Massachusetts Alternative Septic System Test Center

Technology Fact Sheet - *Interim Findings*

Explanation of Fact Sheets

The Massachusetts Alternative Septic System Test Center is a collaborative project of the Buzzards Bay Project National Estuary Program, Massachusetts Office of Coastal Zone Management, Massachusetts Department of Environmental Protection, Barnstable County Department of Health and the Environment, and UMass Dartmouth School for Marine Science and Technology. The Test Center was established in recognition of the need in Massachusetts for cost-effective wastewater disposal systems suitable for sites with limited space, poor soils, high groundwater elevations, or where advanced pollutant removal is required. Its mission is twofold. First, to evaluate the performance and operation costs of new and innovative wastewater disposal technologies in a carefully controlled and unbiased manner, and provide this information to regulators and consumers. Second, to assist vendors in getting their technologies more quickly approved for use in Massachusetts, and at a lesser cost.

Technology Name:

The specific model and technology tested at the Test Center. It is important to recognize that other models may be produced by the company. Also, variations of installation may include different configurations, sizes, pump and blower power, and Soil Absorption System (SAS) area. These differences may result in performances different from those reported here.

Technology Type:

This section describes the general class of technology as commonly identified by those in the industry.

Manufacturer:

Address and phone number of the manufacturer participating in the Massachusetts Alternative Septic System Test Center.

Contact:

The spokesperson to contact on performance of the technology.

Company Website:

Website of the manufacturer participating in the Test Center.

Additional Performance & Permitting information:

Detailed information is available from the Massachusetts Department of Environmental Protection (DEP) and Barnstable County Websites:
www.state.ma.us/dep/brp/wwm/t5pubs.htm#it and
www.barnstablecountyhealth.org/AlternativeWebpage/.

Testing Objectives:

The specific performance the vendor sought to evaluate at the Septic System Test Center.

Testing Period:

The fact sheets indicate both the start of the testing period for the technology, and the period during which data was evaluated as summarized in the fact sheet. "Ongoing" indicates that testing continues, and the final performance evaluation summary may differ from the Interim Findings fact sheets. Vendors had an optional 90-day start-up period of testing in which they could optimize the operation and performance of the system before the evaluation period began, thus the reporting data period is not necessarily equivalent to the testing period.

Testing loadings:

Generally all systems were identically loaded at 330 gpd unless specified. This loading was made in 15 daily doses, concentrated in the early morning and late afternoon to simulate typical septic system usage. SAS loadings were 0.74 gallons per sq. foot per day.

An SAS during construction. Each trench receives a fourth of the discharge from each test replicate. Dosage is 0.74 gallons per sq. ft. per day.

Siting Considerations and Installation Notes

Depending on the skill of the installer, actual installation elevations and layout may differ slightly from engineering plans approved by municipal Boards of Health. The performance of some technologies is more sensitive than others to variations or elevations, tightness of seals, and other factors. Installers should have had training and be familiar with the installation of the technology. Oversight by manufacturer or designer during installation of the waste disposal system is recommended. Some technologies are more complicated and difficult to install than others. Difficulty of installation has relevance to installers and inspectors. For each technology, a visual description was given of what may typically be observed above grade on a property where the technology is employed. It should be kept in mind that more or less of the components may be visible depending upon which components the engineer has placed below grade. Because pumps and air blowers of some systems are audible, decibel output of the system will be reported in the final report. Odors were difficult to quantify due to proximity of various sources and will not be evaluated.

Actual & Manufacturer's Estimated Costs (3-bedroom home) and Labor

Non-Title 5 Components:

The cost of Title 5 components (septic tank, D-box, and SAS) are about $2,000. Innovative systems typically have these components and additional ones. This sections lists costs above those of a conventional system. These estimates are claims by the manufacturer and have not been verified.

Components + Installation:

The cost for a conventional Title 5 septic system for a 3-bedroom home in Massachusetts ranges from $3,500 for a best case in new construction to up to $60,000 for difficult lots as retrofits (mounding, replacement of soils, pumps required, etc.). More typically, these systems range between $8,000 and $16,000. This section shows non-Title 5 component costs with associated additional minimum installation costs above a conventional septic system. These estimates are claims by the manufacturer and have not been verified.

Electrical:

Any system with air blowers or water pumps uses electricity. Electrical use depends on the wattage or horsepower of the pump, and the period of time a pump operates. Electrical use was reported as both annual kilowatt hours (KWh) and average annual cost based on Cape Cod electricity rates. It should be kept in mind that costs of electricity on Cape Cod (11 cents per kWh) are somewhat higher than other areas.

O&M:

(Operation and Maintenance) All septic tanks should be inspected every three years and pumped if necessary. This may cost $180 or more. Thus, a conventional septic system and all other technologies are assumed to average $60 per year in septic tank pumping costs. Other technologies may also have required operation and maintenance agreements, which in general represents a $400 per year minimum cost over the life of the system, in addition to the $60 per year tank pumping costs.

Other costs:

All installations have design and permitting costs associated with their installation that vary considerably with the site and installer. If effluent monitoring is required, this may cost an additional $300 annually or more.

Replacements:

A conventional SAS is expected to last a minimum of 30 years if properly designed. Other technologies may have parts, media, and pumps that may need more frequent replacement. Generally pumps have manufacturer warranties of one to three years, although in practical terms, their duty cycle may typically be longer, sometimes to 10 years. We report only the specific model name and either manufacturer or installer's warranty for replacement**.**

Inspections:

Septic tanks for all technologies should be inspected once every three years and pumped if necessary. Other technologies may have parts or components that may need to be inspected more frequently. Alarms or indicator lights for indicating proper pump functioning are often required.

Theory of Operation
This section includes a brief summary of the physical and biochemical theory of how the technology works or claimed to work.

Permitting and Use in MA
This section includes a summary of what permits the technology has for Massachusetts. A technology may be certified for these uses:
Certification for General Use: Technology can be installed anywhere a conventional Title 5 system may be used. In nitrogen sensitive areas, RSFs can be installed for residential use for sites where the design flow is less than 2000 gpd at a density of 550 gpd per acre.
Remedial Use Approval: To replace a failed, failing or nonconforming system. Can be installed with only 2 feet (3 feet in areas with percolation rates of two minutes per inch or higher) to high groundwater elevation, or with up to a 50 percent reduction in SAS size, or with only 2 feet (3 feet in rapid percolation areas, see above) of naturally occurring suitable material below the SAS.
Provisional Approval: To evaluate alternative systems that appear technically capable of providing levels of protection at least equivalent to those of a standard on-site disposal system and to determine under field conditions whether the system can obtain general use. All systems currently with Provisional Use are attempting to demonstrate a higher nitrogen reduction capability than an RSF.
Piloting: Intended to provide a technical demonstration that a technology can meet a specific performance limit under field testing conditions.

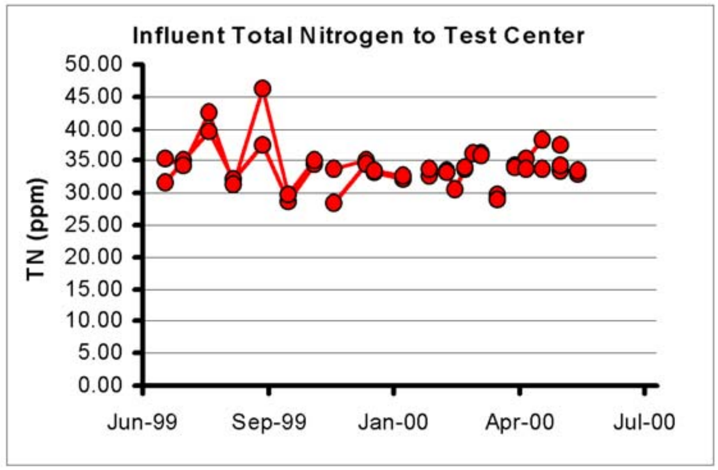
Operation and Maintenance Issues
This section was not completed in the interim fact sheets, but will include a summary of problems observed, or issues anticipated.

Explanation of the Graphs
The ability of a technology to remove pollutants was evaluated against pollutant concentrations in the influent during the period for which they were tested. Thus, if the technology was tested between July 1, 1999 and July 1, 2000, the effluent quality of the discharge was compared to the influent concentrations during the same period to account for changes that may have resulted from changes in operation of the facility, equipment replacement, or other factors. The graphs show the mean of all data from the three replicates for each parameter over the testing period, compared to Title 5 performance and influent, measured in parallel samples during the same period. Fecal coliform results are expressed as geometric means. In the nitrogen graph, NH4 represents ammonia, NOx represents nitrate+nitrite, DON is dissolved organic nitrogen, and PON is particulate organic nitrogen. Total nitrogen is the sum of these four parameters.

SAS samples include wastewater system effluent and precipitation. The recharge of precipitation to groundwater is estimated to be between 8 and 16 percent of effluent discharge based on local rainfall, estimated groundwater recharge rates, SAS size and dosage rates. For all technologies, an interim dilution rate of 10 percent was employed based on precipitation and theoretical and measured dosage rates at the Test Center. The results for nitrogen removal include this estimated dilution factor (note bars labeled "SAS adj.") Results shown for, and fecal coliforms were not adjusted for dilution by precipitation, because the adjustment was negligible in evaluating overall performance. This interim approach, is being compared to specific conductivity, chlorides, and bromide tracer data to better refine this estimate, and develop system-specific dilution factors. **Thus, the "SAS adjusted" values reported here for nitrogen discharge to groundwater should be considered preliminary.**

Summary of Interim Findings
This section includes brief summary statements by the Review Committee as to how the system performed in the tests. Typically, the performance of the technology before and after the SAS was compared to the septic tank effluent, and effluent under the SAS of a conventional septic system. This comparison of BOD and TSS at the D-boxes (technology or septic tank effluent) is important because reductions of BOD and TSS in alternative technologies are the basis of proposed reduced SAS size or reduced depth to groundwater under the SAS. However, it is important to recognize that in a conventional septic system, some pollutants, such as bacteria and nitrogen, receive additional treatment in the SAS, which typically has a "bio-mat" layer that forms in the soil in the SAS. The SAS of advanced treatment septic systems may lack this biological mat. It is for these reasons that the Test Center compares pollutant removal performance of the innovative technology discharges to septic tank effluent (D-Box) of a conventional septic system, and at the base of the SAS, which both must employ. For all systems, BOD and TSS data at the base of the SAS are based on a very small sample size, and small differences among the technologies may not be significant.

Because of the difficulties in capture of SAS effluent in lysimeters, concentrations were made in the collection liner drain ("sump") under each SAS. Concentrations were adjusted by an interim dilution factor of 10% to account for infiltration of rainwater in the SAS. Actual dilutions may vary among the systems, and system specific dilution rates will be based on bromide and chloride tracer data in the year two reports. Samples collected under the SAS are taken less frequently than in other components. These issues and details of system performance will be discussed in greatly detail in a forthcoming performance review report. The fact sheets are meant only to provide a thumbnail view of overall system performance.



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These fact sheets were reviewed by a multi-agency work group. The views or opinions expressed are not necessarily those of the Commonwealth of Massachusetts, the US EPA, or any of the funding organizations and agencies. The information presented here represents the technical findings of the Massachusetts Septic System Test Center after at least one year of system testing. Manufacturer claims of cost and longevity, warranties, or stated costs have not been verified. Modifications to system designs from those tested, or installation under other soil or climate conditions may result in different system performance. This fact sheet was prepared and printed by the Buzzards Bay Project.

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