Texas On-Site Insights
Information about On-Site Wastewater Treatment Systems in Texas
Volume 2, Number 3, Fall 1993

A&M Researchers Evaluate Rock Plant FIlters in Lower Rio Grande Valley

Researchers with the Texas A&M University System are testing the effectiveness of constructed wetlands to treat wastewater in the Rio Grande Valley.

Scientists collaborating in the study include Bruce Lesikar, Guy Fipps, Ann Kenimer, and Don Reddell of the Texas A&M University Agricultural Engineering Department, and Bob Wiedenfeld of the Texas A&M Agricultural Research and Extension Center in Weslaco.

The purpose of the study is to evaluate whether microbial rock plant filters (MRPF) and microbial rock filters (MRF) can be effective for treating wastes from individual homes. In these systems, effluents are treated by microbes that live on submerged rocks. The systems can include wetlands plants that grow above the surface, but can still be effective if the plants die in cold weather because of the treatment provided by the microbes. By using subsurface treatment, these systems avoid mosquito and odor problems that are associated with above-ground wetlands ponds.

Workers place gravel in the bed of this rock plant filter at the Texas A&M Center at Weslaco.

This summer, the researchers installed two MRPF systems. The first was 12 feet wide and 30 feet long and located near trailers used by visiting students at the Texas A&M Center in Weslaco. It will utilize naturally occurring clay soil as a liner. The second system was 10 feet wide and 25 feet long and was installed near the home of a Center

employee. This system will utilize a synthetic liner to prevent effluents from contaminating groundwater. If the clay liner proves successful, it would probably be much less expensive than synthetic liners that are now being used.

Workers excavate this area where a microbial rock plant filter will be installed.

Wastewater quality will be tested for nitrate, total suspended solids, biochemical oxygen demand, fecal coliform, pH, salinity, , and other parameters. Wiedenfeld will test for nitrate and salinity levels and fecal analysis will be done by a lab in Harlingen. Laboratories at the Texas A&M Agricultural Engineering Department will test for suspended solids.

Another component of the project is to evaluate whether existing clay soils provide an acceptable quality liner by restricting the movement of water and nutrients through soils. Lesikar collected soil samples to determine the saturated conductivity of the soil beneath the unlined MRPF when it was constructed. Wiedenfeld took core samples before the system was installed and will take samples up to a depth of five feet every six months and will test them for nitrate.

The study was funded by the Texas Agricultural Experiment Station's Research Enhancement Program.

For more information, call Lesikar at (409) 845-7453.

New Mexico State Study Examines Biological Contactors

A new study that describes how rotating biological contactors can treat septic tank effluents has been published by the New Mexico Water Resources Research Institute (WRRI).

The report, *On-Site Treatment of Septic Tank Effluent: An Evaluation of Rotating Biological Contactor Capabilities* (TR 277), was written by Ricardo Jacquez, Firojbhai Vora and Nehal Zaidan of the New Mexico State University Civil, Agricultural, and Geological Engineering Department. The study evaluated the combined use of septic tanks and a contactor to remove nitrogen from wastewater. The system that was tested consisted of two mobile homes with a combined total of five residents. The results show

that the device was able to achieve nitrification and denitrification while lowering carbon-based oxygen demands. Chemical oxygen demands and total suspended solids were both lowered by 70%. Nitrogen levels were slashed by 82% by establishing anoxic conditions. The system even worked properly after a four-day power failure temporarily shut down the contactor. Copies of the report are available by calling the New Mexico WRRI at (505) 646-1813.

TVA Guidelines for Constructed Wetlands for On-Site Systems

A recent report by the Tennessee Valley Authority describes how constructed wetlands can be utilized to treat small flows of wastewater from individual residences.

The report, *Constructed Wetlands Wastewater Treatment Systems for Small Users Including Individual Residences*, was written by Gerald Steiner, James Watson and Kimberly Choate. The report includes sections on pre-treatment, hydraulic and organic loading, design and construction guidelines, vegetation, and operation and maintenance. Design examples are included for residential or other small systems that use septic tanks for primary treatment.

The report can be ordered by calling the TVA at (615) 751-7338.

Do you have a story idea? Write to us with your ideas!

One of the purposes of the *On-Site Insights* newsletter is to tell people of solutions and challenges people are having all over Texas in dealing with on-site wastewater.

If anyone (people working with regulatory agencies, engineers, consultants, and everyday citizens) has any experiences in working with on-site wastewater, we would like to hear from you. In many cases, we'll be able to work with you to write an article that can appear in a future issue. If you would rather, feel free to write an article and send it to us. We can also use photographs or slides along with the articles.

Finally, please let us know if we're covering the types of issues that you feel are important and that you want to read about. We want to know if *On-Site Insights* can be improved to make it even better.

Please call me, Ric Jensen, the editor at (409) 845-8571 or 845-1851 if you have any suggestions or comments.

Get Ready to Attend Annual On-Site Meeting October 10-12

Final preparations are being made for the second annual meeting of the Texas On-Site Wastewater Treatment Research Council.

The conference, which will be held October 10-12 at the Wyndham Hotel in Austin, is centered around the theme "Breaking New Ground."

The conference begins Sunday evening with an opening social in the exhibit area. The general session begins with an overview of the On-Site Council that will be presented by Council Chairman Bill L. Harris of the Texas A&M University Soil and Crop Science Department. Commissioner Pam Reed will speak about the future of the on-site program in the Texas Natural Resource Conservation Commission (TNRCC). A Monday lunch and panel discussion will include representatives of the TNRCC, the Environmental Protection Agency (EPA), the Lower Colorado River Authority, and the Austin-Travis County Health Department. On Tuesday, there will be a keynote speech by Congressman Greg Laughlin.

The two-day meeting will feature 11 concurrent technical sessions covering such issues as new state regulations, communicating on-site issues to the general public, evaluation of cluster systems, bottom ash as a porous media in drainfields, and the use of sand filters and subsurface drip irrigation, and constructed wetlands. A hands-on workshop on soil types and textures will be presented by the Soil Conservation Service. So far, 23 organizations have agreed to sponsor exhibits and many of their representatives will present talks and display products during the conference.

The registration fee for the conference is $50, which includes meals. Copies of the proceedings can be purchased separately for $10.

For a complete program or for registration information, contact Crespin Guzman or Terri Chapman at the City of Austin Water and Wastewater Department at (512) 499-2894.

The meeting site is the Wyndham Hotel, which is offering a special rate for those attending the meeting. Please mention that you are attending the conference when you register. Their phone number is (800) 433-2241.

TAEX Fact Sheet Describes How Septic Tanks Affect Groundwater Quality

A fact sheet that contains basic information on the potential of septic tanks to contaminate drinking water has been developed by the Texas Agricultural Extension Service (TAEX).

The fact sheet, *Assessing the Risk of Ground Water Contamination from Household Wastewater Treatment*, was produced as part of the TEX-A-Syst Groundwater Protection Program. It was based on information developed nationally and was revised for Texas by Dennis Hoffman. The fact sheet contains a worksheet that individuals can fill out to determine if they are at risk. Homeowners are asked to assess the quantity of wastewater they produce, the amount and type of contaminants they generate, and the methods used to treat and dispose of wastes. It contains a scoring system homeowners can then use to rank their relative risk.

Single copies of the worksheet can be obtained free by calling (409) 845-2425.

Four New Members Appointed to On-Site Wastewater Treatment Research Council

Four new members have recently been appointed to the council. They include Milton Kersten, the manager of the North Alamo Water Supply Corporation in Edinburg, Jose Gil, an engineer who designs on-site systems in Austin, Ann McGinley of the Texas Natural Resources Conservation Commission (TNRCC) Austin office and Randy O'Neal of the TNRCC Tyler office.

In other business, the Council elected a new chairman and vice chairman at its September meeting in Austin. Bill L. Harris, an Extension soils specialist with the Soil and Crop Science Department at Texas A&M University in College Station, was elected as the new Council chairman. Rick Goldberg of Wastewater Systems of Texas was chosen as the Council vice-chairman. The changes take place immediately.

Council Funds Study of Effectiveness of Sand Filters

Research will be Done by Texas A&M, LCRA and Consultant

A collaborative team of researchers from Texas A&M University, the Lower Colorado River Authority, and a private consultant have been awarded a grant from the On-Site Wastewater Treatment Research Council to assess the effectiveness of intermittent sand filters.

Researchers working on the project include Bruce Lesikar and Guy Fipps of the Texas A&M Agricultural Engineering Department, Burt Carter and James Patek of LCRA, and David Venhuizen, an engineer and consultant from Uhland.

The research will be conducted at the Texas A&M University Riverside campus on Highway 21 west of Bryan. One benefit of that site is that it is currently being used by the Texas Engineering Extension Service (TEEX) to train installers and inspectors of on-site systems. As a result, TEEX trainers will be able to use the site in their programs.

Sand filters have been used for some time in areas where traditional septic tanks do not function well. This includes sites with high groundwater tables, sensitive aquifer recharge zones, and properties near lakes. Sand filters are also well known for their ability to be virtually trouble free, while consistently producing high quality effluent.

One of the drawbacks that has limited the widespread use of sand filters is that they often require a large area. For example, typical ordinances governing buried sand filters require one square foot (sf) of sand filter for every 1 or 2 gallons of wastewater. This means that a homeowner would have to set aside up to 200 square feet for such a filter at a cost of roughly $3,000. "Open access" sand filters require less area (often 2 to 5 gallons per square foot) but are still more expensive than other treatment options and are more likely to create odor and health problems.

Lesikar and the other researchers want to follow up on previous studies that suggest that innovative approaches to designing and managing sand filters can increase the level of treatment and lessen the land requirements. For example, adding pre-treatment before effluents are sent from septic tanks to sand filters and distributing the wastewater to the filters in many, small doses can make the filters much more effective. Installing layers of coarse, medium, and fine grained sands on top of one another in the sand bed can provide better treatment. Apparently, the coarse sand at the top of the filter strains out many of the pollutants and prevents the fine-grained sands underneath from becoming clogged.

The overall goal of the project is to demonstrate and evaluate whether intermittent sand filters can consistently and reliably produce high quality effluents. Specific objectives are to: 1) Assess the effect of different sizes of sand particles, 2) Evaluate the impact of raw wastewater quality, 3) Determine the impact of wastewater loading rates, 4) Assess the impact of loading schedules, 5) Determine if applying effluents with sprinklers is effective, 6) Evaluate the potential for denitrification by recirculating effluents, and 7) Evaluate subsurface drip irrigation as a viable method to dispose of effluents. The researchers also hope to determine the operation and maintenance requirements of these systems and to produce a sand filter user's manual.

Effluents will flow through three treatment sequences or "trains." The first treatment train will utilize a septic tank followed by an upflow filter, and a sand filter. Effluents will recirculate from the sand filter to the septic tank, where additional nitrogen removal will occur. The second treatment scheme will utilize a septic tank followed by a modified conventional recirculating sand filter. The third treatment sequence will utilize a septic tank followed by a single pass sand filter. An upflow filter will be placed between the septic tank and sand filter, and could either be used or bypassed.

Six individual sand filters will be used in each treatment train. The first two treatment trains will utilize the following filters: eight inches of fine (0.5 millimeter) and coarse (1 mm) gravel over a foot of sand; 2 feet of fine and coarse sand; a foot of very coarse (1.5 mm) sand, and 2 feet of very coarse gravel (3 to 6 mm). The third treatment scheme will use the following filters: two feet of fine and coarse sand; one foot of fine and coarse sand; one foot of coarse sand laid over a foot of fine sand, and a buried filter bed.

A spray nozzle or perforated distribution head will be utilized to apply wastewater to the sand filters. Some of the effluent from the sand filters will flow to an underground drip irrigation system. Soil samples will be taken from areas that are drip irrigated to measure if nutrients are building up.

The research will include extensive monitoring. Forty-nine samples will be collected over a 70 week period to determine how water quality changes before and after the effluents are treated by the sand filters. Intensive collection efforts will be conducted in which samples will be taken every other day over a four week period.

Water quality parameters that will be monitored include temperature, pH, dissolved oxygen, chemical and biochemical oxygen demand, total suspended solids, fecal

coliform, ammonia, nitrate, nitrite, and total nitrogen. Fecal coliform tests will be performed by a Bryan lab, while other tests will be carried out by the Texas A&M Agricultural Engineering Water Quality Laboratory.

The researchers hope to finish the design this winter and begin installing the system in the spring. For details, call Lesikar at (409) 845-7453.

The Responsibility of Regulatory Agencies to Inspect On-Site Systems

NOTE: This article and **The Responsibility of Homeowners to Maintain Septic Tanks** *were written by Randy O'Neal, who works for the Texas Natural Resource Conservation Commission District 5 Office in Tyler. O'Neal was recently appointed to the On-Site Wastewater Research Treatment Council and can be reached at (903) 566-0476.*

What is a regulatory agency's responsibility after the final inspection has been conducted on an on-site sewage facility (OSSF) which has met the minimum state standards? Should documentation be kept by the agency? Will documentation provided to the owner of the system alleviate most problems?

An OSSF must be properly designed, reviewed, and installed in suitable soils within a good site. A final inspection is conducted before the disposal system is back-filled. A follow-up inspection may be conducted to assure that a proper vegetative cover has been added. An inspector should evaluate the system and document the findings on the proper form. The inspector may want to develop a detailed "as-built" drawing (which shows how the system was actually constructed and installed) to supplement the inspection form.

If these conditions have been met, then the inspector's responsibility has largely been completed. Chapter 366. Section 366.003 states that regulatory agencies that inspect on-site systems are not liable for damages resulting from the installation and operation of on-site systems approved by their personnel. However, inspectors who may have permitted add-ons, or performed "windshield" inspections may be opening themselves up to possible litigation.

As much pertinent documentation as possible should be kept on each individual system that has been inspected. Each inspection form should include specific criteria that enables the system and its components to be documented to show that it has at least met the state minimum standards. Besides avoiding any potential legal problems, these procedures are necessary for regulatory agencies to pass mandatory annual state audits.

Does documentation presented to the homeowner serve any beneficial uses? Absolutely. Specific information and "as-built" drawings can alleviate many types of problems with the consumer.

Benefits of "As-built" Drawings:

The as-built drawings are not meant to alter the original design that was submitted and approved by the authority, but rather to reaffirm the design and soil analysis. They

provide the location of absorption fields, so the owner can avoid placing trees or driving heavy equipment over the disposal system or locating future construction over or near the system.

They provide easy access to clean-out plugs by showing where they are located.

The diagrams provides a useful tool for real estate transactions. They are also helpful for sludge haulers who need to locate the tanks. The diagrams verify that a detailed inspection was conducted.

Specific requirements for maintenance of individual systems could also be made available to the public. This information should supplement brochures supplied by the manufacturers.

These procedures involve a lot of time-consuming work. However, properly documenting that inspections have been performed and distributing these facts to homeowners will increase awareness and communication and could reduce system failures. All of these factors, if utilized, will continue to improve the effectiveness of all OSSF programs.

The Responsibility of HomeOwners to Maintain Septic Tanks

By Randy O'Neal
Texas Natural Resource Conservation Commission
District 5 Office in Tyler, TX

How many "conventional" septic systems that have met t e minimum state standards have failed across the State due to neglect or improper maintenance? What procedures may be implemented to reduce failures to systems after the final inspection?

Most homeowners have a limited knowledge of disposal systems and the responsibility and maintenance involved with these systems. An owner's awareness of these duties must be increased.

All parties involved in the process of installing a disposal system must share the responsibility in educating the owner on properly maintaining the system. Registered installers, designers, inspectors, and other qualified personnel must educate and promote awareness of these objectives. Resources that can be utilized include pamphlets, organizations, documentation, and word of mouth information.

The homeowner must follow these guidelines established by these parties to prolong the life of the system. Some of the main procedures that should be followed are listed below.

Future Construction

In the initial contact with the owner, the designer must discuss future plans for construction near the septic system or the absorption area before deciding on the best location to install the system.

Keep Plumbing in Good Repair/Conserve Water

The owner must keep the plumbing system in good repair. Leaks, drips, or excessive flows must be eliminated. Water-saving devices should be utilized whenever possible. Utilizing conservation measures will reduce the effluent and detention times and prolong the life of the system.

Avoid Non-Biodegradable Products and Chemicals

Consumers must be aware of the problems of disposing of improper material through sinks and commodes. Plastics, metals, sanitary napkins, and other products that are not bio-degradable should not be disposed of through an on-site system. Chemical additives can be very harmful to septic tanks and are typically not necessary for the operation of the system. Toxic materials such as petroleum-based products should not be disposed of through the septic disposal system. Use of these products could leach into the soil and contaminate groundwater.

Structural Integrity of Septic Tanks and Disposal Areas

Tanks should be inspected for leaks. The disposal area should be checked for lines which have become broken or pinched. Trailers, cars and other heavy equipment should not be parked over or near the treatment unit or disposal area.

Inspect Septic Tanks for Sludge and Scum Build-up

One of the most critical aspects of maintenance is to have the tanks pumped and cleaned. If sludge accumulates in the outlet device, solids will eventually enter the drainfield and seal the lines. Generally a family of four with a 1,000 gallon septic tank capacity will need a scheduled cleaning every two or three years. A good rule of thumb is to have the tanks checked for level of solids after the first year's use. This will enable the owner to develop a basis for scheduled cleanings. Garbage grinders are not recommended. If grinders are being utilized, sludge will accumulate rapidly, increasing the number of cleanings that will be needed.

Pump Tanks and Electrical Panels

Owners should know the exact location of the control panel and the high-water alarm. The alarm, pump, float, and other components should be periodically checked to see they are properly functioning. Should any mechanical part become defective, a specialist should be called immediately to perform the proper repairs.

Surface and Sub-surface Water

Surface runoff water must be diverted from the disposal system to prevent the drainfield from becoming saturated. It is recommended that houses be guttered or that French drains

be installed if needed. Berms should be constructed if elevated slopes are near the disposal area.

Maintenance of Ground Covers

Grass or other vegetative cover should be developed and maintained over the drainfield. Fertilizer and lime should be used to maintain the landscape. Equipment weighing more than a "light" riding lawn mower should not be used over the disposal system.

These guidelines must be promoted to the public to increase the awareness of these responsibilities. Homeowners must realize the beneficial cost of assuming these responsibilities. The proper specialist should also be utilized in dealing with the maintenance of the system.

Proper instructions and documentation submitted to the homeowner will increase awareness. As technology, communication, and funding improve, the On-Site Wastewater Program may formulate specific guidelines for disposal systems utilized by the public.

Following these practices will help reduce the number of disposal systems that fail because of neglect. Responsibility and maintenance are the key factors to the efficient operation of any on-site sewage disposal system.

Aerated Package Treatment Systems Evaluated in Virginia Tech Study

The performance of single family aerated package treatment systems is the subject of a new report from the Virginia Water Resources Research Center at Virginia Tech University.

The report, *Evaluation of the Performance of Five Aerated Package Treatment Systems*, was written by J. Kellam and Greg Boardman of the Civil Engineering Department, and Charles Hagedorn and Raymond Reneau of the Crop and Soil Sciences Department.

The research was conducted from 1990 to 1990. Water quality samples were actual residential systems. Samples were taken from the primary settling chamber, the aeration chamber, and effluent. Results suggest that overall performance was poor because the systems were not properly maintained by homeowners. Other problems include ineffective chlorination and dechlorination, inadequate biological treatment, and mechanical malfunctions. More than 80% of the systems had high biochemical oxygen demands and total suspended solids levels. Two-thirds of the systems contained high levels of fecal coliform bacteria.

The report can be obtained by calling (703) 231-8036.

Meetings

NOWRA to Meet Nov. 4-6 in Fort Worth

The National On-Site Wastewater Recycling Association (NOWRA) will sponsor its annual meeting November 4-6 in Fort Worth. The Texas On-Site Wastewater Association (TOWA) will hold its annual meeting in conjunction with the national meeting.

The NOWRA meeting will include numerous trade exhibits. Workshops will discuss the development of a model code for the industry, the development of standards and practices, continuing education seminars, and a suppliers' forum. Numerous presentations will be given at the meeting on such topics as high strength waste and the control of experimental systems. There will also be field tours of technologies and systems being utilized in the region.

One purpose of the meeting is to train realtors, developers, policy makers and buyers' groups that are involved in on-site wastewater.

For details on how to register for either meeting, call TOWA president Gig Drewery at (409) 246-3749. The meeting site is the Radisson Hotel. Their phone number is (800) 333-3333.

Water Resource Management Seminar

A seminar that addresses important topics for managers and technicians for cities, river authorities, water districts, and water utilities will be help November 30 thru December 1, 1993. The seminar will meet at the Holiday Inn Beaumont Plaza. For more information, contact Barbara DuBose at (512) 908-6333 or Israel Anderson at (512) 908-6325.

Conference on Sewage Systems

The Seventh International Conference on Individual and Small Community Sewage Systems will meet December 11-13, 1994 in Atlanta.

The meeting is being sponsored by the American Society of Agricultural Engineering (ASAE) and many other groups. ASAE is now accepting 300 word abstracts for the meeting. The deadline is October 15, 1993. Full manuscripts will be required later.

For more information, call Michael Hoover of the Soil Science Department at North Carolina State University at (919) 515-3285.

Baylor University Researcher Evaluates Performance of On-Site Treatment Units

Many manufacturers sell innovative on-site wastewater technologies in Texas that dispose of effluents using surface application. Before these systems can be sold in Texas, they have to be evaluated and approved by the Texas Natural Resource Conservation Commission (TNRCC).

Until a few years ago, most companies had to send their products to the National Sanitation Foundation (NSF) in Michigan to have the appropriate tests performed.

Recently, Dudley Burton, the Chairman of the Environmental Studies Department at Baylor University, has worked with many manufacturers in Texas to perform the standard tests the NSF and TNRCC require.

Dudley Burton takes a water sample from an on-site system he is evaluating at Baylor University in Waco.

Much of Burton's testing involves aerobic systems. He has evaluated the treatment performance and energy requirements of units that aerate domestic effluents. He has also tested different methods of increasing aeration that provide for more effective treatment. This includes systems that increase flow rates through the use of diffusers, and devices that boost oxygenation by forcing water through cone-shaped devices.

The trials, which are referred to as "NSF 40 tests," are meant to evaluate the performance of treatment units under normal conditions. Stress testing is also performed to simulate conditions that boost the pollutant load the system has to treat (for example, wash days, equipment failure or the return of a family from vacation). At Baylor, most of the tests are performed at the wastewater treatment plant that's operated by the Brazos River Authority. The plant also supplies the wastewater utilized in the testing and helps analyze water quality traits at a laboratory at the plant site.

The units are installed under manufacturers' specifications. Samples of both the raw and treated wastewater are taken regularly and data are recorded for such basic parameters as dissolved oxygen, biochemical oxygen demand (BOD), total suspended solids (TSS), pH, temperature, colors and odors.

Because these units are commercially for sale, we don't want to discuss the specifics of how a particular system performed. However, one representative aerobic unit Burton recently tested lowered BOD and TSS from an average of 190 to 6 milligrams per liter (mg/L) and reduced TSS from 168 to 6 under normal conditions.

Burton thinks that having a regional testing site promotes cooperation between manufacturers and scientists. "I believe that many companies like the idea of having someone relatively close by that they can visit with personally and actually inspect the

studies that are taking place," Burton said. "Because we're nearby, there are more opportunities to collaborate and fine tune the systems and improve them."

Yet another plus is that studies provide opportunities for training Baylor graduate students. So far, Burton's research has provided six graduate students with valuable experience in projects dealing with environmental monitoring and wastewater treatment technology.

Burton said that aerobic units are especially cost effective in areas with rocky and shallow soils, high groundwater tables, and water-logged soils. A major advantage is the area that has to be excavated is smaller. It can cost up to $6,000 to dig a large area required for a septic tank and drainfield, but the cost to install these aerobic units can be as low as $1,000.

Another advantage is that aerobic systems can provide a high enough level of treatment that effluents can be reused for landscape irrigation and other purposes. As water rates soar and as public acceptance of greywater reuse grows, Burton says these and other alternative on-site systems could be in greater demand.

For more information, call Burton at (817) 755-3405.