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EPA

Decentralized Systems Technology Fact Sheet
Septic System Tank

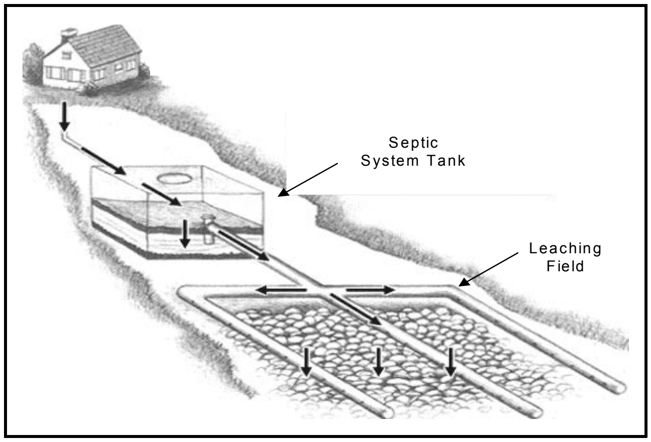
DESCRIPTION

A septic tank is an underground engineered tank consisting of single or multiple units, together with one or more connecting piping systems installed in appropriate soils to receive wastewater flow from one or more residences or public buildings. Wastewater is pretreated in the septic tank before being discharged to a final treatment system. Annually or semi-annually, liquids and solids retained in the tank are pumped into a tank vehicle which transports sewage to a final treatment site.

A septic tank is a traditional wastewater treatment technology using a tank as the primary treatment and holding device. A system to handle multiple residences may be designed as a collection of individual holding tanks with a community treatment and disposal system or a community collection and treatment system. The decision on which type to use is based on available land, existing systems, and maintenance issues. Figure 1 illustrates a septic tank with a leaching field downstream.

The primary device in treatment is the tank, an enclosed watertight container that collects and provides primary treatment of wastewater by holding wastewater in the tank and allowing settleable solids to settle to the bottom while floatable solids (oil and greases) rise to the top. The tank should retain the wastewater for at least 24 hours.

Some solids are removed from the wastewater, some are digested, and some are stored in the tank. Up to 50 percent of the solids retained in the tank decompose, while the remainder accumulate as sludge at the tank bottom and must be removed periodically by pumping the tank.



Source: U.S. EPA, 1991.

FIGURE 1 SEPTIC SYSTEM TANK

There are three main types of tanks for on-site sewage holding and pretreatment:

- Concrete tanks.
- Fiberglass tanks.
- Polyethylene/plastic tanks.

All tanks must be watertight. Water entering the system can saturate the soil absorption field, resulting in a failed system.

From the tank, the wastewater enters a sewer or is passed directly to a treatment system. The most common outlet is a pipe fitting connected to the septic tank. An effluent filter can be placed in the outlet for additional filtering of the wastewater.

Removing more solids from the wastewater helps to prevent clogging the absorption field and causing premature failure.

APPLICABILITY

A holding tank is used to pre-treat sewage and make subsequent treatment systems more effective by allowing a constant flow to enter the treatment system. The effluent from the tank is consistent, easy to convey, and easily treated by either aerobic (with free oxygen) or anaerobic (without free oxygen) processes.

ADVANTAGES AND DISADVANTAGES

Advantages

Subsurface infiltration systems are ideally suited for decentralized treatment of wastewater because they are buried. The tanks are relatively inexpensive and can be installed in multiple tank installations.

Disadvantages

The sludge may pose an odor problem if the sewage remains untreated for an extended period. Provisions for alarms and pumping are necessary if the downstream treatment units go off-line due to power loss or equipment failure.

DESIGN CRITERIA

A holding tank must be the proper size, have a watertight design, and stable structure for proper performance.

Tank size: The size of a tank for a single residence depends upon the number of bedrooms, the number of inhabitants, the home's square footage, and whether or not water-saving fixtures are used. For example, a three-bedroom house with four occupants and no water-saving fixtures would require a 1,000-gallon septic tank. The tank should be designed to hold at least one week of waste flow (U.S. EPA, 1992.) Holding tank systems for multiple units should include the above parameters for each residence. Commercial inputs should be evaluated on a case by case basis and may need pre-treatment to remove oil, grease, or solids.

Tank design: A key factor in the holding tank's design is the relationship between the liquid surface area, the quantity of sewage it can store, and the rate of wastewater discharged. Each of these factors will impact the tank efficiency and the amount of sludge it retains.

The greater the liquid's surface area, the more sewage the tank can accommodate. As solids collect in the tank, the water depth decreases, which reduces the time sewage flow is retained in the tank. Less solids will settle in the tank, resulting in increased solids in the tank effluent that may have a negative impact on the final treatment process.

Placing risers on the tank openings makes it easier to access the tank for inspection and maintenance. If a septic tank is buried more than 12 inches below the soil surface, a riser must be used on the openings to bring the lid to within 6 inches of the soil surface. Generally, the riser can be extended to the ground surface and protected with a lid.

Hydraulic Loading Rate

The design capacity of the holding tank is related to the hydraulic loading rate of the treatment system. For a ground absorption system, it is determined by soil characteristics, groundwater mounding potential, and applied wastewater quality. Prolonged wastewater loading will clog the infiltrative surface, reduce the capacity of the soil to accept the wastewater, and may back up the wastewater into the holding tank. However, if the loading is controlled, biological activity at the infiltrative surface will maintain waste accumulations in relative equilibrium so that reasonable infiltration rates and pass through in the holding tank can be sustained.

PERFORMANCE

To keep a holding tank system operating efficiently, the tank should be pumped periodically. As the system is used, sludge accumulates in the bottom of the tank. As the sludge level increases, wastewater spends less time in the tank, and solids are more likely to escape into the absorption area. Properly sized tanks can accumulate sludge for at least three years.

The frequency of pumping depends on:

- Tank capacity.
- Amount of wastewater flowing into the tank related to size of household(s).
- Amount of solids in the wastewater. For example, there will be more solids if garbage disposals are used.
- Performance of the final treatment system.

OPERATION AND MAINTENANCE

A well-designed holding tank requires limited operator attention. Management needs include tracking system status, testing for solids accumulation, evaluating pump performance, and monitoring system controls. Monitoring performance of pretreatment units, mechanical components, and wastewater ponding levels above the filtration surface is essential. If a performance or level change is noted, the operator should inspect the system to determine if additional service is required. Routine servicing of a holding tank is limited to annual or semiannual inspection and cleaning, if necessary.

COSTS

The costs for tanks greatly vary for each site. Land and earthworks are the most significant capital costs. Where a select fill must be used to bed the tank, the cost of transporting this material may be significant. The factors that affect costs include location, access, subsurface site conditions, and the type of tank installed. A general cost range for tanks is from $1.00 to $4.00 per gallon. (A 1,000 gallon tank installed in the City of Austin cost $2,000.) Other costs include installation of equipment to transport the wastewater to the holding and/or treatment site.

REFERENCES

Other Related Fact Sheets

Septic Tank Leaching Chamber
EPA 832-F-00-044
September 2000

Septic Treatment/Disposal
EPA 832-F-99-068
September 1999

Septic Tank - Soil Absorption Systems
EPA 832-F-99-075
September 1999

Other EPA Fact Sheets can be found at the following web address:
http://www.epa.gov/owmitnet/mtbfact.htm

1. Barret, Michael E. and J. F. Malina, Jr., Sep. 1, 1991. *Technical Summary of Appropriate Technologies for Small Community Wastewater Treatment Systems*. The University of Texas at Austin.

2. City of Austin, "Septic Tank". Site accessed May 2000. http://www.ci.austin.tx.us/wri/treat1.htm

3. Corbitt, Robert A., 1990. *Standard Handbook of Environmental Engineering* McGraw-Hill, Inc., New York, New York.

4. Crites, R. and G. Tchobanoglous, 1998. *Small and Decentralized Wastewater Management Systems,* WCB. McGraw-Hill, Inc. Boston, Massachusetts.

5. U.S. Environmental Protection Agency. 1980. *Design Manual: Onsite Wastewater Treatment & Disposal Systems*. EPA Office of Water. EPA Office of Research & Development. Cincinnati, Ohio. EPA 625/1-80/012.

6. U.S. Environmental Protection Agency. Sep. 1992. *Design Manual: Wastewater Treatment and Disposal for Small Communities.* EPA Office of Water. EPA Office of Research & Development. Cincinnati, Ohio. EPA 625/R-92/005.

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