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Research and Extension
Biological and
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Why Do Onsite Wastewater (Septic) Systems Fail?

Water Quality

Ask yourself: Under normal water use (wastewater flow) conditions …

- Are sewage drains sluggish?
- Does sewage back up into the facility?
- Have you had a wet, smelly spot in your yard?
- Does your septic system discharge at the surface such as road ditch, draw, storm sewer, or stream?
- Is the system connected to a drain tile?

If you answered yes to any of these questions, your onsite wastewater system is failing. It is not treating and dispersing sewage in a safe, sanitary manner. Other evidences of onsite systems not working effectively include persistent bacteria or excess nitrate in nearby wells and excessive aquatic plant growth in surface water. In Kansas, wastewater can legally be discharged only to a permitted community sewer and treatment facility or to a permitted onsite wastewater system. Onsite systems must be located, designed, and operated in compliance with the local sanitary code or the minimum state standards in Kansas Department of Health and Environment (KDHE), Bulletin 4-2: *Minimum Standards for Design and Construction of Onsite Wastewater Systems* (*www.kdheks.gov/nps/resources/mf2214.pdf*).

How Septic Systems Work

A traditional septic system consists of a watertight septic tank and a soil absorption field. Pipes carry sewage from the house to the tank and connect the tank to the absorption field. Perforated pipes distribute effluent underground within the field. The tank also may have an effluent filter. Heavy and light materials are separated and retained in the septic tank, allowing relatively clear effluent to flow to the field. The purposes of the septic tank (remove, store and degrade solids) cannot be achieved without maintenance, including removal of accumulated solids.

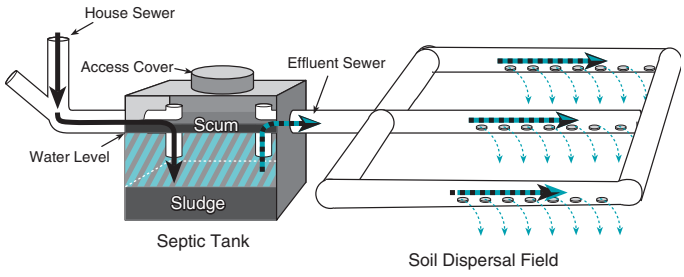


Figure 1. *How a septic system works.*

The breakdown of wastes, especially solids, begins in the septic tank. However, wastewater treatment requires a properly functioning absorption field. The field typically is either rock-filled trenches with perforated pipe or gravelless trenches, usually with chambers.

The correct system size is determined by the amount of wastewater flow and the soil properties in the dispersal field. If the wastewater flow is greater than the soil can accept, it often surfaces in the field or backs up into the house. A properly designed, constructed, maintained, and protected onsite system should treat wastewater effectively for 20 to 40 years or more. However, premature failure sometimes occurs.

Causes of Septic System Failure

Common causes of system failure are inappropriate system selection, improper design, construction mistakes, physical damage, inadequate maintenance, and hydraulic or organic overload. These are discussed below:

Inappropriate System Selection. In most cases, the effect of system selection on failure may be difficult to detect or determine. All onsite wastewater systems should be matched not only to the site properties, especially the soil and geologic conditions, but also to the volume and concentration of wastewater. Thus the site and soil conditions must be known in detail in order to do a good job of matching the system to the site. The absorption and treatment capability of the soil must match the wastewater flow and characteristics.

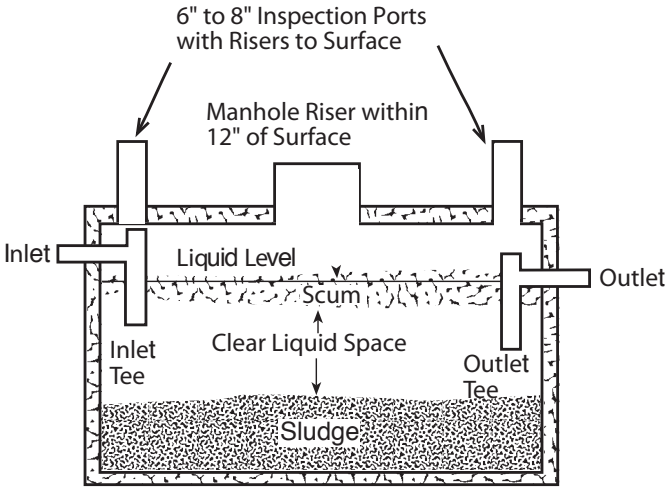
When an inappropriate system is used, the capacity may be reduced, the system life may be shortened, and/or treatment may be incomplete. This contribution to failure may not become known for years. By then other factors contributing to failure may be equally, or even more important.

Improper System Design. An improperly designed onsite wastewater system is doomed from the start. These systems usually fail within months to a few years because they are inadequately sized, installed

in impermeable soils, or designed incorrectly. The designer must know the site conditions, especially the soil, and must select and design the system to match those conditions.

The soil profile is the most essential part of an onsite treatment system and must be carefully evaluated so the design matches the soil conditions. Ideally, a trained, certified, and experienced person evaluates the soil profile to ensure that it is adequate to absorb and treat wastewater.

Figure 2. *A septic tank designed for easy maintenance.*



For more information, see K-State Research and Extension publication *Site and Soil Evaluation*, MF-2645.

If the soil layers are too shallow or too porous, treatment may not be effective as wastewater percolates down. Limiting conditions such as high clay content, poor soil structure, rock, high seasonal water table, or other layers restrict downward water movement and may cause inadequately treated wastewater to flow laterally and surface. In Kansas, traditional systems should have 4 feet of unsaturated, permeable soil beneath the application area.

Construction Mistakes. Never construct the soil absorption field when the soil is wet. Working wet soil causes compaction, smearing of the excavated surfaces, and in extreme cases puddling. Compaction closes pores in the soil, reducing the soil permeability, which can lead to failure of an absorption field in a short time. Restoration of compacted conditions may take decades. It is important to prevent compaction of the area by equipment before, during, and after construction of the absorption field. Exclude vehicles and heavy equipment by fencing the area that includes the absorption field, a future replacement absorption area, and the area downslope from these fields.

It is essential that the absorption field not be buried too deep. Use a contractor, engineer, or laser level to check elevations of onsite components and to ensure a drop to the septic tank and orderly flow throughout the laterals. The soil cover over the absorption field should be uniformly thick and no more than 12 inches. The bottom of the lateral lines must be level throughout the absorption field to assure uniform distribution. Likewise, the lateral pipe and the top of gravel fill around the pipe should be level. Remember, water flows downhill and small differences in elevation can cause an overload of part of the field while leaving another area dry.

When stepdown laterals are used for slopes over 1½ percent, the outflow level to the next lateral should allow a 2-inch air space beneath the soil cover over the gravel.

Neglected Maintenance. Inadequate septic tank maintenance is one of the most common causes of system failure. Solids accumulate in the septic tank and must be removed by periodic pumping (average every 3 to 5 years). More frequent pumping is necessary for homes that have a small tank (less than 1,000 gallons) or that use a garbage disposal. If solids are not removed, they will be carried out of the septic tank and clog pipes and absorption field. For pumping interval guidance, see K-State Research and Extension publication, *Septic Tank Maintenance: A Key to Longer Septic System Life*, MF-947.

Biological or chemical additives are not necessary and do not eliminate the need to pump the tank. Use of these additives is not recommended. Some additives are harmful to the system because they cause solids to become buoyant and to be carried to the absorption field, contributing to lateral failure. Other additives are toxic chemicals that can pollute the water.

A typical septic tank is equipped with baffles or "tees" at both the inlet and outlet. These are essential for the tank to effectively retain solids. In time, baffles often deteriorate and fail. The condition of baffles should be checked when the tank is inspected or pumped. Any baffle in poor condition should be replaced with a sanitary "tee." If the tank is cracked or deteriorated, it must be replaced.

An effluent filter in the outlet tee or in a separate chamber outside the tank helps retain solids in the tank and thus protects the absorption field. An effluent filter is easily cleaned by removing and rinsing it at regular intervals.

Physical Damage. Driving, parking, paving, or building on top of an onsite wastewater system can damage the septic tank or the absorption field. Pipes can shift or be crushed and the soil compacted. Structures can make it difficult to locate the septic tank and may prevent access for regular pumping and needed repairs.

During times of intermittent use, tree roots may grow into distribution lines and/or the soil absorption field. Grass, not trees or shrubs, should be planted on the absorption field. It is good practice to remove trees within 25 feet of the absorption field or to provide a root barrier to keep roots out. Used properly, copper sulfate may help control roots. Copper sulfate is available at some

hardware or plumbing supply stores. Select only products labeled for use in septic systems. Carefully follow the package directions for application and safe handling. If large roots have grown into the lines, the roots will have to be physically removed and repairs made to the line. If this happens, it is best to simply remove trees and shrubs near the lines.

Hydraulic Overload (too much water). Using more water than the dispersal field can absorb is a very common reason for failure. This problem often results from water-use habits, an increase in the number of occupants, or the addition of water-using appliances. Excess water also enters from leaky toilets, dripping faucets, sump pump, or a spring discharging to the wastewater drain. When flow to the wastewater system is considerably greater than what would be considered reasonable, the solution likely is to control the sources.

Surface drainage from impervious areas such as roofs, roads, and pavement should always be diverted away from the soil absorption field. This water adds an unnecessary load to the system. If the soil is saturated with water, even seasonally, it cannot accept more. Wastewater will then either surface or back up into the house.

Organic Overload. Wastewater "strength" is based on the type and amount of wastes it carries. Some wastes (like sugar) degrade readily, others (like fiber or cellulose) take much more time, and some (like soil) are inert and do not decompose. Changing the composition of the wastewater can accelerate the accumulation of solids in the tank or increase the load to the absorption field. High strength sewage requires special system considerations that if ignored, can cause failure in a comparatively short time (few weeks to perhaps a few months). Examples of activities that cause an overload include: frequent use of garbage disposal, disposal of milk products, and putting greasy or oily foods or wastes down the drain. For information about avoiding a septic tank overload, see K-State Research and Extension publication *Septic Tank Maintenance: A Key to Longer Septic System Life*, MF-947.

Never do any of the following:

- Place more soil over a wet, smelly spot in the absorption field. This does not correct the cause or fix the system. Sewage will soon surface again or back up into the house.
- Pipe the sewage to a road ditch, storm sewer, stream, or a field drain tile. This pollutes water, causes a health hazard, and is illegal.
- Discharge sewage into a sink hole, abandoned well, cesspool, or pit. This pollutes the groundwater, your well water, and is illegal.
- Put large quantities of solids, fats, oils, grease, or chemicals down the drain.

Correct Onsite Wastewater System Failure

If failure of an onsite wastewater system occurs, it should be corrected promptly. No matter what the cause, onsite system failure is a nuisance, health hazard and danger to the environment.

A trained and experienced sanitarian can help diagnose onsite system problems and recommend corrective action. In some cases, corrective measures may mean altering or adding to the system or constructing a new one. Under especially difficult conditions an enhanced treatment unit such as a sand filter or aerobic treatment, may be required ahead of a traditional absorption field. Most counties require a permit for repairs or alterations to an onsite wastewater system. Before making changes to the system, be sure to contact the appropriate authority, usually the local health department or the planning and zoning office.

Alter the Wastewater System

Sometimes an existing system can be modified to improve its operation. An effluent filter added to the septic tank outlet helps protect the absorption field from solids. An existing absorption field can often be enlarged, increasing its capacity to accept wastewater. When a new absorption field is constructed, the old field should be retained when possible. All wastewater should be diverted to the new field for at least a year. After the old field has rested and recovered, flow can be alternated between the two fields.

In counties with sanitary codes, new onsite wastewater system construction or alteration of the original design or materials usually requires a permit from the local health department. In other counties, follow the standards in KDHE Bulletin 4-2 available from KDHE, cofunty health department, planning and zoning office, or local K-State Research and Extension office.

K-State Research and Extension publications are available on the internet at *www.ksre.ksu.edu/library*.

Preventive Actions

Regular maintenance of your onsite system, including pumping the septic tank, is the best precaution to prevent system failure. Below are some simple things you can do to benefit your onsite system. Since these actions do not change the system, a permit should not be needed.

- ✓ ***Conserve water***. Employ water saving habits at the source in the bath, kitchen and laundry.

Check for and promptly repair water leaks. Install water-saving fixtures and appliances such as low-flow toilets. This one-time expense is a wise investment to reduce hydraulic load and protect the wastewater system.

- ✓ ***Upgrade the tank and absoprtion field***. A larger tank allows better retention of solids and may reduce pumping frequency. A larger field simply has a longer useful life
- ✓ ***Pump the septic tank as needed.*** Solids settled in the septic tank, accumulate as sludge, and are partially degraded. If not removed, solids will eventually be carried to the laterals where they can plug pipes and contribute to absorption field failure.
- ✓ ***Avoid adding solids.*** Limit use of the garbage disposal. Wash rugs and other linty material at a laundromat. Be aware that clothes washers without a lint catcher will increase solids going to the septic tank. Dispose of fats, grease, chemicals, drugs, etc. in the trash.
- ✓ ***Prevent excess water.*** Avoid foundation drain or sump pump discharge to the system. Repair any leak immediately. Minimizing wastewater flow allows more time for solids to settle in the tank and reduces the hydraulic load to the absorption field. This prolongs the life of the field.
- ✓ ***Improve surface drainage.*** Surface runoff and roof drains should be diverted away from the soil absorption area.
- ✓ ***Maintain healthy grass.*** A good stand of cool season grass helps maximize evapotranspiration from the dispersal field. Never garden over the absorption field.
- ✓ ***Repair physical damage.*** Crushed or broken pipe should be repaired and all obstructions in the lines should be cleared to ensure wastewater distribution throughout the field.
- ✓ ***Level the distribution box.*** A level distribution box and connecting the ends of laterals on the same level helps ensure more uniform water distribution throughout the field.
- ✓ ***Avoid excess soil cover.*** No more than 1 foot of soil should cover the absorption field. Before planting grass be sure to slightly slope the surface to shed stormwater.

For more information about onsite wastewater systems, contact your local health department, planning and zoning office, county or district K-State Research and Extension office, or KDHE District Office.

Judith M. Willingham
Extension Associate

G. Morgan Powell, retired
Extension Engineer, Water Quality

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