



## On-site wastewater treatment systems

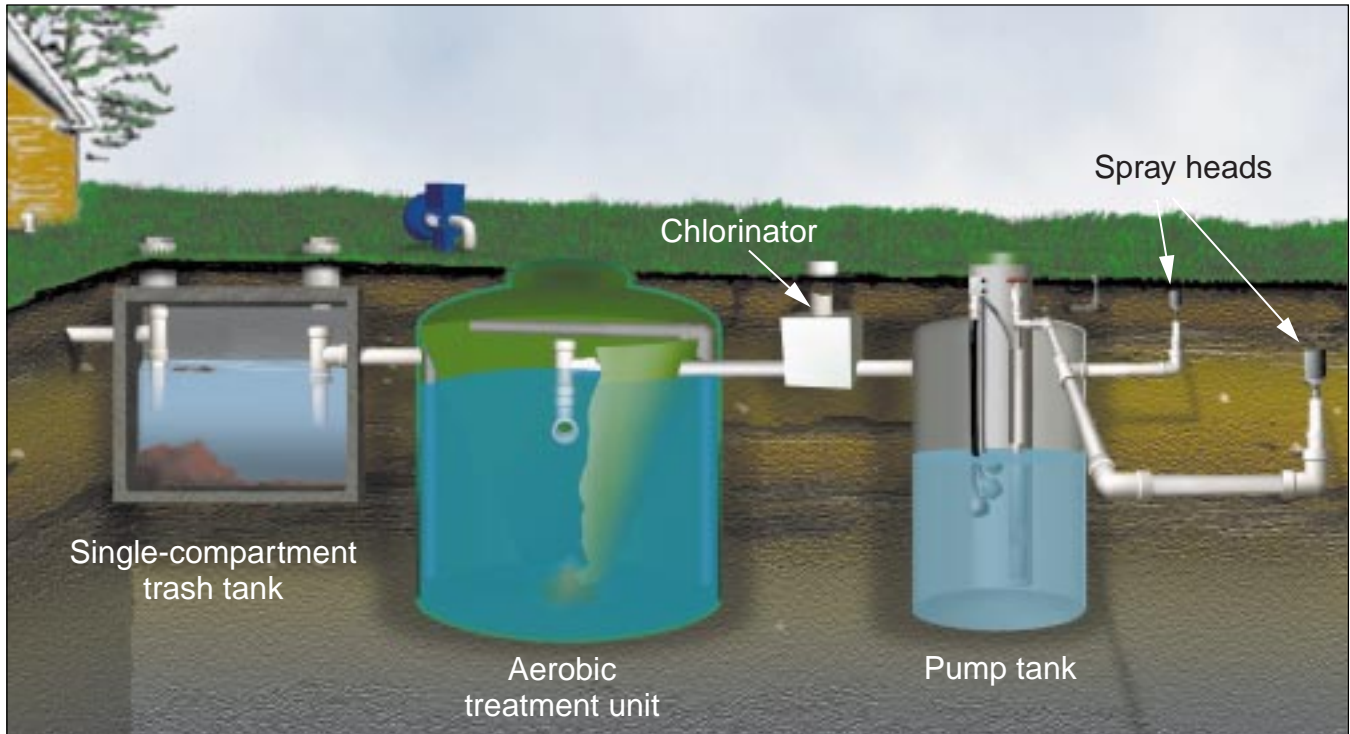


Figure 1: An on-site wastewater treatment system using an aerobic treatment unit.

# Aerobic treatment unit

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**A**erobic units treat wastewater for homes and small businesses using the same process, only scaled down, as our municipal wastewater treatment systems use. They remove 85 to 98 percent of the organic matter and solids from the wastewater, producing effluent as clean as that from municipal wastewater treatment plants, and cleaner than that from conventional septic tanks.

Aerobic units, which are certified as Class I aerobic systems, treat wastewater well enough to be used in conjunction with spray systems, which distribute treated wastewater over lawns. They are the most common way to treat wastewater for spray systems.

The aerobic treatment process includes four main components that work together to purify wastewater:

- ✓ A pretreatment tank, generally referred to as the “trash tank” because it removes materials that microorganisms (microbes) cannot degrade.

- ✓ An aeration chamber, where aerobic microbes decompose waste in the water. An aeration system consists of an air pump, piping and diffusers that force air into the aeration chamber. The air pump, located near the aerobic tank, compresses air to flow into the aeration chamber. The diffuser forces the air into the water, dividing the air into bubbles that float to the surface. The oxygen in the air bubbles goes into the water for the microbes, while the rising bubbles mix with the water.

- ✓ A settling chamber, commonly called a clarifier, which

provides a place for the microbes that have treated the wastewater to settle out of the water.

✓ A land application system, which distributes the wastewater into the soil for final treatment and disposal/reuse. Aerobic treatment units usually disperse wastewater via spray distribution systems, which include a disinfection component for removing disease-causing microorganisms, a pump tank for dosing water, and spray heads for spreading the water over the ground.

For more information on the disinfection, pump tank and spray distribution components, see Extension publication L-5303, "Spray Distribution System."

Aerobic treatment units can be built from concrete or fiberglass. Both materials are durable and can be used across the state.

Concrete tanks are heavier and require larger equipment to carry them to the site, which can delay installation during wet periods. Some concrete systems incorporate the trash tank, aeration chamber, clarifier and pump tank into a single structure; others include in one structure only the trash tank, aeration chamber and clarifier.

The main advantage to having the components in one structure is that the system can be delivered prebuilt. The installer must dig only one hole with a level bottom, reducing preparation time for installation.

Fiberglass tanks are light enough to be carried to the installation site by a backhoe. They generally have an aeration chamber and clarifier in one structure. A separate trash tank and pump tank accompany the aeration chamber and clarifier.

Both tank types can meet your wastewater management needs. But the systems must be installed according to manufacturer specifications. They also must be watertight to

prevent groundwater from entering the system and overloading the treatment unit and land application area.

## Treatment

The aerobic treatment unit components — pretreatment tank, aeration chamber, air pump and settling chamber — work together to treat the water to a high quality. In the system, wastewater first enters the pretreatment tank or trash trap, which removes plastic objects and other solids that float or settle. Then it enters an aeration chamber, where oxygen supplied by an air pump allows aerobic organisms to live.

Treatment in the aeration chamber is a biological process in which microbes eat the waste and their bodies transform it into nonpolluting material. The microbes change dissolved and solid pollutants into cell mass, nondegradable material and gases such as carbon dioxide, hydrogen and methane.

It is important to maintain an active population of microbes in the system to break down solids. A variety of aerobic microorganisms living together in a mixed state can decompose many kinds of materials. The mixed state keeps the microorganisms and the solids suspended in the wastewater.

Treated wastewater moves from the aeration chamber into a settling chamber or clarifier. The clarifier allows the cell mass and nondegrad-

able materials to settle from the water before it leaves the treatment system. The separation of microbial cells from treated effluent is an important part of the process.

Aerobic treatment processes greatly lower biochemical oxygen demand (BOD), a common measure of pollution, as well as reduce the suspended solids that do not settle to the bottom of the clarifier. This process also removes some of the nitrogen and reduces the number of disease-causing organisms in the waste.

## Design

To select an aerobic unit, first determine the amount of daily wastewater flow from the home or small business. Then choose a Class I aerobic unit that can handle the amount of flow. The Texas Natural Resource Conservation Commission maintains a list of Class I aerobic treatment units approved for sale in Texas. The approved units are listed by company, model number, their rated treatment capacity and whether or not they require a trash tank in the treatment system. Choose a Class I aerobic unit with a rated treatment capacity of more than the amount of flow expected from the residence.

The daily flow rate from a home is based on its square footage and number of bedrooms (Table 1). Most residential aerobic systems can treat 500 gallons a day. This approach to choosing a system assumes that the wastewater

**Table 1. Wastewater flow rates for single-family residence of various sizes.**

Number of bedrooms	Square footage of house	Flow rate from house [without water-saving devices] gal/day	Flow rate from house [with water-saving devices] gal/day
1 or 2	less than 1,500	225	180
3	less than 2,500	300	240
4	less than 3,500	375	300
5	less than 4,500	450	360
6	less than 5,500	525	420

includes an amount of organic matter common for homes; it may be inadequate for certain businesses.

The size of systems for restaurants and other facilities with strong wastes should be calculated by using both the quantity and organic strength of the facility's wastewater. Base the system size on the greater of these two factors.

Aerobic treatment units, marketed in Texas as Class I aerobic treatment units, must be tested and certified according to National Sanitation Foundation International Standard 40 policies for wastewater treatment devices. Aerobic treatment units that pass the tests are approved for sale as Class I units.

## How to keep it working

To remain effective, aerobic treatment unit components need regular maintenance. Poorly maintained systems may not produce water as clean as desired.

For the best care for an aerobic treatment unit, follow the manufacturer's recommendations. Use these general guidelines as a basis for maintaining your system. They are divided into practices provided by a maintenance contractor, and those performed by the homeowner.

The maintenance provider should perform these tasks:

- ✓ Monitor the trash tank to determine the amount of solids accumulating in the tank. Have the tank pumped on a schedule similar to a septic tank pumping interval of every 2 to 3 years.

- ✓ Periodically remove some of the solids in the aeration chamber. Solids form a blanket on the bottom of the clarifier and float in the aeration chamber. Use the "30 minute settle ability" test to determine when the aerobic unit needs to be pumped. When aeration tanks are pumped,

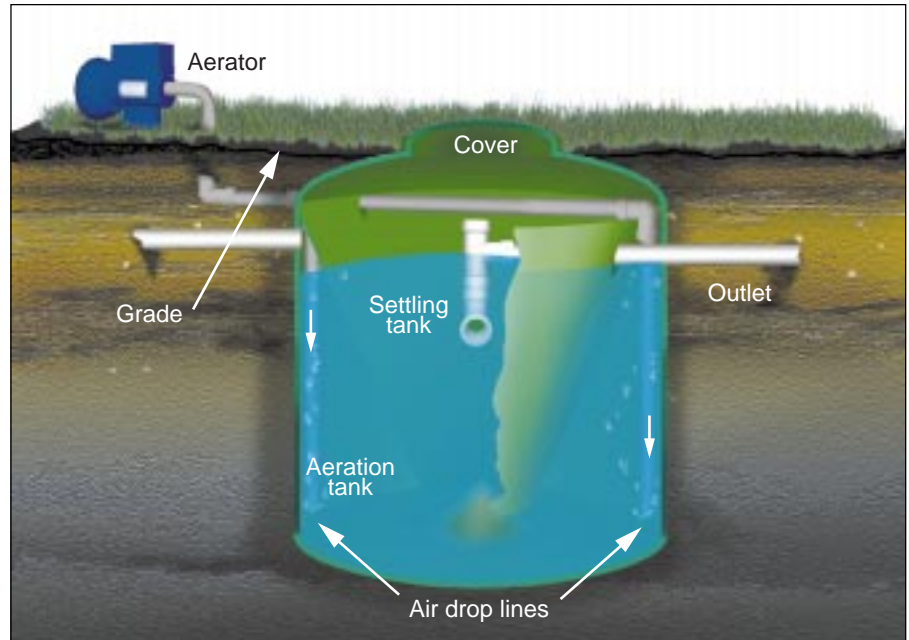


Figure 2: An aerobic treatment unit.

some water that contains microbes is left in the tank bottom, unlike in septic tank pumping.

- ✓ Check the air pump to make sure the air flow rate entering the aeration chamber is constant. Clean the air filter on the compressor inlet to remove dust and fibers. Look for air leaks in the other components of the aeration system. Check the diffusers in the aeration chamber to make sure the air is being distributed properly. The dissolved oxygen concentration in the aeration tank must be more than 1 milligram per liter. A dissolved-oxygen meter can determine the oxygen concentration in the water. When the air flow is reduced, less oxygen is available for the microbes.

Homeowners should follow these general guidelines for operation and maintenance:

- ✓ Keep electricity going to the aerobic treatment unit. It needs a continuous supply of power for the aeration system. The aerobic microbes need the air from the aeration system to survive.

- ✓ Maintain the spray heads in the system. If they are broken, replace them with the same type and model as the original. Do not change the spray head locations. Also, do not place a vegetable garden in the spray area.

- ✓ If an alarm sounds, call your maintenance provider. Also, reduce nonessential water use in the home until the system is fixed.

- ✓ Maintain a landscape cover in the spray field. The grass and plants there will use the water and nutrients being dispersed by the system.

- ✓ Most disinfection systems use chlorine tablets to disinfect the treated water. You must add chlorine tablets to the chlorinator. Be careful when handling chlorine, because chlorine gas can burn your lungs. Disinfection is important; without it, untreated wastewater will be sprayed onto the ground.

- ✓ If the wastewater smells bad when it is being distributed, ask the maintenance provider to evaluate all system components. If they are

working properly, evaluate your habits in the home.

You may be overloading the system with too much organic matter. For example, you may be pouring too much fat and grease down the drain, grinding too much food in the garbage disposal, or sending too many paper products into the wastewater system.

Another problem could be that products toxic to the aerobic microbes are being sent into the system. For example, sending too many cleaning products down the drain can kill the microbes. Also, overloading water to the system, such as when fixtures leak or too much laundry is washed on a single day, dilutes the microbes' food source.

Sending too little waste into the system also can affect it. Microbes need a steady source of organic matter. Homes with periodic usage, such as

lake houses with weekend visits, will have problems maintaining a good population of microbes to treat the wastewater. Also, if you leave home for a couple of weeks, their population in the system could drop for lack of food.

For example, vacationing for 2 weeks lowers the microbial population by reducing the food supply entering the system. Returning home and washing 10 loads of laundry can flush out what population is left with all the laundry water. After a period of low system activity, the microbial population needs time to rebuild so it can function well.

If the aerobic unit uses a spray distribution or subsurface drip distribution system, you need to keep a maintenance contract in force. The maintenance provider will report to the local permitting authority on the

unit's operating condition every 4 months.

The National Sanitation Foundation Standard 40 program provides a way for homeowners to make sure their units can be serviced. Those who cannot find a local maintenance provider can contact the manufacturing company for help in locating one. If the manufacturer does not respond, the homeowner can contact the testing and certification group that tested the unit for help in working with the manufacturer to find a maintenance provider.

Generally, aerobic treatment units are used in conjunction with spray distribution systems that disperse treated wastewater over lawns. To minimize the risk of human exposure to disease-causing microorganisms, it is important that the aerobic treatment unit works properly.

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