

Home & Environment

Operating and Maintaining an Onsite Sewage System

Gary C. Steinhardt and Philip R. Owens, Purdue University Agronomy
Natalie J. Carroll, Purdue University Agricultural and Biological Engineering
Alan Dunn and Denise Wright, Indiana State Department of Health

Nearly half of all Hoosiers live in residences with septic systems (onsite sewage systems). These systems can effectively treat sewage and protect you and the public from disease that is carried by human waste.

This publication helps those who live in homes or operate businesses that have onsite sewage systems. We will explain how onsite sewage systems work, how to keep them working, and provide recommendations for living with onsite sewage systems, including the operation and maintenance of septic tanks, outlet filters, distribution boxes, and absorption fields. The goal is to help you lengthen the effective lifespan of your onsite sewage systems and avoid the unpleasant experience of sewage backups or other failures that cause inadequately treated sewage to leave the site.

Successful onsite sewage systems are based on five key factors:

1. Accurate information about the soils on the site.
2. A proper design based on the soils information.
3. Construction that accurately follows the design plans.
4. Installation under favorable weather.
5. Ongoing care and maintenance after installation.

If one of these key components is missing then a premature failure of the system is likely. Ongoing care and maintenance is often a culprit in onsite sewage system failures. Many homeowners have little understanding of, or interest in, the operation of their onsite sewage systems until problems arise.

One challenge is that people often feel that beyond their initial investment in an onsite sewage system, sewage disposal is free. Nothing could be further from the truth. Safely disposing of human sewage is costly. Economists have suggested that the lifetime cost of a well-managed onsite sewage system is comparable to the lifetime cost paid to a central wastewater treatment plant.

Purdue Agronomy

www.ag.purdue.edu/AGRY

Purdue Agricultural and Biological Engineering

engineering.purdue.edu/ABE

Indiana Environmental Health Association

www.iehaind.org

Indiana State Department of Health

www.state.in.us/isdh

Even if you've lived with an onsite sewage system all your life, you may be blissfully ignorant of the ticking time bomb in your backyard. And if you have moved from an urban area or community that provided water and sewer service, you may be bringing a water-luxurious lifestyle that is incompatible with an onsite sewage system. Another challenge is, in most cases, the septic tank and soil absorption field were already in place when you moved in



Figure 1. The basic design of an onsite sewage treatment system

(even to a newly built house), which means you probably were not around when the system was installed.

Erma Bombeck wrote *The Grass Is Always Greener Over the Septic Tank* about life in the suburbs. But anyone who has experienced an onsite sewage system failure may not appreciate the humor in the book's title. Sewage that backs up in drains or in a seeping, smelly area of the yard is not just unpleasant; it is potentially hazardous to health and robs you of the enjoyment of your property. Unfortunately, a failure is often an expensive introduction to the importance of onsite sewage system maintenance.

How Onsite Sewage Systems Work

Sewage is liquid-carried waste that is generated as part of normal living processes. Sewage has many sources in the home: toilets, bathtubs and showers, sinks, and washing machines.

It may also include water from the periodic regeneration of the water softener, if one is present. In Indiana it is illegal to discharge water from this process above ground. Often, water from softener recharge is run through the onsite sewage system although this is not required.

Onsite sewage systems work on the same principle as wastewater treatment facilities. Treatment involves a three step process:

1. Separation of the waste.
2. Treatment of the waste by anaerobic and aerobic organisms.
3. Disposal of the remaining products.

The pipes that transport sewage from the house to the tank and that transport the effluent from the tank to the absorption field are typically 4 inches in diameter. Watertight joints are necessary to prevent root penetration and leakage. New constructions typically use plastic pipe, while vitrified clay and cast iron are common in many older homes.

In a conventional onsite sewage system (Figure 1), sewage flows from the household sewer into a watertight, underground septic tank. From the tank, sewage flows to a distribution box and out to a soil absorption field for final treatment.

The septic tank is probably the best-known component of an onsite sewage treatment system. It receives a wide range of waste from the building sewer. The waste in a typical septic tank includes pathogens, nutrients, and even heavy metals (from makeup). In a properly functioning septic tank, the waste forms three distinct layers (Figure 2). Heavy solids settle to the bottom of the tank to form a sludge layer. Greases and fats float to the surface to form a scum layer. The middle, and largest, layer is the liquid waste (or,

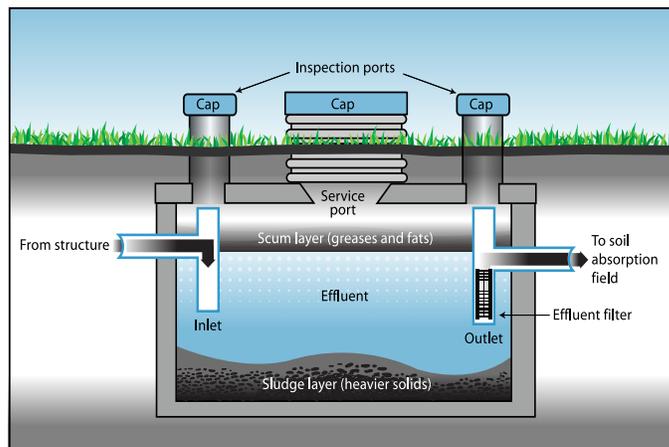


Figure 2. This diagram of a septic tank shows the three layers of waste: scum, effluent, and sludge.

effluent). The sludge and scum layers resist treatment by the bacteria that break down the effluent.

Just before the tank is an inlet baffle, which serves many important functions. First, the baffle slows the sewage as it enters the tank. If the sewage enters too fast or in too great a volume, it will disturb the sludge and scum layers. If the sludge and scum layers are stirred up, some may exit the tank, which could plug up the absorption field because scum and sludge may never degrade. An accumulation of scum and sludge can eventually cause the absorption field to fail.

When an onsite sewage system is working properly, sludge and scum build up in the septic tank over time and must be periodically pumped out. A slight opening left between the top of the baffle and the tank cover allows gases generated in the tank to vent back through the house sewer stack. Venting prevents an air lock from developing and permits the smooth flow of wastewater through the system.

Indiana regulations require that the volume of a septic tank be based on the number of bedrooms in a home. The formula typically calls for the tank volume to be large enough to retain effluent for two to three days. After sufficient retention time, the treated effluent flows through an outlet filter to the soil absorption field for final treatment by aerobic organisms that destroy potentially hazardous organisms. A baffle located at the outlet prevents floating scum from leaving the tank.

When effluent leaves the septic tank, it flows to a distribution box, which has a number of openings for distribution pipes that evenly distribute the partially treated effluent to the absorption field for final treatment. To ensure even distribution of the effluent, distribution boxes must be level and stable.

An absorption field usually consists of a series of trenches that begin after the distribution box. Each trench contains a

distribution pipe that must be laid on the level to uniformly distribute effluent. The pipe is embedded in coarse gravel or similar media. The effluent trickles out through holes in the pipe, and then down through the gravel and into the soil.

Organic matter in the effluent forms a biomat on the bottom and sides of the absorption trench. The biomat filters out the remaining solids and allows the effluent to pass into the soil. In some cases there can be too much organic matter in the sewage, so it may be necessary to add a secondary treatment system to reduce the organic content of the effluent before it is discharged to the soil absorption field.

The area required for an absorption field in Indiana is based on the volume of effluent that must be treated and the characteristics of the soil in which it is placed. Soil texture (sand, silt, and clay content) and structure determine its capacity to transmit effluent — areas with more sandy soils may require smaller fields than areas with more clayey soils. After effluent leaves the pipe, organisms in the soil break down the organic matter and hazardous organisms. About 24 inches of well-aerated soil are necessary to treat the effluent and render it harmless. Plants can take up the nutrients, and harmless water is free to slowly percolate to the groundwater.

A well-designed absorption field in the right kind of soil, properly constructed and maintained, should function trouble-free for a long, long time. However, many soils in Indiana are not well suited to onsite sewage systems — at least, not to the conventional system shown in Figure 1. Soil with slow permeability or a high water table make the sequence of treatment described above impossible. In such cases, Indiana allows for more complex designs, including pressure distribution and elevated sand mound systems. These alternative systems have their own maintenance needs but the principle of all of onsite sewage systems is roughly the same: retain effluent for at least two days in the septic tank for anaerobic treatment, and make the effluent pass through at least 24 inches of aerated soil for final treatment.

Living Successfully with an Onsite Sewage System

Those two simple requirements for successful sewage treatment can be complicated by poor design, faulty construction, lack of maintenance, or failure by the occupants to practice the lifestyle an onsite sewage system requires. These shortcomings can reduce the life of an onsite sewage system and add substantial cost and aggravation to an already stressful situation.

To maintain the health of an onsite sewage system, you need to:

- Conserve water effectively.
- Control what goes into the system.

- Protect the absorption field.
- Perform periodic inspection and maintenance.

Conserve Water Effectively

Putting less water into the soil absorption field is an important part of extending the life of an onsite sewage system. As you add water to the septic tank, effluent is pushed out into the absorption field. If the effluent is not sufficiently treated, problems can develop quickly.

The soil in the absorption field can only accept so much effluent at a time. If you use more water than the soil can absorb, the effluent will pond in the absorption field and may result in inadequately treated sewage coming to the surface or backing up in the plumbing.

There are several effective ways to manage water use, including the six suggestions below.

► *Reduce Water Use From Toilets*

Reducing the amount of water you need to flush a toilet will help reduce the load on your system.

Newer bathroom fixtures are designed to use less water than older models and still be just as effective. Of course, the cost of replacing a working toilet may be prohibitive — still, a new toilet may cost less in the long run than repairing a failed sewage system. At a minimum, you should consider water-efficient models carefully whenever you need to replace a toilet.

Some people have suggested a low-cost way to use less water: placing items in the toilet tank to use less water. While this may work for some purposes, it may not be effective. Most toilets are designed to operate with a certain volume of water and making modifications, however well intended, may not be satisfactory. If the fixture becomes unduly sluggish due to insufficient water pressure, then additional flushes may be required, which defeats the purpose.

► *Avoid Automatic Flush Bowl Cleaners*

There is a great temptation to use automatic flush bowl cleaners because they are so convenient. However, the cleaners contain anti-microbial agents that will be flushed into the septic tank, which could unintentionally affect the organisms in the tank that are so critical to breaking down the waste.

► *Install Water-conserving Faucets*

Most faucets deliver water through an aerator at 4 gallons per minute. Low-flow aerators can cut this flow to 2 gallons per minute. Over the course of a day, this can save an average family of four approximately 15 gallons per day. The cost of these replacements is very reasonable.

► *Install Water-saving Showerheads*

Showers are better for onsite sewage systems than baths, especially if you can limit showers to five minutes or less. For some families, short showers may be wishful thinking. But a sure-fire way to reduce water use is to install water-conserving showerheads. Two types of showerheads are available: flow restricting and aerating. Both types reduce a standard 6-gallon per minute flow to 3 gallons per minute. You might also consider installing a valve that allows you to turn off the shower while you wash, and then turn it on again for rinse. Individuals who use showers to relax may need to consider alternative methods while living on an onsite sewage system.

► *Repair Plumbing Leaks Immediately*

Drips from faucets are easy to spot and you must address them promptly. Leaks only get worse, and even a minor leak can severely stress an onsite sewage system.

Finding toilet leaks in toilets may be more of a challenge to spot, but you should also repair them immediately. If you suspect a leak, add a little food coloring to the water tank. If the toilet has a leak, the coloring will soon show up in the bowl.

► *Pay Attention to Laundry*

Laundry can add significant amounts of water to the onsite sewage system. In Indiana, all sewage from the home must go into the onsite sewage system. When you need to replace a washing machine, always look for models that use the least water possible. Smaller or front-loading machines may be more appropriate choices if you have an onsite sewage system.

When you do wash clothes, do full loads whenever possible. When full loads aren't possible, use the machine's smaller load setting.

Always use liquid detergent. Powder detergents have a solid residue that will add to the sludge in the bottom of the septic tank, which will require more frequent cleaning. Normal amounts of detergents are generally safe. Bleach may be acceptable, but be careful not to use it excessively. Too much bleach can kill the microorganisms in the septic tank, resulting in a "dead" tank.

Avoid doing laundry early in the morning and late at night. These are usually the times of peak use of the onsite sewage systems for showers. Spacing out loads at odd hours through the week is a much better way to ensure that the onsite sewage system is not stressed.

Another issue that is certainly a personal choice is how frequently you wash your clothes. The fewer loads you wash, the less stress you place on the system. You might consider having children change from school clothes to play

clothes when they come home. This practice may cut how often you need to wash the school clothes. Other choices may present themselves with some careful thought.

In severe cases, you may wish to consider washing clothes at a coin-operated laundry.

Control What Goes Into the System

Keeping your onsite sewage system in good working condition means you need to pay close attention to what goes in it. Here are three things you should monitor carefully.

► *Avoid Garbage Disposals*

Garbage disposals are a wonderful convenience, but they do not promote long life for onsite sewage systems. With each use, disposals add appreciably to the sludge in the bottom of the septic tank, so the tank will require more frequent pumping. For that reason, you should consider removing or not using garbage disposals.

Coffee grounds, which are commonly poured down the drain, are another problem. As with the rest of your garbage, coffee grounds are immune to the effects of microorganisms in the septic tank. Coffee grounds and other waste add to the solid material in the tank and will require removal before it plugs the system. If a material cannot be digested in the human gut it cannot be digested in the septic tank.

► *Keep Fats, Oils, and Grease Out of Drains*

It is tempting to pour fats, oils, and greases from cooking down the drain. Unfortunately, this adds greatly to the scum layer in the septic tank, which can lead to premature system failure. These substances can also plug the lines throughout the system, which can also lead to failure. Septic treatment processes can never break down these substances, so the only alternative is to pump them out — if you can do so before the system fails.

► *Don't Dispose of Solid Waste or Chemicals*

Onsite sewage systems are designed to treat human waste, bathroom tissue, household sewage, and nothing else. Many feel that solid waste flushed down the toilet is gone for good. This is not true for an onsite sewage system. Every cigarette butt, flushable diaper, tampon, sanitary napkin, and family planning aid is still floating, undecomposed, in the septic tank. These items will never be broken down and they will cause the system to plug up if you do not remove them.

Dispose of paper towels and facial tissue with the rest of the solid waste collected in the home. These items do not decompose readily in septic tanks, so they add to the floating scum or solids in the bottom of the tank.

Never pour chemicals into an onsite sewage system. Chemicals can harm the organisms in the septic tank whether you intend it or not. Furthermore, the chemicals could pass through the system and contaminate groundwater.

While keeping chemicals out of the system seems entirely reasonable, you have to be diligent. If you have a sink in the garage, it might be tempting to use it to rinse out the latex paint from your brushes. But that paint will ultimately end up in the septic tank. This is also true for motor oil, pesticides gasoline, charcoal lighter fluid, and a myriad of other products that can end up, often innocently, in the septic tank.

For similar reasons, never dispose of medicines (prescription or over the counter) in the sewage system. Remember, the goal of many medicines is to destroy microorganisms — that may be good for you, but not so good for your tank.

Protect the Absorption Field

The soil absorption field is a critical, but often overlooked, component of onsite sewage systems. Here are six things you can do to keep the absorption field working properly.

► *Keep Storm Water Off the Absorption Field*

Divert storm runoff from the roof or other parts of the property away from the absorption field. The absorption field disposes of a volume of effluent that is much greater than the natural water the hydrologic cycle would ever put through the soil. The field's design is based on the amount of effluent that can be treated and successfully flow through at least 24 inches of aerated soil into the groundwater. It is not designed to carry any more water. Storm runoff can overload the system and cause it to fail.

► *Keep Vehicles off the Absorption Field*

The open space above an absorption field may make it seem like an attractive place to park vehicles. This is tempting but parking on the system can significantly damage the absorption field.

Vehicles can compact the soil and make it harder for effluent to move through it. A greater concern is the potential vehicles have to crush key components of the system. Many new onsite sewage systems are installed shallow to get the required 24 inches of aerated soil. That means vehicles or farm implements can easily crush a distribution box or pipe in a soil absorption field.

If any component is crushed and not immediately repaired, then lasting damage to the entire onsite sewage system can follow. The absorption field is even more

vulnerable to vehicle damage in winter because they can pack snow and increase the chance that the system will freeze.

► *Keep Children and Pets Away*

An absorption field with a vigorous stand of grass looks like an ideal place for children and pets, but it is not a desirable place for them to play. In spite of our best efforts failures occur. Absorption fields can be overtaken by excess water from the home or rising water tables. Either can leave untreated sewage on the surface, which can become an even greater problem if children or pets are exposed to harmful organisms.

► *Promote Vigorous Grass Growth*

Grass growing over the absorption field is an important way of removing some water and plant nutrients from the onsite sewage system, but don't expect a healthy stand of grass to make up for a site with too little natural drainage. Grass also prevents soil erosion on sloping sites.

Take care to promote vigorous growth of the grass cover. Mowing will cause a thicker stand, but avoid mowing the lawn too short. Scalping will lead to poor growth, weeds, and bare spots.

Never fertilize or water grass over an absorption field. The effluent should provide these in abundance.

► *Don't Plant Trees or Shrubs Nearby*

Tree roots and onsite sewage systems do not mix. Unfortunately, an absorption field in your backyard can look like a space in desperate need of a creative landscape design. Resist this temptation. Tree roots can cause septic systems to fail.

A good rule of thumb is that a tree's roots extend to the drip line (or outermost branches) of the crown of the tree. Even small trees planted at a distance can grow toward an absorption field and cause problems for an onsite sewage system that may have been adequate without the problem of tree roots. Generally, tree roots initially damage pipes that carry waste from the house or (more likely) away from the septic tank.

If a tree root blocks the absorption field, there are a number of things you can do. First, you can physically remove the tree roots that are causing the problem. Second, you can apply copper sulfate to kill the roots —use only the rate specified on the product label. If applied properly, copper sulfate should not harm the organisms sewage systems require.

But the most effective resolution may be to remove the trees. If they caused a problem once, they will cause it

again. Examine the pipes in the vicinity of the blockage for any damage because damaged pipes most likely caused the situation to develop.

► *Map Your System*

It is essential to have a map of all the components in your onsite sewage system. If the system fails, a map will help you know where to start looking. If you contemplate any future construction, a map is absolutely critical. You must keep new construction specific distances from the onsite sewage system. You can obtain these standards from your county health department. Following the distance standards can save you money and headaches. Nothing could be more frustrating than to remove a beautiful, expensive, but improperly installed patio brick-by-brick with untreated sewage oozing up under it from a failed absorption field.

Getting a map may be as simple as visiting your county health department — since 1990, all new sewage systems must be mapped and on file with the local health department. For older systems, a map may be more difficult. Ask the previous owner or the septic installer, if possible, to help map the system. If these are not options, then consider hiring an installer to locate the various elements using a tile probe. Alternatively, this could be a project you complete in a matter of a few hours on a pleasant summer day — but if it's -10°F and there is 2 feet of snow on the ground, it may not be as easy.

Perform Periodic Inspection and Maintenance

Periodic maintenance is critical for the long life of an onsite sewage system. You may wish to do some maintenance yourself, but you may be more satisfied if you hire a professional who is familiar with onsite sewage systems and what issues need to be addressed.

No matter who does the work, there are at least three types of maintenance you should always perform.

► *Clean the Septic Tank Outlet Filter*

Indiana law requires that a filter be installed at the outlet of every new septic tank installation or repair. This filter protects the absorption field from solid material that can pass into the field with the partially treated effluent. The most common solids these filters trap are laundry lint and human hair — dog hair also can rapidly clog the filter.

The outlet filter is very effective at lengthening the life of onsite sewage systems throughout Indiana, but you must clean the outlet filter periodically or sewage will back up into the home!

While this can be costly, a system without an outlet filter will fail much sooner and the repair will be even more expensive. At first, clean the filter every six months but you

can extend this interval if it is apparent that not enough is collected in six months to justify cleaning.

Modern septic tanks have an access port for inspecting the outlet filter, which is usually located on the outlet pipe. The filter can be detached, pulled from the tank and rinsed off with a garden hose. Always rinse the filter back into the septic tank so the solids can be removed when the tank is cleaned.

This is a job best left to a professional. Your local health department or your sewage system installer may suggest professionals who are qualified to perform this service in your area. You can also look for professionals on your own. The National Association of Wastewater Transporters, Inc. (www.nawt.org) and Indiana Onsite Wastewater Professionals Association (www.iowpa.org) maintain lists of trained service providers and certified installers.

If you choose to clean the filter yourself, then be sure to observe safety precautions. Wear a face shield and rubber gloves to avoid contact with the waste. Human waste is hazardous and errors can affect your health.

► *Inspect the System*

The best way to avoid problems and correct deficiencies when they are still minor is to routinely inspect your onsite sewage system. An excellent time to do this is when you have the outlet filter cleaned.

It's best to leave an inspection to a trained and certified professional. They will know how to look for problems and how to deal with them. An inspection should always include looking in the septic tank to inspect the inlet and outlet baffles, and to check the depth of sludge, effluent, and scum. An inspector should also examine the distribution box and soil absorption field. Anything short of this is a waste of time and money.

► *Clean Out the Septic Tank*

You must periodically remove the sludge and scum completely from the septic tank — using a septic tank additive won't eliminate the need to periodically clean out the tank. If you don't clean out the tank, scum and sludge buildup will eventually cause the system to fail.

Generally, you should clean your septic tank every three to five years, but this can vary by how you use your system. Measurement by a trained professional is the only way to know with certainty when a tank needs cleaning. Have a professional measure the sludge and scum depths at least once a year, starting with the second or third year after a cleaning.

If you use a garbage disposal, it will add about 50 percent more solids to the tank, so you may have to clean more frequently.

Only companies licensed by the Indiana Department of Environmental Management can clean out a septic tank. When you hire a company, make sure they:

- Pump and completely clean the tank. Make sure the tank is completely cleaned out. There are enough organisms left in the septic tank to start the treatment process, so there is no need to leave any sludge — doing so only means you'll have to clean it again sooner.
- Inspect tank openings and baffles.
- Dispose of the sludge in an approved manner.

When they are performing the work, be certain they pump the tank through the manhole cover and not the ports that are used to inspect the baffles.

Starting Up a New System

When you have new onsite sewage system installed, just begin using the tank. Filling the tank with water first is unnecessary. As the solids begin to accumulate, natural bacterial digestion processes will begin. Commercial products are available for “seeding” an onsite sewage system with desirable bacteria, but this is not necessary for successful operation.

Septic Tank Safety

Septic tanks can generate hydrogen sulfide and methane gases — and they are extremely dangerous! Never lean into or enter a septic tank, particularly during pumping. Methane is explosive, so do not smoke, or use torches or other flames near a septic tank opening.

Getting Additional Help

If you need to install, replace, or repair your onsite sewage system, you must receive a permit from your local health department before the work begins. Health department personnel can advise you of the procedures, assist with troubleshooting, and refer you to professionals. They can also make valuable location, design, and construction recommendations that will minimize the chances of failure.

If you're installing a soil absorption field, your health department will require soils information about the proposed site before they issue a permit. You can get soils information by hiring a consultant who is an Indiana Registered Soil Scientist (www.isco.purdue.edu/irss).

You can find a certified installer by visiting the Indiana Onsite Wastewater Professionals Association website, www.iowpa.org.

More information about onsite sewage systems is available from publications in the *Home & Environment* series, available from your Purdue Extension county office or the Education Store, www.the-education-store.com.

More publications in the *Home & Environment* series are available from the Purdue Extension Education Store, www.the-education-store.com.

Jan. 2013

It is the policy of the Purdue University Cooperative Extension Service that all persons have equal opportunity and access to its educational programs, services, activities, and facilities without regard to race, religion, color, sex, age, national origin or ancestry, marital status, parental status, sexual orientation, disability or status as a veteran.

Purdue University is an Affirmative Action institution. This material may be available in alternative formats.