In Your Own Backyard: Septic Systems

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Introduction

The Indiana State Department of Health has been involved in on-site sewage disposal since its creation over a century ago. The agency's emphasis has always been to train, guide, and assist local health department personnel and individuals to ensure that on-site sewage disposal facilities are properly sited, installed and maintained. The agency also continuously works to upgrade the status of on-site sewage disposal technology in Indiana. The National Council of State Governments has recognized the Indiana State Department of Health for its progressive approach to on-site sewage disposal.

History and Public Health

The public health ramifications of exposure to inadequately treated wastewater have been documented throughout history and in third world countries today. There have been, and continues to be, waterborne disease epidemics caused by contamination of our water resources by human wastewater. The diseases that can be transmitted by contact with domestic wastewater include cholera, giardiasis, hepatitis, typhoid fever, shigellosis, cryptosporidiosis, and various forms of gastroenteritis. The survival times of pathogens can vary greatly in the environment. For example, the Hepatitis A virus can be viable for more than a year in both surface and groundwater. Other organisms can remain viable for days to months. In addition, the Culex pipiens pipiens mosquito, which is the vector for transmission of St. Louis Encephalitis, breeds in pools of wastewater caused by failing on-site sewage disposal systems.

According to our estimates, projected from the 1990 U.S. Census, there are more than 800,000 on-site sewage disposal systems in Indiana today. The amount of wastewater disposed of through these systems exceeds 240,000,000 gallons per day. One third of existing homes utilize on-site sewage disposal systems; fifty percent of new homes being built utilize on-site sewage disposal systems. However, seventy to seventy-five percent of soils in Indiana are rated severe for conventional on-site sewage disposal systems. The Indiana State Department of Health (ISDH) has documented sewage problems throughout the state from failing on-site sewage disposal systems.

Many of the existing problems with on-site sewage disposal systems were created with the advent of indoor plumbing. Because of these problems, and the lack of uniformity throughout the state, ISDH adopted two statewide rules in 1977. Those rules are now Rule 410 IAC 6-8.1, *Residential Sewage Disposal Systems*, and Rule 410 IAC 6-8.10, *Commercial Sewage Disposal Systems*. Local health departments in Indiana administer the residential rule. The commercial rule is administered by the ISDH; however, portions of that program is being turned over to local health departments that have the ability to properly administer the program. Parts of the commercial rule will continue to be administered by ISDH, because some commercial systems are quite large and complex, handling thousands of gallons of wastewater per day.

Legal Considerations

Indiana administrative code defines a failure of an on-site sewage disposal system as a system that exhibits one or more of the following: (1) the system refuses to accept sewage at the rate of design application thereby interfering with the normal use of plumbing fixtures; (2) effluent discharge exceeds absorptive capacity of the soil, resulting in ponding, seepage, or other discharge of the effluent to the ground surface or to surface waters; or (3) effluent is discharged from the system causing contamination of a potable water supply, ground water, or surface waters. Indiana administrative code also has a general requirement that prohibits individuals from causing or contributing to a health hazard or water pollution resulting from the use of an on-site sewage disposal system. Indiana Code states that a person shall not institute, permit, or maintain any conditions that may transmit, generate, or promote disease. It states that a local health officer, upon hearing of the existence of such unlawful conditions within the officer's jurisdiction, shall order the abatement of those conditions.

An on-site sewage disposal permit must be obtained prior to the start of new construction, and prior to repair or replacement of an existing on-site sewage disposal system. The permit process includes examination of the topography, soils analyses, and site characteristics such as position in landscape, slope, and drainage. It also includes a review of a site plan and system design.

The Soil Is The System

On-site systems must be designed based on the site and soil characteristics of the specific site in order to prevent surface and groundwater contamination. A soil profile analysis must be conducted by a soil scientist prior to the selection and design of a specific on-site sewage disposal system. The site information and soils analysis must be used to design a system for that specific site – a cookbook approach using soils maps and preset diagrams or sketches cannot be used.

The reason for this approach is that the soil is actually the final treatment system. The soil provides the final purification of wastewater before it reaches groundwater. The soil is actually an ecosystem, containing a variety of organisms that will attack and devour pathogenic organisms in the wastewater. There is a tremendous cleansing ability of the soil if it is used properly.

Some of the site characteristics looked at are (1) position in landscape, (2) topography, (3) slope, and (4) vegetation. There are three basic landscape positions: upland, terrace, and floodplain. Uplands contain older well-developed soils; terraces contain newer, younger soils not as well developed. Flood plain soils are considered unsuitable for on-site sewage disposal systems because of flooding.

Various soil characteristics affect the ability of the soil to accept and cleanse wastewater. Soil characteristics looked at include texture, structure, wetness (seasonal high water table) and hydraulic conductivity.

Soils are made up basically of sand, silt and clay particles. Mixtures of these particles determine the soil texture. Soil also has a structure to it. That is the way that the soil particles fit together in a physical way. The basic soil structures are blocky, prismatic, platy, single grain, and granular. The combination of texture and structure affects the soil's ability to accept, transmit and cleanse wastewater.

Hydraulic conductivity is the rate at which water moves through the soil - it is a function of the soil texture and structure. It is sometimes referred to as soil permeability. If the hydraulic conductivity is too high due to coarse texture (medium to coarse sand or gravel), wastewater will not be purified before it reaches groundwater. If the hydraulic conductivity is too low, because the texture is too fine, or the structure too dense, the wastewater moves too slowly through the soil, the absorption field will pond, and ultimately wastewater will back up into the plumbing or break out to the surface and cause surface water pollution.

Soil wetness is the depth to the seasonal high water table - the depth to soil that is saturated during various times of the year with naturally occurring groundwater. If the seasonal high water table encroaches on the absorption field, it will not be able to function properly. Groundwater contamination will occur, plus an increased probability of sewage backing up into the plumbing or being discharged to the ground surface. This is a serious consideration with many of the soils in Indiana. Drainage may be used to lower the seasonal high water table so that a site may be considered for an on-site sewage disposal system. The drainage system must be capable of lowering the seasonal high water table to at least 24 inches below the center of the absorption field.

The optimal approach to final treatment of wastewater by the soil is to maintain an unsaturated flow of wastewater through soil that has suitable hydraulic conductivity. An unsaturated flow promotes aerobic conditions and good treatment of the wastewater resulting in the removal of contaminants - primarily viral and bacteriological - which is predominantly what we are concerned with in public health. Saturated flow, where the soil is always saturated with wastewater or shallow groundwater, promotes anaerobic conditions that discourage good treatment of the wastewater by the soils. In Indiana, at least 24 inches of unsaturated soil with acceptable permeability must be provided underneath the soil absorption field to permit adequate treatment of the wastewater.

Types of Systems

There are four basic types of on-site sewage disposal systems approved for use in Indiana: gravity flow, flood dose, trench pressure, and elevated sand mounds. They are used in different scenarios and different soil conditions. All systems have certain components to them such as the septic tank, piping, and soil absorption field.

Gravity systems, flood dose systems, and pressure trench systems all use a series of underground trenches in the absorption field for final disposal of the effluent. Gravity systems use gravity throughout the system to move the effluent from one part to another. The lifespans of gravity systems are adversely affected by the buildup of organics in the trenches, creating an "organic mat" and sealing the infiltrative soil surfaces. Flood dose systems and pressure distribution systems use a pumping chamber and pump to collect the effluent from the septic tank and periodically dose the absorption field. This dosing effect extends the lifespan of the system by significantly reducing organic mat development in the trenches. Trench pressure systems are required in medium textured sands to control organic mat development and to provide for aerobic conditions and get maximum treatment of the effluent.

The elevated sand mound is used where very shallow depths to limiting layer or seasonal high water table prevent the use of subsurface trench systems. The absorption field is above ground and utilizes a foot of medium textured sand fill with an aggregate bed above that. The septic tank effluent is discharged to the aggregate bed; from there it filters through the sand prior to being absorbed by the underlying soils. Preliminary treatment of the effluent is achieved in the sand and final treatment is achieved in the shallow suitable soil layers.

Experimental systems using additional pretreatment such as constructed wetlands, and recirculating sand filters are being researched for use in Indiana in order to provide additional treatment of the wastewater prior to discharge to the soils. This will enhance the ability of the soils underlying the absorption field to provide final treatment while significantly extending the lifespan of the system. This approach to on-site sewage disposal may be the next big step in providing for the continued use of on-site sewage disposal systems while preventing exposure of citizens to the health hazards of failing on-site sewage disposal systems.

System Failures

If the on-site sewage disposal system serving a residence should go into failure, what should the homeowner do? The local health department and a reputable contractor should be contacted so that they can work with the homeowner to determine the problems, the soil conditions, and the options for resolution of the problem. No attempt at repair or replacement should be made without a thorough examination of the situation and a permit from the local health department.

Maintenance Of The System

Finally, homeowners should also know the type, location, and maintenance required for their on-site sewage disposal systems. The "Do's and Don'ts for On-Site Sewage Disposal Systems" include:

1. Do know the location of your on-site system (keep a plan/sketch).
2. Do pump your tank every 3-5 years.
3. Do record all maintenance
4. Do obtain a permit from your health department prior to making repairs to your system.
5. Do practice water conservation.
   - Repair dripping faucets and leaking toilets.
   - Run washing machines and dishwashers when full.
   - Avoid long showers.
   - Use water saving fixtures on faucets, showers, and toilets.
6. Do divert all surface and subsurface water away from your absorption field.
7. Do limit your use of a garbage disposal
8. If you have an alternating field system, do turn the diversion valve annually.
9. Do protect your on-site system.
   - Don't allow anyone to drive or park on your system.
   - Avoid septic tank additives.
   - Don't use caustic drain cleaners (use boiling water or a drain snake to open clogged drains).
   - Limit use of bathroom cleaners (use mild detergents or baking soda).
10. Do feed your on-site system well
    - Don't use your toilet as a trash can.
    - Don't dump non-degradables (grease disposal diapers, etc.), down your toilets or drains.
    - Don't poison your system with harmful or toxic chemicals (gas & oil, paint, antifreeze, etc.)