THE OHIO STATE UNIVERSITY EXTENSION

Extension FactSheet

AEX–754-01

Food, Agricultural and Biological Engineering, 590 Woody Hayes Dr., Columbus, OH 43210

Managing Septic Tank-Sand Bioreactor Systems

Karen Mancl
Professor and Water Quality Specialist
The Ohio State University

A septic tank-sand bioreactor system is made up of four parts as shown in Figure 1. Wastewater first flows from the home into a 1000 to 2000 gallon septic tank buried in the yard. The tank is water-tight and equipped with baffles to create a place for wastewater to stand for at least a day. During that time the solid materials settle to the bottom of the tank and the greases and other light materials float to the top. While the wastewater, with the solid material mostly removed, flows out of the tank past an outlet baffle for additional treatment, the solid material accumulates until the tank capacity is reduced and the tank requires pumping.

Wastewater from the septic tank accumulates in a second, smaller tank which is equipped with a pump and switches. Spaced throughout the day, switches activate the pump and small doses of wastewater are applied to the surface of a sand bioreactor.

The wastewater that flows from the tanks is still sewage, requiring additional treatment to prevent contaminating water resources or threatening the health of people in the area. Deep, well drained soils are ideally suited to provide the necessary treatment. Unfortunately, rural homes are planned for areas which have shallow soils, very permeable soils, or in areas with high seasonal water tables. Special sand bioreactors can be used to provide the necessary treatment. Any remaining solid particles are filtered out, and the organic matter and ammonia are reduced in a layer of sand by the microorganisms that colonize the sand particles.

A disinfection system is needed after the sand bioreactor to kill disease-causing organisms before the wastewater can be permitted to be discharged to a stream or dispersed on the lot through an irrigation system. To learn more about sand bioreactors ask for Bulletin 876, *Sand Bioreactors for Wastewater Treatment* for sale at Ohio county Extension offices.

The process of filtration and treatment occurs for years in properly designed, constructed, and managed sand bioreactor systems. If neglected, a number of things can go wrong. Fortunately, if identified early, problems can be easily corrected at no or minimal cost.

The goal of a management program is to ensure long-term performance of septic tank-sand bioreactor systems to protect the public health and the environment. This is accomplished through a five-step process.

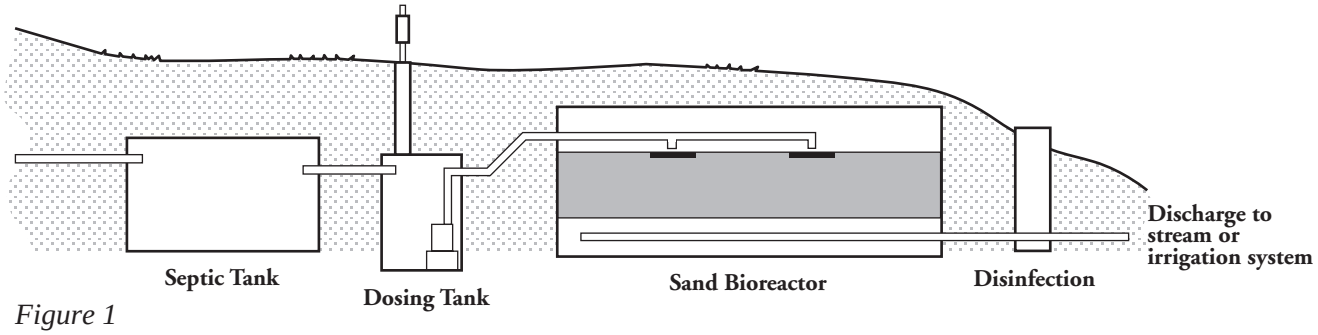

Figure 1

Step 1

Proper design is always critical in the consideration of septic tank-sand bioreactor systems. Ensuring that these systems are properly designed takes on extra importance to the entity providing long-term management. Systems that have serious design problems are sometimes referred to as "lemons." A management program, no matter how conscientious, will be unable to overcome the deficiencies present in systems that are constructed with the incorrect sand, have serious ground or surface water infiltration problems, or are inadequate for the amount of wastewater being generated.

Management entities have detailed rules and design criteria for the systems they plan to manage. Inspections of the system are planned during construction to ensure that the system is right from the start. Designs are also reviewed and approved by the management entity to avoid oversights.

Step 2

New septic tank-sand bioreactor systems that will be managed, must be constructed with management in mind. Fortunately, it is not difficult or expensive to construct a system to facilitate long-term management. The special features include:

- *a detailed drawing* of the system as built.

The Stinson Beach County Water District has operated a management program for this oceanfront community in Marin County, CA, since 1977. The district has a detailed set of rules for system design.

All systems at Stinson Beach have tank risers, lateral valves and risers, and inspection ports. The pumps also have an elapsed time meter and a dose counter to verify the wastewater loading to the bioreactor in this recreational community.

- *risers* to the ground surface with access covers are needed on all tanks. This provides for quick and easy access for inspection and maintenance. All electrical connections and alarms must be placed in a weatherproof box outside of the dosing tank.
- *an inspection port* is needed down to the sand surface. This enables an inspector to quickly check for ponding that is an indication of an impending malfunction.
- *valves and risers* at the end of all lateral lines to facilitate flushing debris from each line. Sand bioreactor systems are sometimes constructed with small diameter pipes with small holes. If not flushed out, the holes in the pipe can clog over time.
- *an access* to collect samples for analysis is needed following the disinfection chamber to ensure the system meets discharge standards.

Tank risers, lateral valves and risers, inspection ports, and sampling access can be added as a retrofit to existing septic tank-sand bioreactor systems.

Step 3

Because sand bioreactor systems have mechanical dosing systems and sometimes have disinfection units, each sand-bioreactor system should be in-

About 330 sand-bioreactor systems are inspected each year at Stinson Beach. By catching problems early, they can be corrected quickly and reduce the environmental and public health impact.

spected every 6 months. Inspections take from 30 to 60 minutes to complete and include:

- walking around the lot looking for landscape changes that can cause runoff into the area of the sand-bioreactor. Also looking for problems caused by cross connection with a well or community water system.
- walking downslope of the sand-bioreactor to check for signs of surfacing sewage.
- locating and opening up the inspection port to check for ponding.
- activating the pump and checking alarms.
- opening risers at the end of each lateral to open and flush lines to remove debris that may clog holes in the small diameter pipe.
- checking the disinfection system.
- collecting an effluent sample to check compliance with discharge standards.

Every three to five years the septic tank should be opened and inspected to:

- check for deterioration of the tank lid and riser.
- open tank and check for deterioration of tank baffles.
- measure the level of sludge and scum in the tank.

An additional 15 to 20 minutes per system must be set aside for record keeping to:

- record observations of ponding, deterioration and, if measured, disinfectant and sludge level.
- leave a hang-tag for resident to let them know their system was inspected.
- review analysis of effluent.
- send a follow-up with a form letter to property owners on the condition of their system.
- update databases and generate reports.

Finally, time to travel to the systems for inspections in rural areas must be included. By scheduling inspections by neighborhood, travel time can be kept to a minimum.

Step 4

Early maintenance and repairs are possible and encouraged through a regular inspection program. Routine maintenance, like septic tank pumping, can be accurately prescribed. Problems, such as ponding in a sand bioreactor, can be identified and corrected before they begin to surface on a lot.

Management entities aggressively monitor routine maintenance and repairs to make sure they are done as needed. Most management entities have penalty provisions in place if a homeowner refuses to maintain or repair their system. The management entity may also have the authority to go onto private property and perform the necessary work. Fortunately, this is sel-

Overall management system performance at the Stinson Beach County Water District is very high. Fewer than 1% of onsite systems malfunction per year.

dom a problem. Once properly sited, designed, and guarded from damage, sand bioreactor systems need only regular maintenance to pump the septic tank and add disinfectant, and repair or replace worn pumps and controls.

It is important to note that the expected life of any wastewater treatment system, including sand bioreactor systems, is 20 to 30 years. Pumps can wear out in 10 years or less. While older systems may still function, they will likely require upgrading or component replacement. A management entity can monitor the age of systems and forewarn property owners of anticipated upgrades.

Step 5

Supporting the management entity ensures long-term performance of sand-bioreactor systems. While it is not cost-free, managing sand-bioreactor systems is about half the cost of a typical sewer bill. The most important element of a management program is a knowledgeable and dedicated inspector. Depending on labor costs in the area and travel distances, semi-annual sand bioreactor system inspections cost from $250 to $300 per year per home.

Maintenance and repair costs vary. Some management entities set fees so they can provide the necessary maintenance for everyone. In others, the property owner contracts and pays for necessary maintenance and repairs on an individual basis. What works best depends on the wishes of the community.

The inspector at Stinson Beach has been checking the over 680 sand-bioreactors and other onsite systems since 1994 as a full-time job. Because he knows so much about every system, inspections are completed quickly. When asked what he likes best about his work, he said protecting the water quality of the area where he and his family live and recreate. He also likes the challenge of working with onsite technologies.

Providing long-term management of sand bioreactor systems is simple, quick, and inexpensive. With semi-annual inspections, the need for maintenance and repair is identified early, and it can be taken care of at no or minimal cost. Most importantly, with regular checking, the reliability of a disinfection system can be assured. Through management of properly designed septic tank-sand bioreactor systems, rural communities can provide for low-cost wastewater treatment and protect the public health and the environment in areas with thin soils and high, seasonal groundwater.

Funded in part through a grant from the National Onsite Demonstration Project, West Virginia University.

10/01-klw