, which serves as a reservoir for the wastewater until it is distributed into the soil. The tank also is generally where the chlorine is mixed with the effluent.

After chlorination, the treated wastewater is distributed into the soil periodically in what are called distribution events. Distribution events can be activated either by a float in a demand-controlled system or by a timer in a timer-controlled or night distribution system.

System components

Various types of liquid chlorinator systems are available for disinfecting wastewater. They may be purchased from manufacturers or distributors or through installers. All liquid chlorinator systems include some form of the following components: chlorine bleach, a storage reservoir, a powering mechanism and a metering device.

The **chlorine bleach** kills the disease-causing organisms, or pathogens, in the wastewater. Chlorine bleach can be purchased from various stores and is available in several chlorine concentrations, including 3 percent, 5 percent, 5.25 percent, 6 percent and 13 percent.

It is vital that you choose a product that is specifically labeled (registered with the U.S. Environmental Protection Agency) for disinfecting wastewater and that meets the chlorine concentration specified by the manufacturer of the chlorinator.

Using a bleach product not labeled for disinfection of wastewater is a violation of the Federal Insecticide, Fungicide, and Rodenticide Act. Use products only in accordance with their label instructions.

The **storage container** holds the bleach until it is dosed into the effluent. This reservoir usually is made of a plastic container or PVC piping. It may be located inside the pump tank, located outside the pump tank on the ground surface, or buried in the ground.

The reservoir holds a specific amount of chlorine. The amount it holds will determine the length of time between additions of bleach. The bleach is added to the reservoir by the homeowner, another responsible person or the operation and maintenance service provider.

The **powering mechanism** sends a dose of chlorine to the effluent and mixes it with the wastewater. When the pump turns on to distribute the treated effluent, the water flowing through an aspirator will generally power the mechanism that doses chlorine into the wastewater. The water flow through the aspirator creates a vacuum that pulls bleach from the reservoir and doses it into the pump tank.

The **metering device** controls the chlorine dose. The device is placed in the supply system to restrict the amount of chlorine delivered to the pump tank. Several types of metering devices are available. The meter can restrict the dose to a specific volume of chlorine, to a specific flow rate, or to operation for a specific period of time.

Legal requirements

If wastewater is to be applied to a lawn or other ground surface, Texas regulations require that it contain at

least 0.1 mg of residual chlorine per liter of wastewater and have no more than 200 fecal coliforms (a type of bacteria found in human or animal waste) per 100 milliliters of wastewater. Because the constituents in the wastewater neutralize some of the bleach, much more than 0.1 milligram of chlorine per liter will need to be added to obtain the proper residual.

The amount of organic matter in water is often measured in 5-day biochemical oxygen demand (BOD₅) units. The higher the BOD₅, the more organic matter there is in the water and the more chlorine needed for proper disinfection.

In a liquid chlorination system, the bleach is introduced into the pump tank when the tank contains a specific amount of wastewater (as determined by a float) or through a timer system. This dosing must be precise to ensure that the wastewater contains the correct amount of chlorine. If there is too little chlorine, the water is not disinfected properly; too much chlorine can harm the grass in the spray field.

Kits are available to measure chlorine levels in water. However, some test kits made for chlorine testing in swimming pools are not sensitive enough to measure 0.1 mg of residual chlorine per liter in wastewater.

Factors affecting performance

Several factors affect the performance of chlorine as a wastewater disinfectant:

- ✓ **Mixing**, the action of introducing the chlorine into the wastewater to make sure all the constituents in the wastewater come into contact with the chlorine.

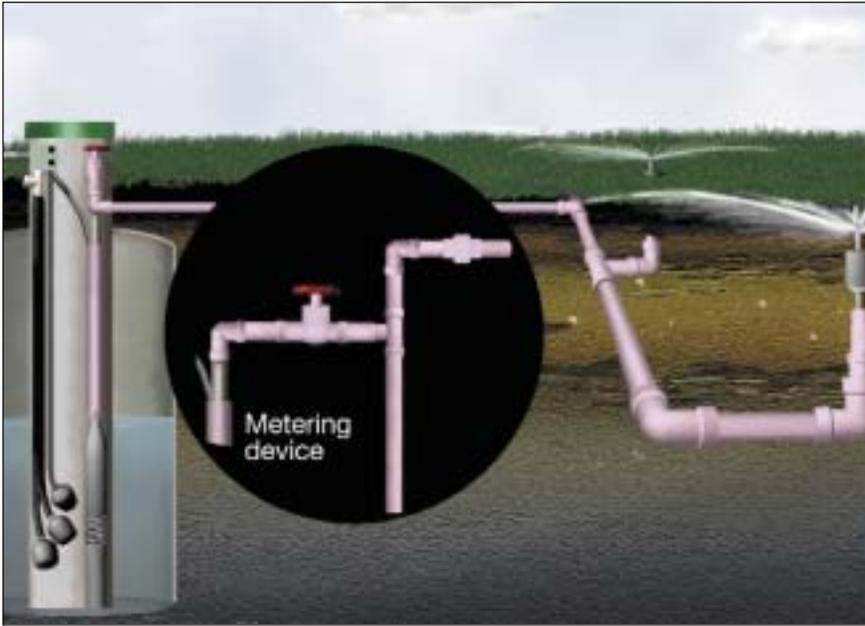


Figure 2: In a liquid chlorination system, the metering device controls the dose of chlorine delivered to the pump tank.

- ✓ **Contact time**, the amount of time needed for the chlorine to react with the constituents and kill the disease-causing microorganisms, or pathogens.
- ✓ **Dosage**, the concentration of chlorine in the wastewater. There is a direct relationship between contact time and dosage. Generally, the more chlorine that is dosed to the wastewater, the less contact time needed to kill the pathogens.
- ✓ **Residual control**, the concentration of chlorine that remains in the wastewater after the contact time has passed. This residual concentration is important

because some organisms can be introduced into the wastewater after the initial treatment. These pathogens also need to be killed.

The residual concentration is also the concentration needed to meet regulatory requirements. For most residential chlorination systems, the chlorine residual is monitored by the system's operation and maintenance service provider.

How to keep it working

It is very important to follow all installation and maintenance guidelines. To ensure proper chlorination:

- ✓ Keep chlorine bleach in the reservoir at all times. The rate of chlorine use may vary with water usage. If the chlorine reservoir is emptying much faster than normal, or if the chlorine level seems to be staying the same from day to day, there is a good chance that the chlorinator is malfunctioning and needs maintenance.
- ✓ Keep the reservoir closed and the lid fastened securely to prevent chlorine gas from forming and making the bleach less potent.
- ✓ Eliminate air leaks in the vacuum system when using an aspirator to power the system.
- ✓ Calibrate the chlorine dosage to ensure that the water is chlorinated properly. It may take some effort. The method of calibration varies with the type of system, and an initial period of trial and error may be necessary. Use a chlorine test kit to determine the chlorine concentration in the pump tank.
- ✓ If the liquid chlorinator is malfunctioning, contact the manufacturer or your maintenance provider for help.

All methods for disinfection of wastewater effluent require maintenance. Over all, liquid chlorination is very effective when the chlorinators are properly calibrated and the system is maintained regularly.

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