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The Care and Feeding of Your Septic System

BY BARRY CHALOFSKY

Do you know what happens when you flush the toilet? While it usually isn't a topic discussed at cocktail parties, it can be a critical issue for many homeowners. People who live in a city rarely think about it because their waste usually goes through a central sewer system to a wastewater treatment plant. Approximately 25 million suburban and rural homeowners using onsite wastewater systems, however, do need to pay attention, because a failure in their system could affect their property or even their drinking water. Unlike sewers, onsite systems collect, treat and dispose the wastewater from your house right on your property. Therefore, the proper care and maintenance of these systems is entirely up to you.

What Type of System Do You Have?

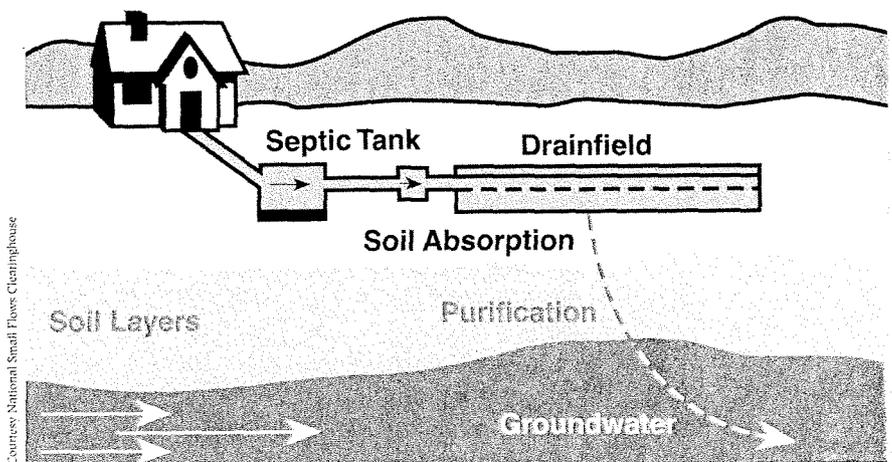
Most older homes have conventional septic systems. However, some may still have cesspools (a large brick, stone or concrete vault where solids can settle and liquid can leak out) or a seepage pit (a septic tank connected to a dry well or pre-cast tank with holes surrounded by gravel) or even a privy. Cesspools and seepage pits were popular prior to the 1950s, but they are no longer allowed in most areas of the country. A privy, or an outhouse, is simply a structure built around a hole in the ground that can be relocated when the hole is full — these are usually illegal, although some may be found in remote areas.

The first step is to determine what kind of system you have. This is not always easy since these systems are all buried in the ground. Go in the basement or crawlspace and try to determine the direction that the wastewater pipe is exiting the house. Also look for pipes or covers protruding from the soil. In winter, the soil over the tank is usually the last to be covered by snow and the first place where snow melts (this sometimes happens over the disposal field as well, but often the liquid has cooled enough to have little effect). If you can-

not find the system, contact your local health department, which may have record of its installation, or you may need to hire a septic-system inspector to identify the type and location. Some newer systems, particularly in areas where the water table is high or where there is too much clay in the soil to allow the water to seep through, may have a large mound in the yard. In this case, the disposal field is actually located within the mound in order to provide enough soil to filter out pollutants.

How Does a Septic System Work?

The typical septic system includes a septic tank (or tanks), typically about 9 feet long, 4 to 5 feet wide and 5 feet tall, that is designed to capture solids from household wastes, and a disposal field (also referred to as a leach field, drainfield, absorption bed or absorption field), which is designed to dispose of the liquid wastes. Wastes go from the toilet, sink, shower or washer through the indoor plumbing to the septic tank. The tank is a watertight, underground receptacle where the solid wastes are broken down by bacteria. Septic tanks may be rectangular or cylindrical and may be made of concrete, fiberglass or polyethylene. As the wastes move through the tank, the solids settle to the bottom and form a layer of sludge, while the liquids pass through the outlet pipe. Anaerobic



bacteria (bacteria that live in the absence of free oxygen) decompose the solid wastes over time.

As the liquid passes through the tank, lighter particles and grease rise to the surface to form a floating scum layer that remains in the tank. The liquid that passes through the tanks still contains large concentrations of harmful bacteria and organic matter. The liquid then goes through the outlet pipe to a distribution box or a manifold, which distributes wastewater to perforated or

The components of a typical residential septic system. A properly built and maintained system ensures a healthy home environment while protecting precious groundwater from waste contamination.

open-jointed pipes buried in shallow, gravel-filled trenches. Baffles installed at the outlet help prevent solids and scum from leaving the tank and entering the disposal field. Liquid waste, or effluent, flows out of the pipes and is evenly distributed into the soil through the disposal system. The soil below the drain field provides the final treatment and disposal of the septic tank's effluent. After the effluent has passed into the soil, most of it percolates downward and outward, eventually entering the groundwater. A small percentage is taken up by plants through their roots or evaporates from the soil.

The septic tank may be either single, divided or dual. It should have at least one inspection port (a pipe with a cover), and a pumpout port covered by a small manhole cover (although this may be below the ground surface).

Why Do Septic Systems Fail?

Most septic systems are designed to have a lifetime of 20 to 30 years, under the best conditions. However, many septic systems will fail before this time. Eventually, the soil around the absorption field becomes clogged with organic material, making the system unusable. Many other factors can cause the system to fail well before the end of its "design" lifetime. Pipes blocked by roots, soils saturated by storm water, crushed tile, improper location, poor original design or poor installation can all lead to major problems. But by far the most common reason for early failure is improper maintenance by homeowners. When a system is poorly maintained and not pumped out on a regular basis, sludge (solid material) builds up inside the septic tank, then flows into the absorption field, clogging it beyond repair.

Solids are always accumulating in the septic tank because the rate of decomposition is much slower than the rate at which sewage is added. In addition, some solids will never decompose. Also the fats and grease that form the scum layer will accumulate faster than the rate of decomposition. This scum layer is held in the tank by the baffles. If the baffles become damaged, the scum may enter the disposal pipes and cause them to clog and malfunction. Failures may also occur if you dispose of inert, toxic or non-biodegradable substances into your system. These materials will not decompose and may either kill the good bacteria or simply clog the tank.

Additionally, large surges to the system from too much usage (like the party your teenagers have when you are away) can either cause an overflow or disturb the balance of the system. Water overload occurs when the disposal field is flooded with more water than it can effectively absorb, thereby reducing the ability of the system to drain wastes and filter sewage

before it reaches groundwater. It also increases the risk that effluent will pool on the ground surface and run off into surface water or down nearby water well casings.

Maintaining Your Septic System

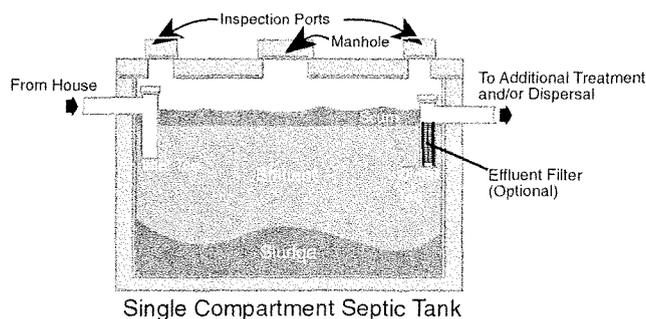
Locate and diagram your septic tank and disposal field.

As stated earlier, many homeowners, particularly those who live in older houses, are not sure where their tank and field are located. Once you have identified the location of the system, you need to find the pumpout port. This may be a surface or underground manhole, or a riser pipe that is at the soil surface. All of the components of the system, the tank, pumpout ports, inspection pipes and disposal field, should be diagrammed on a map that you keep in a handy location.

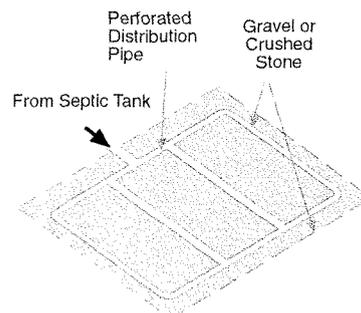
Inspect and pump out your tank regularly. The most important maintenance is to pump out your tank on a regular basis. When the tank is not cleaned, solids build up until they are carried into the disposal field, where they block the flow of liquid. The frequency depends on the size of the tank and the number of people it services. Tanks should be inspected at least once every two years to determine the rate of sludge (solids on the bottom of the tank) and scum buildup. With ordinary use and care, a septic tank usually requires cleaning every three to seven years, although there are no set rules since the usage will vary with each homeowner's circumstances. According to Daniel Freeman, American Home Service Company, Poughkeepsie, N.Y., "When a tank is not pumped sufficiently, often there is less settling time for waste entering the tank, so small bits of floating solids are pushed out into and begin clogging the soil-absorption system, shortening and eventually ending its life." If you use a sink-mounted garbage-disposal unit, you may need to pump out more frequently. However, in many cases, septic tanks can be operated for up to five years without pumping, if they are maintained properly.

Depending on the size of the tank and your location, plan on about \$200 for each pumpout. Pumpouts must be performed by a licensed septic-tank cleaner (also known as a honey dipper). A non-licensed cleaner may simply empty your tank and then dispose of the wastes in the nearest stream. Ask the service technician to check the tank baffles for possible damage. While the tank is open, the technician can also run some water from a hose with a tracer dye added, into the distribution box. If no effluent shows on the surface of the ground, then the leach field is most likely functioning properly.

A word of caution: Toxic gases build up in septic tanks;



The septic tank (left) is where solids settle and are acted upon by bacterial agents, while the semi-treated effluent continues to flow out to the leach field (right).



therefore, never allow anyone except a professional to go into the tank. You should exercise caution when simply peering in the tank. Also, check the cover to the manhole, because children can fall through a rusted manhole cover.

Don't plant trees or bushes near your disposal field. Trees and bushes have extensive root systems that can damage the disposal field. Tree roots can move 30 to 40 feet from the trunk base and break, disrupt or clog the pipes. Margeret Lauderbach writes in *The Idaho Statesman*: "Willows love water, and woe to the landowner who plants one within 50 feet of a sewer line or septic system." Grass is the best vegetative cover for the disposal field. Also, don't drive vehicles or heavy equipment over the disposal field. This is especially important if you are constructing an addition or doing some other type of construction, since construction vehicles can be particularly heavy.

Reduce water flow to your system by conserving water. Excessive water use can compromise your system's ability to treat and dispose wastewater. Reduce the amount of water by using low-flow toilets and showerheads. Try to distribute dishwashing and laundry throughout the week rather than at one or two times. Fix leaking toilets and faucets. Don't connect downspouts or sump pumps to the septic system.

Be careful about disposing items into the system. Try to avoid pouring cooking oils, fats and grease into the kitchen sink. Also avoid using a sink-mounted garbage disposal, since this will increase the wastes entering the system. Don't flush non-biodegradable items like disposable diapers, cat litter, filtered cigarettes, sanitary napkins, plastic tampon applicators, paper towels, condoms or similar materials. Never flush toxic substances like used motor oil, oil or acrylic paints, varnishes, photographic solutions, pesticides, insecticides, fertilizers, disinfectants, paint thinners or solvents. Many of these products can pass directly through the septic system and contaminate groundwater. They can also kill the microorganisms that decompose the wastes and can damage the soil in the disposal field.

Do not use caustic drain openers for a clogged drain. Instead use boiling water, baking soda and vinegar, or a drain snake to free up clogs. Clean your toilet, sinks, shower and tubs with a mild detergent or baking soda, rather than the stronger and potentially system-damaging commercial bathroom cleansers. If a water softener is used in the home, the salt recharge solution should not be allowed to enter the system if the predominant soils in the disposal field are very fine textured and drainage is very slow. In these situations, sodi-

um in the softener recharge solution may damage soil structure in the disposal field and plug the system. If you have a water softener, the size of the absorption field must be increased to accommodate the additional flow.

Avoid additives. Some products are marketed with the promise that they can keep septic systems operating smoothly, correct system upsets, or do away with the need to pump the tank periodically. These additives are either chemical or biological. Chemical additives are strong acids, alkalis or organic solvents. Biological additives are cultures of harmless bacteria, plus waste-digesting enzymes. These sometimes contain yeast cultures.

Although some manufacturers of additives have test data showing how their products perform, there has been almost no independent verification of these products in full-sized septic systems. The information that exists does not show improved long-term performance, and there is no evidence of significant benefits. The amount of material added with each dose of product is very small compared with the biological material already present and working in the tank.

Occasionally a system suffers an upset when the septic-tank bacteria are harmed or destroyed. This can happen if the home is vacant for a long period and the tank receives no fresh wastewater, or if strong cleaning agents are flushed down the drain. After a few days of normal use, the biological system in the tank will reestablish itself. In this situation, the biological additives may help speed the recovery of the septic tank.

While the biological additives are not likely to be harmful, the chemical additives could harm your system.

MORE INFORMATION

Contact your municipal or county health department for more detailed information. They can also provide you with the appropriate local and state regulations governing construction of septic systems. Other information sources include:

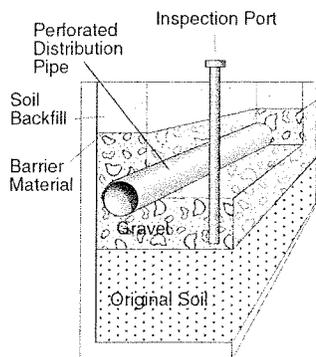
U.S. Environmental Protection Agency
www.epa.gov/owm/mtb/decent/index.htm

National Small Flows Clearinghouse West
Virginia University
800-624-8301
www.nsfv.wvu.edu
(Free or inexpensive brochures and technical manuals)

The Home Inspection and Construction Information Website
www.inspect-ny.com/septic-book.htm

The University of Minnesota Septic System Web
www.bae.umn.edu/septic

Septic Resources and Information Online
www.septic-info.com



A cross section of a trench disposal system. Waste drips down through the perforated pipe and is progressively filtered by the gravel, soil and sand.

Although they may unblock a clogged disposal pipe, they can also contaminate drinking water or groundwater supplies. Avoid using cleaners that contain sodium hydroxide, potassium hydroxide or hydrogen peroxide. Also do not use any product that contains toxic chemicals in excess of 1 percent by weight, such as trichloroethane, trichloroethylene, tetrachloroethylene, methylene chloride, benzene, carbon tetrachloride, toluene, naphthalene, trichlorophenol, pentachlorophenol, acrolein, acrylonitrile or benzidine. These products have the potential to sterilize your system temporarily and the resulting passage of raw sewage into the disposal field will hasten its failure. In addition, the acid and alkali products can corrode the plumbing and the tank. Also, the chemicals can pass through the system and infiltrate the groundwater or endanger nearby wells.

How Do You Tell if Your System Is Failing?

Septic-system failure is not always evident. However, there are various indicators that are clues to a potential problem.

- Sewage from toilets (a black liquid with a disagreeable

odor) may backup in your drains.

- Toilets and other drains may flush slowly, despite the use of plungers or drain-cleaning products.

• Surface flow or ponding of wastewater may be seen on the ground near your septic system (unlike in the house; however, the water may not have a strong odor).

• Lush green grass may grow over the absorption field, even during dry weather, which indicates that an excessive amount of liquid from your system is moving up through the soil, instead of downward, as it should. (With due respect to Erma Bombeck, the grass in a healthy lawn shouldn't be greener over the septic field.)

• Testing of drinking water from your well reveals the presence of nitrates or bacteria, which indicates that liquid from the system may be flowing into the well through the ground or over the surface. (Water test kits are available on the Internet.)

- A buildup of aquatic weeds or algae in lakes or ponds adjacent to your home, which may indicate that nutrient-rich

REPLACEMENT OPTIONS

In some situations you may not be able to fix a failed septic system by just replacing the disposal field. Many older houses were built on small lots or in places where there was limited suitable disposal area in the first place. The original system may have also been underdesigned, or you may have significantly expanded the house. This is particularly common in vacation areas where seasonal homes have been expanded to year-round residences. In addition, the property may have been subdivided since the original house was built, and/or the setback requirements (distance to property lines, adjacent wells or streams) may have changed since the system was installed.

More importantly, federal, state and local agencies are increasing their efforts to clean up environmental contamination from nonpoint sources of pollution (sources that are not from discrete pipes, like contaminated

runoff and failed septic systems). Even properly functioning septic systems do not adequately treat nitrates, which is a nutrient that causes contamination of nearby lakes and streams. As a result, there is a growing trend toward stricter standards when a septic system has to be replaced.

Fortunately, the list of options is getting longer every year as regulation fosters additional improvements. The following is a brief description of some of the latest technologies.

Gravelless and Chamber Systems

A gravelless system is an onsite system that does not use gravel in its disposal field trenches. Instead, these systems may use alternative materials, such as rubber, sand, fiber membrane, plastic, glass, or expanded clay, shale or polystyrene foam chips. One recent addition is chips made from old tires, which also reduces the amount of old tires in our landfills. Cham-

ber systems are another type of gravelless system that use plastic chambers to disperse the liquid in the field. Although gravel is a common natural resource and is usually fairly inexpensive, high-quality gravel is not always available. In certain parts of the country, the cost of transporting a heavy shipment of gravel can raise the cost of onsite system construction considerably. Because some alternative media materials are lightweight, heavy equipment may not be needed to haul the media to the installation site. This can help minimize the disruption to property that machinery can cause. Also, the lighter-weight media is easier to handle, which can reduce labor costs and allow the systems to be constructed in areas inaccessible to heavy machinery.

In general, gravelless systems are as easy to maintain as conventional systems. However, many are proprietary designs, and therefore

homeowners should follow manufacturer recommendations concerning operation and maintenance.

Mound Systems

Mounds are small hills composed of sand under a soil cover with perforated disposal pipes that are fed by a pump from the septic tank. The main purpose is to provide additional treatment to the wastewater before it enters the natural environment. Mound systems are designed to overcome site restrictions, such as slow- or fast-permeability soils, shallow soil cover over porous bedrock, and a high water table.

On the plus side, mound systems enable the use of land that would otherwise be unsuitable for in-ground or at-grade onsite systems. Mounds can also be used in most climates. On the negative side, construction costs are typically much higher than those of conventional systems, the location of the

septic-system waste is leaching into the surface water (this may also result from excessive fertilizing).

- Unpleasant odors around your house may be caused by an improperly vented plumbing system or a failing septic system.

Remember that effluent on the ground is a serious health hazard and should be corrected as soon as possible. Do not allow children or pets near a failing disposal field.

What if the System Fails?

Contact your local health department if you suspect that your system is failing. Also seek the services of a professional septic-system contractor. Work with both of these parties to develop a plan of action. A major concern for older houses is that the septic system may be underdesigned, improperly located or in a location that will no longer support the type of system installed. In some cases, where you have enough land, you may be able to just put in a new disposal field. However, in some situations, particularly where you don't have enough land for a new field, you may have to replace

the entire system with a new one that is up to today's codes (see sidebar on page 52). This may involve significant expense. Nevertheless, while it may be costly, a properly functioning septic system is essential to the use of your home and the health and safety of your family.

Last Thoughts

A properly operated and maintained septic system can provide you with up to 30 years of service while protecting the environment from water-quality contamination. While it may seem more difficult to live with a septic system, with only a little effort, you can have a system that will last for many years. If you don't take the time on a regular basis however, you may have to pay for major repair or replacement work in the future. In this case the old maxim clearly applies: An ounce of prevention is worth a pound of cure. ■

Barry Chalofsky is an environmental planner and the author of The Home and Land Buyer's Guide to the Environment. For more information, visit his website at www.erols.com/profed.

mound may affect drainage patterns and limit land-use options, the systems require pumps or siphons, and the mounds are usually not aesthetically pleasing.

Sand Filters

Sand filter systems have been used since the late 1800s. They can be used where there is shallow soil cover, inadequate permeability, high groundwater and limited land area. They are a low-cost, mechanically simple alternative. There are various types of sand filters, including intermittent, trickling and recirculating. In general, their operations are similar in that the wastewater receives primary treatment in a septic tank or an aerobic treatment unit and then is pumped to the sand bed where it is evenly distributed over the top of the sand filter. As the wastewater passes through the sand filter, treatment is accomplished through physical and chemical means, but mainly by microorganisms attached to the filter

media. The treated wastewater is collected in underdrains at the bottom of the sand filter and is then transported to a line for disposal.

Sand filters produce a high-quality effluent that can be used for drip irrigation. The disposal fields can be small and shallow, they have low energy requirements, construction costs are moderately low, and they can be installed to blend into the surrounding landscape. On the downside, the land area required may be a limiting factor, regular (but minimal) maintenance is required, odor problems could result, clogging of the filter media is possible, and they can be sensitive to extremely cold temperatures.

Home Aerobic Systems

Aerobic systems are similar to septic systems in that they both use bacteria to treat wastewater. While septic systems rely on anaerobic treatment (bacteria that does not require oxygen), aerobic systems require oxygen for the

bacteria to thrive. Aerobic treatment units use an electric-powered mechanism to inject and circulate air inside the treatment tank. For this reason, aerobic systems cost more to operate and require more routine maintenance than most septic systems. However, when properly operated and maintained, aerobic systems can provide a higher quality wastewater than septic systems. Aerobic systems require regular maintenance, and abuse or neglect can easily lead to system failure. Most manufacturers include the cost of the first two years of service in the price of purchase; however, service is an ongoing necessity.

On the plus side, aerobic systems can provide a higher level of treatment than a septic tank (particularly for nitrates) and can often be placed where conventional systems can't because they generally require a smaller disposal field. The disadvantages are that they are more expen-

sive to operate than a septic system, require electricity, have mechanical parts, and require more maintenance. There are many different designs and more are being developed each year.

There are other alternatives, such as pressure dosing systems, composting toilets, drip-irrigation disposal, even constructed wetlands and greenhouse systems. Your local health department will be familiar with the regulations and permit requirements for your area, as well as which onsite options are best for your particular property. Be aware that replacement systems often require more permits than conventional systems. One thing is certain, as regulation increases and site suitability decreases, technology will continue to provide greater opportunities to replace the conventional septic system with more environmentally sound disposal methods.

Barry Chalofsky