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The Standard Septic System:

Still an Effective Choice for Onsite Wastewater Treatment

By Dennis F. Hallahan P.E.

In 1997, EPA and Congress officially recognized onsite wastewater treatment systems (commonly referred to as septic systems) as a viable, long-term solution for treating wastewater. This was an important designation since nearly 40 percent of new homes in the United States use this type of system to treat household wastewater.

For more advanced wastewater management, there are dozens of pretreatment technologies to choose from that use the standard septic system as the core. The number of pretreatment installations is anticipated to grow over the next ten years due to environmental issues and new regulations, but it is predicted that the majority of systems installed in the future will still be the standard septic type.

Why? The standard septic system provides effective treatment, requires minimal maintenance, offers longevity and is a good economical choice. This makes the standard septic system an effective solution for the majority of onsite wastewater applications in the future.

History of the Standard System

Septic systems play a vital role in the protection of public health and the environment. The goal of the septic system was once thought to be a temporary one: provide a solution for wastewater disposal in rural/suburban areas until sewer piping

Table 1: Summary of Results
Massachusetts Septic System Test Center

System Type	BOD	TSS	FC/100ml	N (% removal)	Cost	O&M/year
Standard	4	1	13	23%	$8–16,000	$60
Drip	11	5	1	42%	$10–18,000	$222
A&S*	3	2	16	61%	$12–19,500	$1097
RSF**	4	8	1	40%	$13–21,000	$860
AR***	2	<8	93	66%	$18–26,000	$851
Foam Filter	3	4	9	64%	$15–23,000	$810

* A&S: Attached and Suspended Growth System
** RSF: Recirculating Sand Filter
*** AR: Aerated Reactor

Notes: All effluent data is collected from the base of the soil absorption system.
More information can be found at the Test Center website: www.buzzardsbay.org.
The manufacturer provided system costs to the Test Center.
O&M estimated:
- $60/year for septic tank pumping every 3 years
- $400/year for quarterly inspection
- $300/year for quarterly effluent quality sampling
- Electrical is included and based on actual costs
- No cost included for parts replacement

could be extended to those areas. A significant shift away from this mindset occurred in 1997 when Congress recognized the vitality and effectiveness of the tried and true standard septic system, particularly for small communities. In its "Response to Congress on the Use of Decentralized Wastewater Treatment Systems," the U.S. Environmental Protection Agency (EPA) stated that onsite systems can and should be considered as long-term solutions. For the professionals (contractors, regulators, soil scientists, engineers and research professors) working with onsite systems, this was not ground breaking information. However, obtaining political acceptance from the EPA and Congress had been a long battle and therefore made this conclusion a milestone.

Not all wastewater professionals agree on what specific components make up the standard, every-day septic system. Scott Wallace, P.E., vice president of North American Wetland Engineering said, "For me, a standard system is one that uses a septic tank and soil-based treatment and disposal. What makes up a good standard system is combining the correct application of soils evaluation, loading factors, topography and hydraulics to develop a system layout that achieves high levels of treatment in a simple, cost-effective package."

Bob Long, Chief of Special Programs for the Oakland (Mich.) County Health Department said that to him, a standard system is one that meets his local sanitary code related to the amount of trench per bedroom in optimum or acceptable soil conditions.

"This can be a combination of conventional septic tank, tile field, tile bed or drywell, however the system cannot be oversized from what is prescribed in the sanitary code," Long said.

Although the characteristics of a standard system may vary depending on to whom you speak, what people do agree on is that this method, elegant in its simple utilization of a tank and a leachfield, does more than meet the goal of disposal. In fact, the system far exceeds the original expectations and provides highly effective wastewater treatment. Field and laboratory research data available today draws the same conclusion.

Defining a Standard System

What defines a standard onsite system depends on the timeframe being considered. At one time, cesspools were standard systems. Then came septic tanks with either seepage pits or seepage beds. Now the septic tank and leachfield combination is generally considered the standard or standard system. Today, more than 25 percent of homes and nearly 40 percent of new development in the United States are served by onsite septic systems. Of this number, approximately 70 percent are a combination of a septic tank and leachfield. Of the remaining 30 percent, 25 percent incorporate pretreatment systems.

The perspective on what specific combination of tank and leachfield makes up a standard system varies by region of the country. The tank can have one or two compartments and it can be manufactured from a variety of materials including concrete, plastic or fiberglass. Leachfields can be constructed with plastic or concrete chambers, stone and pipe, or they can be gravelless. Installation can be in beds, trenches or mounds, with sequential or parallel distribution. The large majority of systems function by gravity, but some may require pumping for mound applications or to overcome elevation differences. In many areas with slowly permeable soils or seasonally saturated soil conditions, mounds are the only soil treatment units that will function to treat sewage. Therefore, mounds have today become standard in those areas such as Wisconsin and Minnesota.

"I consider a standard system to have a septic tank or tanks in a relatively shallow installation to allow access for cleaning and service. My definition of a traditional system also includes a series of drainfield trenches using drop boxes to provide sequential distribution," said Roger E. Machmeier, Ph.D., P.E.

How is this different than an advanced or pretreatment system?

Pretreatment systems were developed to handle wastewater in extremely sensitive areas or to accommodate unusual applications such as insufficient soil depth or difficult soil types. In some areas of the country, regulation has begun to specify pretreatment as a safeguard for onsite system performance whether it is necessary or not. This practice raises the cost of wastewater treatment that is borne by homeowners and developers. While these more complex systems are of tremendous value when enhanced treatment is

required to protect public health or the environment, they should not be specified due to a lack of knowledge about the performance of standard systems.

Pretreatment systems come in a variety of shapes and sizes. The majority fall under the heading of Advanced Treatment Units (ATUs) or packed bed filters. A sand filter is a type of packed bed filter that has been around for more than a century. Newer packed bed technologies consist of peat, textile or foam media. The packed bed filters generally are very reliable and provide good treatment.

ATUs can be further broken down into two groups: suspended growth and attached growth. Suspended growth systems provide an environment for organisms to thrive within the liquid. Attached growth systems rely on a media as a surface for organisms to attach. Extended aeration is an example of a suspended growth system, while a trickling filter is an example of an attached growth system.

The primary difference between a pretreatment system and a standard system is not necessarily in treatment levels. It is in the increase in cost and maintenance requirements of the pretreatment system. If a pretreatment device is compared only to the septic tank in a standard system, then yes, it provides an improvement in terms of treatment. When the treatment provided by the soil is included in the equation, the difference is not so apparent.

Table 1 illustrates results from a study performed by the Massachusetts Septic System Test Center. The highly controlled test compares new technologies to the standard septic system. Each system receives the same wastewater flow and each is designed for a three-bedroom home. They also each receive the same wastewater strength, the sanitary sewer line is tapped, and supplies flow to the test center. Each technology discharges to a soil absorption system, and each has the same soil type and depth from which effluent samples are taken.

As shown by the results, the standard system performs similarly to the newer technologies in terms of treatment. The data suggests that the term "Advanced" in Advanced Treatment Units (ATUs) may be misleading. They may be advanced as compared to a septic tank alone, but not as compared to the system of the tank and soil together. The noted exceptions are nitrogen treatment, installation cost and O&M costs. The case where proper treatment by standard onsite septic systems can be a potential concern is in nutrient sensitive areas, waterfront areas or tight lots where the accumulation of the nutrients is a concern.

Why Does It Work?

Function and Maintenance

At the National Onsite Wastewater Recycling Association (NOWRA) 2000 Conference, E. Jerry Tyler presented a paper entitled, "What happened to the passive onsite wastewater system?" At the presentation he explained that the standard system uses the soil and the

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processes of nature to treat wastewater. It is simple in design but effective, making it cost efficient as well as environmentally responsible. It also is a passive system, requiring no outside energy to operate. It is truly a wonder of nature. In our highly technological world, the idea that something can function sufficiently without constant attention is hard to accept.

Because of its simplicity, the standard system requires only minimal maintenance. Tank pumping and overall inspection every three to five years is typically required to ensure proper system function. Although improved maintenance programs are needed and are on the horizon, this is mainly an effort to ensure that the operator (homeowner) is actually contracting for the basic maintenance required.

Longevity

The standard septic system has an excellent track record despite the bashing it often gets from advocates of sewering or more stringent regulation. The low failure rates are the result of improved site evaluation and installation by knowledgeable contractors. These contractors tailor the installation and specific combination of products used to the available site and usage information.

In Oregon, a recent study evaluating more than 400 systems put the failure rate below two percent. The low failure rate was attributed to a strong wastewater program operated by the Oregon Health Department. It also was a result of modern site and soils evaluations, educated, trained site evaluators and contractors that were certified and licensed.

The Massachusetts Septic System Test Center touches on system longevity in its "Explanation of Facts" sheets. It states "A conventional soil absorption system is expected to last a minimum of 30 years if properly designed." I would only add "…and maintained," and I think most experts would agree.

Raising the Bar

It often has been said that in order for onsite septic systems to play a major role in the future of wastewater treatment, the level of standards and professionalism throughout the onsite wastewater industry must be raised. While it may not be apparent to most users, the education, technology and regulation related to onsite wastewater treatment has been the focus of much attention for the last several years.

Contractors have an increased understanding of how systems function due to the establishment of training centers and manufacturer education initiatives. There are presently thirty onsite wastewater training centers in the United States and Canada, and several states and provinces require that installing contractors be licensed or certified.

The EPA manual and state regulatory codes have been revised to incorporate the latest university research. State regulatory departments also have increased their level of knowledge and professionalism. Many updated codes require the site evaluation and/or the design of the system to be conducted by professionals such as soil scientists or engineers.

Post-installation system management is being reviewed as a key area needing further attention and regulation beyond the individual system operator (the homeowner). The onsite industry is having growing pains regarding system management, and many new management strategies currently are being tested and discussed. These include fee-based utility oversight of individual systems and mandatory pumping schedules with record keeping by the regulatory department.

Conclusion

Standard onsite wastewater treatment utilizing a septic tank and a leachfield has accomplished the goals set out by EPA. The bad reputation they sometimes receive due to poorly designed, installed or failing systems is not generally deserved. They have been and will continue to be the workhorses of the wastewater treatment industry, available to the public in areas where there are no options and at a cost that no competitive technology can match. These systems have protected community health for the last century. Due to substantial improvements in the onsite wastewater industry from increased science and understanding, higher standards for installers, updated codes, more thorough site evaluations and inclusion of designers, there is no reason to believe that the next century should be any different.

After reviewing the benefits and advantages of the standard system as compared to new treatment technologies, ATUs or pretreatment systems, it is clear that the standard septic system will remain the system of choice for the majority of installations in the future.

A conventional soil absorption system is expected to last a minimum of 30 years if properly designed and maintained.

About the Author:
Dennis Hallahan is manager of Infiltrator Systems Technical Services Department, Old Saybrook, Conn. Dennis oversees a staff that is responsible for product research and testing for both universities and private consultants. Dennis holds a BS in Civil Engineering from the University of Vermont, and a Masters of Science in Civil Engineering from the University of Connecticut and is a registered professional engineer in Colorado and Connecticut.