Cause A.2. Plugged house sewer vent.

A plugged sewer vent (or soil stack) slows the rate at which sewer lines drain to the point that solids can settle out (Figure 4). A plugged or incorrectly installed vent sometimes results in a sewer gas smell around house drains; but more typically causes a gurgling sound as air is pulled through the trap into the house sewer.

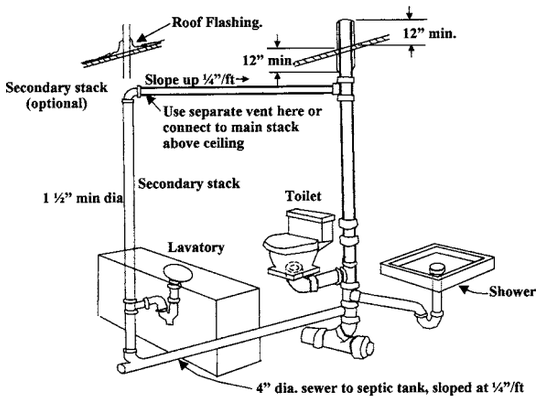

Figure 4. *House sewer vent diagram with recommended installation guidelines.*

Plugged vent problems should not occur if the plumbing code was followed. Temporary blockage can occur in winter if an under-sized roof vent opening freezes shut. The stack should extend at least 12 inches above the roof (measured on the high side of the vent). Check local building codes or contact a qualified plumber for proper installation.

Cause A.3. Blockage between tank and field.

If the liquid level in the septic tank is above normal, either: (a) the tank outlet is plugged, (b) the line from the tank to the absorption field is obstructed, or (c) the absorption field is clogged. If the latter is the case, there will probably also be evidence of seepage or general wetness in the absorption area.

a. *Plugged septic tank outlet.* If an effluent filter is present, remove and clean it and have the tank cleaned. If not, check and replace the baffle if defective. This would be a good time to install an "effluent baffle" in place of an existing baffle. This requires a riser extended to ground level and cap (with ground sloped away for drainage). Effluent filters are an economical way to protect an expensive soil absorption field.

b. *Obstruction of tank-to-field line.* Likely causes are solids overflowing the tank, tree roots getting into pipe joints or collapse of a pipe section, such as under a road or due to heavy equipment. Roots should not be a major problem in the trench area, since roots seldom penetrate very far into the gravel fill. Sewer pipes can break, however, if not uniformly supported on soil or gravel fill.

c. *Clogged absorption field.* See discussion under Cause B.2 below.

Symptom B. Seepage or Swampy Conditions in Absorption Field Area

Cause B.1. Too small a filter field.

Many older homes have systems that are inadequate to handle the large amounts of water used in modern living. Use a tile probe (used to locate agricultural field tile) to locate the pipe runs in your soil absorption system if you are not sure of its size. Consult your county Health Office to see if your absorption field is properly sized for your home and soil conditions.

If undersized, the field should be enlarged or a new one constructed. The best decision might be a completely new system, if the septic tank is also too small. Often the old field can be reused as an alternate absorption area after resting a year or so.

If capacity is inadequate, but not severely so, install water conservation. Low-flow toilets and shower heads, faucet aerators and other devices can cut water use significantly with little change in lifestyle.

Cause B.2. Clogged soil absorption field.

Make sure the field is properly designed, constructed, and loaded. Otherwise, the "clogging mat" can develop to the point where the system fails. Even in a properly designed and maintained system, organic mats develop and aid in treating the effluent. Excess buildup can cause failure however. Make sure the distribution box is level and is loading trenches equally.

The best solution, assuming the tank is in proper repair and cleaned regularly, is to rest the absorption field periodically. This allows the organic matter to oxidize, restoring much of the permeability around the trenches to near its natural state. Resting the area, however, requires that a second filter field be available to accept effluent. Being able to switch from one absorption area to the other every year reduces soil clogging problems and significantly lengthens the total system life. Alternating fields are especially effective in slowly permeable (high clay) soils.

Cause B.3. High water table in spring.

Septic system operation can become sluggish and even fail in the spring, if a seasonal high water table saturates the soil around the trenches. The solution is to use subsurface tile drainage to lower the water table. The drainage tile must discharge to a surface ditch or to a tile drain.

If located on a sloping site, installation of drain tile upslope from the absorption field can be very effective. Place the tile at least 10 feet away from the filter field and, if possible, down to a soil limiting layer. Home water conservation devices and practices (such as taking clothes to a nearby laundry) may also be needed to make it through prolonged rainfall periods.

Cause B.4. Solids carryover and leaking faucets.

The overflow of solids from a septic tank which has filled with sludge, or from the increased water load from leaky faucets, can seriously affect soil absorption field operation. The prevention is periodic tank clean-out, well-maintained effluent filters and keeping the plumbing fixtures in good repair.

Getting Additional Help

If you are planning to repair a septic system, you should seek help from county Health Board personnel. They can make location, design, and construction recommendations that will minimize the chances of failure.

Purdue Publications on dealing with septics:

ID-163 Steps in Constructing a Mound (Bed-Type) Septic System
ID-164 Steps in Constructing a Pressure Distribution Septic System
ID-170 Construction Guidelines for Conventional Septic Systems
ID-220 Individual Constructed Wetlands in Indiana

These publications are available through the Media Distribution Center at 1-888-EXT-INFO (398-4636). Publications and additional information are available at the following Web sites:

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http://danpatch.ecn.purdue.edu/~epados/onsiteOnline/start

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Operating and Maintaining the Home Septic System

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Over a third of Indiana's population lives in residences having private waste disposal systems. In many cases, the septic tank and soil absorption field were already in place when they moved in.

Most homeowners have little understanding of, or interest in, the operation of their waste disposal systems until problems arise. Sewage backed up in the house or a seeping, smelly area in the yard is an unpleasant and often expensive introduction to the ABCs of septic system maintenance.

This publication explains briefly how the common home sewage disposal system works and how to keep it working. It also contains a troubleshooting guide for determining the cause of system malfunction and its prevention or cure.

How a Septic System Works

Waste water flows from the household sewer into an underground septic tank in a typical system (Figure 1). In the tank, the waste components separate; the heavier solids (sludge) settle to the bottom, the grease and fatty solids (scum) float to the top, and the more liquid portion (effluent) flows through an outlet to the soil absorption field.

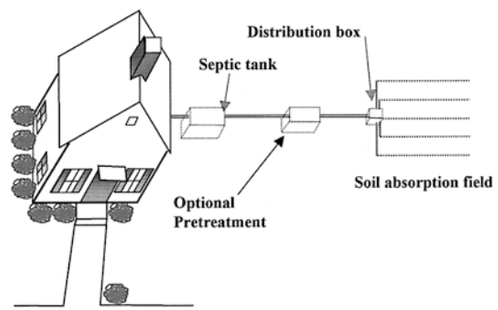

Figure 1. *Schematic of on-site waste disposal system.*

The soil absorption field should consist of a distribution box to send effluent to a series of level trenches, each containing a distribution pipe embedded in coarse gravel. The effluent runs out through holes in the pipe, down through the gravel and into the soil. The soil filters out most remaining solids. Nutrients and microorganisms are also treated in the soil under the trench and are also diluted by groundwater.

A well-designed absorption field in the right kind of soil, properly constructed and maintained, should function trouble-free for a long time. However, many soils in Indiana are not well suited to conventional septic systems. Soil conditions such as slow permeability and high water table, especially where coupled with poor design, faulty construction, or lack of maintenance, significantly reduces the life of septic systems in Indiana.

The Septic Tank and Sewer Lines

The tank receives sewage from the house sewer system. An inlet baffle slows the sewage as it enters the tank, allowing the heavier solids to settle and scum, grease, and fats to float to the surface (see Figure 2). A slight opening between the top of the inlet 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 smooth flow of waste water through the system.

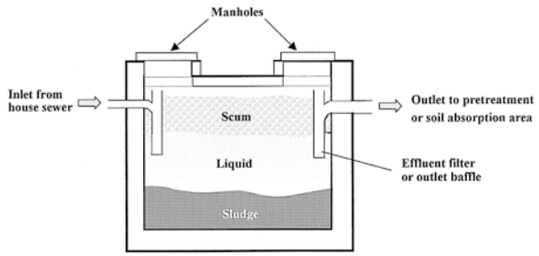

Figure 2. *Septic tank cut-away showing the distribution of solids within the tank.*

Tank volume is typically designed to give 2-3 days retention before the effluent overflows to the soil absorption field. A baffle at the outlet or an effluent filter prevents most solids and floating scum from leaving the tank.

Lines that transport sewage from house to tank and the effluent from tank to absorption field are typically 4-inch diameter sewer pipes. Watertight joints are necessary to prevent root penetration. Plastic pipe is generally used in construction, but vitrified clay and cast iron are common in older systems.

The sewer line from the house to tank should have a uniform slope of 1-2 inches vertical drop per 8 feet of horizontal distance (1-2%), with no high or low spots to keep solids from settling out in the line. Slope greater than 2 percent can cause the liquids to flow too fast to carry the solids. If steeper slopes are required, a vertical drop is normally used with the lateral pipe laid at 2 percent.

Slope of the pipe from tank outlet to soil absorption field should be at least 1 percent. A maximum slope is not important since solids are removed in the tank.

Septic Tank Start-Up

Late spring or summer is the best time to begin septic system operation. It is not necessary to fill the tank with water before use, although some hot water should be added to the tank if you will begin using it in winter.

As solids accumulate in the tank, the natural bacterial digestion process begins. Commercial bacteria "seeding" products are not necessary for successful operation.

Septic Tank Clean-Out

All septic systems will fail unless the sludge and floating scum are periodically removed from the tank. Otherwise, solids overflow and clog the absorption field.

Septic tanks should be cleaned out every 3-5 years, depending on size and the amount of solids entering them. Estimate clean-out interval on the basis of 100 gallons of tank capacity per person per year. For example, a 1,000 gallon tank used by a family of two should be cleaned after 5 years [1000 ÷ (100 X 2)].

(Note: Use of garbage disposals increases solids loading by about 50 percent!) Commercial additives *do not* eliminate the need for periodic clean-out.

An effluent filter, if present, will plug when solids build up. When this happens, the filter can be removed and cleaned by hosing the solids off into the tank, and the tank pumped. Homeowners with older systems without an effluent filter can determine when it's time to pump by checking sludge and scum build-up. Measurement of both sludge and scum depths should be taken at the outlet, starting the third or fourth year after a cleaning. Clean the tank when the sludge layer is within 12 inches from the bottom of the outlet baffle, or when the bottom of the scum layer is within 3 inches of the bottom of the baffle.

Septic Tank Safety

Poisonous hydrogen sulfide and explosive methane gases can be generated in a septic tank. Never enter a septic tank, during or after pumping. Hatches or manholes should be secured with childproof locks or nylon safety netting under the manhole lid to allow visual observation, but prevent entry.

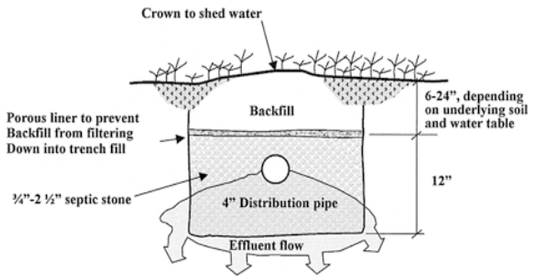

Figure 3. *Scum and sludge build-up in a septic tank determines clean-out frequency needed.*

The Soil Absorption Field

The most common type of soil disposal system is a series of parallel absorption trenches, each consisting of a distribution pipe running through a bed of gravel (see Figure 3). This helps distribute the sewage effluent over the entire trench area and stores it until it can filter into the bottom and sidewalls of the trenches. This forms a biomass that helps treat the sewage effluent, but also slows its percolation into the soil.

Operating and Maintenance Tips

- Never discharge from basement footing drains or other clean water sources into the field.
- Divert surface runoff water from roofs, patios, driveways, or other areas away from the absorption field.
- Establish a grass cover over the field as soon as possible after installation to prevent erosion and promote plant uptake of water.
- Keep traffic off the absorption area, especially when saturated or if there is snow cover. Compacting the snow reduces its insulating value, and can push the frostline down.

Troubleshooting Septic System Problems

There are no simple solutions for many problems where a system was installed in unsuitable soil or was improperly designed and constructed. But other problems, if correctly diagnosed, can be solved with a minimum of expense. Following is a guide for troubleshooting and correcting septic system problems.

Symptom A. House Sewers Don't Work or Sewage Backs Up into Basement

Check the liquid level in the septic tank. If it's normal (i.e., a foot or so below the top of the tank), go to Cause A.1. or A.2.; if above normal, go to Cause A.3.

Cause A.1. Blockage between house and tank. The blockage may be in the house sewer, or the scum layer could be plugging the inlet pipe at the tank. If scum is the problem, the tank should be pumped down and the inlet baffle checked.

Use a sewer routing tool from the clean-out at the house end of the line. If root penetration is the reason for the blockage, the pipe joint should be resealed to make it watertight. If the blockage occurs in a new system, the problem may be improper sewer line slope and the only solution is to re-lay the line at the correct slope. If the blockage re-occurs in a previously trouble-free system, the cause may be a broken sewer pipe section, which must be located and replaced.