



## Preventing On-lot Sewage System Malfunctions

Albert R. Jarrett, Professor of Agricultural Engineering

For most people living in rural areas, collection, treatment, and disposal of sewage must be accomplished on site. On-lot sewage systems typically consist of a treatment tank and a soil absorption area. The treatment tank removes and partially biodegrades solids while the soil under the absorption area absorbs and renovates the liquid effluent from the treatment tank. Figure 1 shows a typical on-lot sewage system.

### Why On-lot Systems Malfunction

Properly designed on-lot sewage systems provide adequate treatment and disposal of liquid household wastes. In spite of the efforts of regulators, and contractors to properly design and size these systems, on-lot systems may malfunction. A malfunctioning on-lot system results in sewage backup in the household, untreated sewage emerging at the land surface and/or groundwater degradation. Although groundwater degradation is seldom visible, it is

important since nearby wells (including the homeowner's) and streams can become contaminated.

Assuming your on-lot system was properly designed and sited, malfunctioning of on-lot sewage systems usually occurs for one of four reasons: poor installation, hydraulic overloading, biological overloading or lack of maintenance. This fact sheet discusses each type of malfunction and suggests potential remedies for keeping your on-lot system healthy.

**Note: See your SEO before redesigning or altering your on-lot sewage system.**

### Installation Malfunctions

If your on-lot system is properly selected, located, sized and designed, there are still several poor installation practices that can eventually lead to the malfunctioning of your on-lot system. The most common of these is to let construction equipment operate on the

absorption surface; the surface where the treatment tank effluent is expected to enter the soil. Heavy equipment should **never** be permitted to track on the absorption surface during installation or on the absorption area after it is put into service. This equipment can compact the absorption surface, compact the absorption

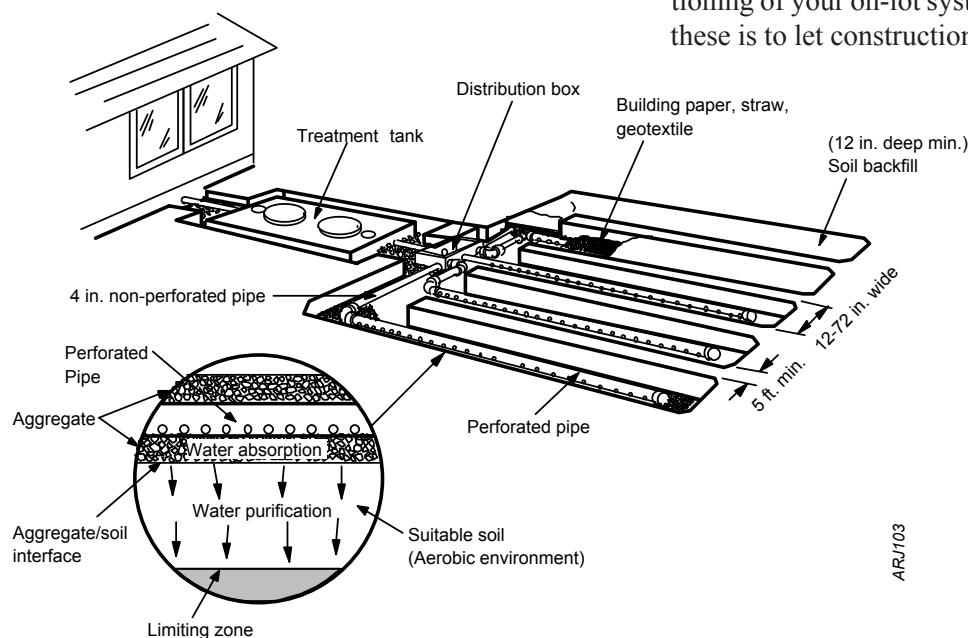


Figure 1. Typical on-lot sewage system.

area, or break pipes within the aggregate layer. These compaction problems are most often associated with the construction of large seepage beds, where it is difficult for equipment to excavate to the center of the bed without entering into the bed itself. The presence of heavy construction equipment moving on this absorption surface can destroy the natural soil structure. This is particularly true when the soil is wet (too wet for tillage). If seepage beds and the associated piping are not installed level, water will not be distributed uniformly over the absorption area. Finally, if surface runoff water is not diverted away from the absorption area, it may flow onto the absorption area. Remember, the system was designed to absorb the household wastewater not an additional volume of surface water.

## **Hydraulic and Biological Overloading**

On-lot sewage systems often fail because; (1) the soil is not capable of absorbing all of the wastewater delivered to it by the sewage system (Hydraulic Overloading), and (2) the aggregate-soil interface in the absorption area becomes clogged due to the development of a slime layer or biomat created as a result of persistent wet (anaerobic) conditions in the absorption area (Biological Overloading).

### ***Hydraulic Overloading***

Hydraulic overloading arises when water usage in the home exceeds the parameters used in the design of the absorption area. Before most on-lot systems are constructed, a percolation test (Perc Test) must be conducted to determine how fast the local soils can infiltrate or absorb water. From these Perc Test results and the number of bedrooms in the home, the minimum dimensions of the absorption area are determined. This ensures that as long as the flow from your house does not exceed its design flow (400 gallons/day for a three bedroom home) the soil should absorb the effluent distributed to the absorption area from the treatment tank. There are several ways this water balance can be disturbed. The most common is that some people use more water than expected. Typical conditions that can cause excessive water use are facilities like swimming pools, hot tubs, and parties where unusual numbers of people gather. It is not the actual facilities that use the extra water, but the extra high water use associated with those using the facilities, especially in the toilets that overload the sewage system. On-lot system malfunctions due to excessive water use are actually quite

common. Any water conservation activities/practices that can be implemented in the home will reduce the chances of excessive water use.

### ***Biological Overload***

Biological overloading is the development of an impermeable anaerobic slime layer on the aggregate-soil interface within the absorption area. In many homes about 80% of all daily water usage occurs during the early morning “get-up-and-get-to-work/school period” and during the evening “eat-dinner-get-ready-for-bed period”. Because these two heavy water-use periods are separated by 8 to 12 hours, each of these large volumes of water enter the absorption area where they have 8 to 12 hours to infiltrate into the soil. These periods of relatively large water usage separated by periods of low water usage usually produce a desirable flow cycling to the absorption area that generally uniformly distributes the wastewater over the absorption area but still gives adequate time for the soil to absorb the water.

There are, however, many homes where water is discharged to the on-lot sewage system at a slower, more uniform rate that often extends over much of the day. In these homes the toilet is flushed, then a few minutes later the shower is used. A half-hour later teeth are brushed. An hour later a load of laundry is started. The afternoon will bring more toilet flushes, cleaning, and cooking. After dinner, there is the dishwasher to run, get the kids ready for bed with baths and more toilet flushes and finally, if everyone actually goes to bed at once the absorption area may get a much needed rest. If we think about what these small, but persistent water uses within the home mean to the absorption area, you should be able to visualize many small flows of wastewater entering and leaving the treatment tank. The water leaving the treatment tank flows to the absorption area at a slow nearly constant dribble, which creates a constantly wet zone near the beginning of every trench or the bed. This constantly wet condition will eventually lead to the development of an anaerobic microbial condition in the trench or bed, the by-products of which are a nearly impermeable slime layer or biomat on the aggregate-soil interface at the bottom of the trench or bed.

Research at Penn State and other places has shown that when this slime layer develops the only practical way to remove it is to turn off the water and shut down the on-lot sewage system. Yes, its time to give your system a long rest. When your on-lot sewage system begins to give you trouble, its time

for two things; first is to have the treatment tank pumped, and second is to find a way, such as a family vacation, that will reduce water usage in the home to zero for a short time.

Actually, you should be having your septic tank pumped every two years regardless of whether your on-lot sewage system is giving you problems or not. Penn State Agricultural and Biological Engineering Extension Fact Sheet “Septic Tank Pumping” F-161 will give further guidance on this topic, but a pertinent suggestion is to have your septic tank pumped every two or three years. This will limit the build-up of solids in the septic tank, see Figure 2. When solids get too deep in the septic tank, they can be carried to the absorption area with the septic tank effluent. These additional solids and higher-than-usual carbon content enhance the anaerobic slime layer development in the absorption area.

“How do you get rid of the slime layer?” This is where the septic tank pumping and system resting come to the rescue. The goal here is to create the greatest opportunity for the absorption area to be drained of all the free water, for the soil at the aggregate-soil interface to become as dry as possible, and to create an aerobic biological environment in the absorption area so the slime layer will decompose and return your absorption area to its former well functioning state. Pumping the septic tank will not only remove all the water, sludge and scum from the septic tank, but also should permit water ponded in the absorption area to drain back into the septic tank where it too can be pumped and removed. The second part of this plan is to give your on-lot system a long rest; a long family vacation works well. A two- or three- week vacation would be great if you can do it. A week or 10 days will help, but not as

much as several weeks. If this vacation can be planned for the driest time of the year, it will yield even greater benefits.

The point is that you do not need to wait until your on-lot sewage system shows signs of failure before you implement this plan. Recommendation: have your septic tank pumped the day before you leave for vacation every other summer.

#### Maintenance Malfunctions

Septic tank-soil absorption systems were never intended for a lifetime of use without maintenance. Neglecting to maintain your on-lot sewage system can lead to malfunctions.

The most important maintenance issue is having your septic tank pumped every two years. See the section above for details about this issue. Chemical or biological enzyme additives are not recommended. In addition to solids buildup in the tank, baffles at the inlet and outlet pipe can deteriorate and even drop into the tank. Without the baffles, sewage can short circuit the tank or scum and solids can enter and clog the absorption area.

Failures can also occur in a maintenance-neglected absorption area. Deep-rooted plants and trees should never be planted over or near an absorption area. Roots, seeking oxygen, may find and enter the distribution lines and clog them.

Finally, never put anything into your on-lot system or do anything to it that might decrease its effectiveness. Garbage disposals introduce very high carbon loads to the system and should not be used, or at least severely curtailed in homes with on-lot systems. Never place harsh chemicals, such as bleach, lye, latex paint, and sodium hydroxide into your septic system.

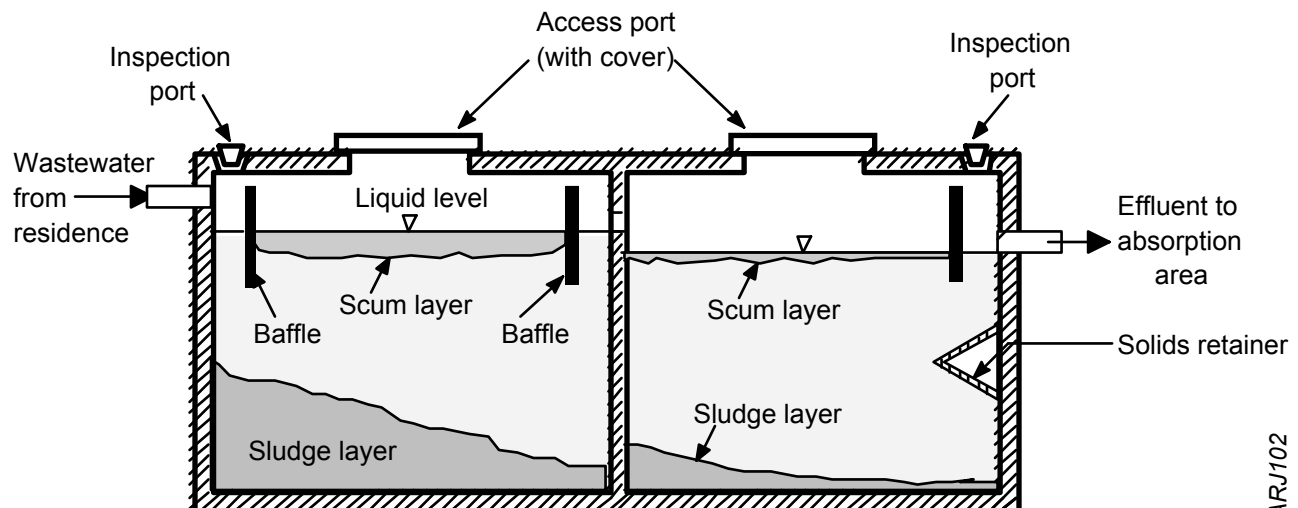


Figure 2. Cross-section of a typical two-chamber septic tank.

## Prevention and Cures for a Malfunctioning System

---

With all the things that can go wrong in your system, you may be wondering what you can do to prevent problems from happening. Fortunately, a number of preventive and corrective measures can be undertaken to ensure that your septic system functions properly. Here are several reminders:

- Take every opportunity to conserve water in the home.
- Have your septic tank pumped the day before you leave for vacation every other summer.
- Do not use, or at least severely curtail, the use of a garbage grinder in the home.
- Do not flush non-biodegradable wastes into the septic system.
- Do not flush...
  - \* Coffee grounds
  - \* Dental floss
  - \* Disposable diapers
  - \* Paints
  - \* Pesticides
  - \* Kitty litter
  - \* Sanitary napkins
  - \* Tampons
  - \* Varnishes
  - \* Photographic solutions
  - \* Cigarette butts
  - \* Condoms gauze
  - \* Paint or stain thinners
  - \* Bandages
  - \* Fat, grease, or oil
  - \* Waste oils
- Do not add harsh chemical cleaners to your septic system.
- Do not plant deep-rooted plants or trees over or near the absorption area.

You can also have the system inspected by an experienced professional. For a list of companies performing PSMA inspections in your area, contact:

The Pennsylvania Septage Management Association  
P.O. Box 7096  
Mechanicsburg, PA 17050  
Phone: 717-763-PSMA  
e-mail: paseo@aol.com  
Internet: www.PSMA.net

## More Information

---

Other Penn State Fact Sheets relating to on-lot sewage treatment systems include the following:

- F-161 *Septic Tank Pumping*
- F-162 *Preventing On-Lot Septic System Failures*
- F-164 *Mound Systems for Wastewater Treatment*
- F-165 *Septic Tank-Soil Absorption Systems*
- F-166 *Inspection of Existing Septic Systems During Real Estate Transactions*
- F-167 *Use of Dyes and Tracers to Confirm Septic System Failures*
- F-168 *On-Lot Sewage Disposal Publications Available Through the Penn State College of Agricultural Sciences*

For further information or for a copy of our Fact Sheet Listing contact:  
Agricultural and Biological Engineering Department  
246 Agricultural Engineering Building  
University Park, PA 16802  
Telephone: 814-865-7685  
FAX: 814-863-1031  
www.abe.psu.edu (see Publications)

For additional assistance contact:

Your local Sewage Enforcement Officer  
Your County Extension Agent

**Safety Note: Never enter a septic tank. The gases contained therein can kill you.**

PSU  
2nd Edition 09/02  
3rd Edition 03/08

The Pennsylvania State University is committed to the policy that all persons shall have equal access to programs, facilities, admission, and employment without regard to personal characteristics not related to ability, performance, or qualifications as determined by University policy or by state or federal authorities. It is the policy of the University to maintain an academic and work environment free of discrimination, including harassment. The Pennsylvania State University prohibits discrimination and harassment against any person because of age, ancestry color, disability or handicap, national origin, race, religious creed, sex, sexual orientation, or veteran status. Discrimination or harassment against faculty, staff, or students will not be tolerated at The Pennsylvania State University. Direct all inquiries regarding the nondiscrimination policy to the Affirmative Action Director, The Pennsylvania State University, 201 Willard Building, University Park, PA 16802-2801, Tel 814-865-4700/V, 814-863-1150/TTY.