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Small Flows

Animal Feeding Operations Targeted for Better Nutrient Management

by Michelle Moore
NSFC Contributing Writer

Livestock production generates a tremendous amount of waste. Whether a farmer raises beef cattle, chickens, turkeys, or pigs, the accumulated waste has to be dealt with in some fashion that won't pollute surface or groundwater. Animal feeding operations, "AFOs" as these more intensive farms are called, are notorious for their pollution potential. The trend toward larger, corporate farms indicates an even greater possibility of water contamination if wastes are not properly managed. The Joint U.S. Environmental Protection Agency(EPA)/U.S. Department of Agriculture (USDA) Draft AFO Strategy released in September 1998 defines an AFO as a facility "where animals are kept and raised in confined situations . . .. Feed is brought to the animals rather than the animals grazing or otherwise seeking feed in pastures or fields."

Farming—livestock production—has changed considerably in the last 20 years with advances in feeding technology and manure management. The EPA publication, *Nonpoint Source News-Notes*, reported that USDA data shows a decline in the number of smaller farms and a substantial growth in the number of large operations. The number of hog farms in North Carolina, for example, decreased between 1982 and 1992 by 62 percent, but the number of hogs per farm jumped by 578 percent.

When water pollution does occur, the contaminated water most often results from poorly maintained feedlots or barnyards, exposed manure stacks, improperly built and maintained manure handling and storage facilities, or improper manure spreading. Presently, voluntary programs sponsored by the USDA and EPA intend to help remedy problems. But more needs to be done, including additional support for voluntary efforts and an enhanced regulatory program for a small percentage of high-risk AFOs.

Which AFOs will be regulated?

Farmers across the U.S. are questioning whether their operations fall under guidelines that will force them to need a permit to dispose of their livestock wastes. Of the 450,000 AFOs in the U.S., the USDA/EPA strategy proposes that 95 percent be encouraged to voluntarily devise and implement comprehensive nutrient management plans (CNMPs) that can be incorporated into existing farm planning activities.

Concentrated feeding operations like this one in Kansas can be potential sources of water pollution if the wastes that are produced are not managed and disposed of effectively.

John Classen, assistant professor with the biological and agricultural engineering department of North Carolina State University, says that these plans are detailed descriptions of what nutrients will be produced on a farm and how they will be managed. Classen said that for North Carolina operations, the plan should include the soil type of the land application area, the total amount of land to be used, the land that will actually receive irrigation water, the crop to be raised, a realistic yield expectation of that crop on that soil, and a calculation of how the nutrient production balances the nutrient use by the crop.

The USDA/EPA draft proposes that CNMPs identify management goals at the AFO, as well as management measures and schedules to reduce threats to water quality and public safety. The management

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Education Paves the Path for Regulation

by Margaret Caigan McKenzie
NSFC Staff Writer

People often resist change, especially when it involves how they spend their money and how they behave. But if they understand that the change is financially beneficial to them, they are usually willing to at least listen. This is what Clermont County Health District in Ohio found when it began to expand its new onsite sewage management system.

This new management program, "Reduction of Nonpoint Source Pollution from Onsite Systems in Clermont County, Ohio" is commonly referred to as the 319 project because it is funded under section 319 of the Clean Water Act (CWA). The 319 program provides formula grants to states to implement nonpoint source projects and programs in accordance with section 319 of the CWA.

In part, the Clermont County 319 project was designed to achieve the following goals:

- increase routine operation inspections for the county's 20,000 onsite systems,
- increase homeowner understanding of how to maintain these systems, and
- increase the homeowners' knowledge of alternative onsite systems such as the at-grade distribution system (modified mound) and the drip irrigation system.

One of the project goals was to educate the homeowner about sewage disposal systems that would work well in the clay soil of Ohio. With this information, the homeowner could make an informed choice about which system would be best suited to his or her property.

There were numerous obstacles to overcome to effectively implement this program, but key to its effectiveness would be its acceptance by the community.

Clermont County found from past experience that the community would accept increased regulation, such as the expansion of the Operation Permit Inspection Program, if they were informed of a program ahead of time and are not surprised by the presence of a sanitarian at their door ready to conduct the initial operation inspection.

Homeowner Education Key to New Program's Success

Jean Roth Caudill, formerly the director of water and waste in Clermont County, said, "It is critical that homeowner education begins early and well in advance of planned onsite program changes, advances, and expansions. The Health District has found that effective education, followed by regulatory enforcement, can lead to homeowner acceptance of their role as a wastewater treatment system operator, or as resources become available, may promote their acceptance of the purchase of an individual service contract or payment of a centralized management fee."

Caudill went on to explain that another critical role of homeowner education is in marketing alternative systems. First, homeowners need to understand the types of alternative systems suitable for the soil limitations at their homesites. Then, homeowners need to understand the operation and maintenance needs and costs of the alternative systems. With these two pieces of information, homeowners can make an informed decision that will protect their investment.

Funding Homeowner Education

To ensure homeowner education would not be shortchanged because of a lack of money, the health district applied to the Ohio Environmental Protection Agency (EPA) for an Ohio Environmental Education Fund (OEEF) grant. This request was approved and

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education

Education Paves the Path for Regulation

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the money dedicated to homeowner education on preventative maintenance. (This grant is available for a variety of environmental educational programs. For grant guidelines, contact the Ohio EPA at (614) 644-2873.)

Some Methods Worked, and Some Did Not

Interestingly, some advertising methods that were expected to boost the homeowner education program were barely noticed. For example, Caudill said that a promotion spot on a community cable show was not widely seen. In fact, she never saw the spot herself.

Posters at grocery stores weren't helpful either. Often these bulletin boards are so cluttered that no one stops to read what is posted.

The return-on-investment for paid advertising in newspapers and on the radio proved less useful than the health district had expected. Robert Wildey, acting director of water and waste, said, "An education program is not front page news, so we were buried too deep in the newspaper to be noticed. We did get some leads from this, though. The radio might have worked well if we could afford to advertise our homeowners' meetings during prime time, but the expense for that just didn't seem to be a good use of our money."

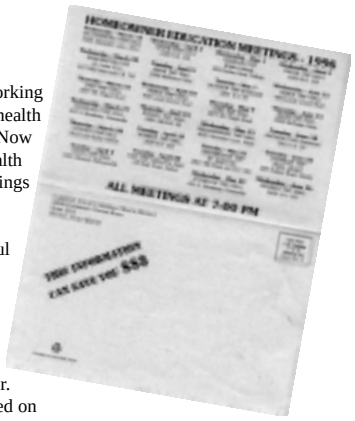
What did work was word-of-mouth support from township officials. While posters didn't work at the grocery store, they were widely read at the township bulletin board since this was the place where people checked to find upcoming community information.

Caudill was very excited about two "hidden resources" that supported the homeowner education program. The first resource was an advisory group. Caudill said, "While these types of required advisory groups can often be perfunctory, may very seldom meet, and could be used simply as in-kind contributors (providing unpaid services to match grant dollars), that has not proven to be the case for this 319 advisory group."

Caudill said that this 18-member advisory group brought health district officials into organizations in which group members belonged, thereby performing a valuable educational outreach service. Because of the advisory group's willingness to get involved, Caudill said, the health district was able to complete the following outreach activities:

- 319 project display at the Clermont County Watershed Stakeholders Forum;
- Health District Advisory Council—319 presentation for county commissioners, township trustees, and mayors;
- Ohio, Kentucky, and Indiana Regional Council of Governments—joint presentation of the 319 project and the county watershed plan;
- national satellite video conference on alternative sewage treatment systems;
- WOBO radio program—two-hour interview on operations and maintenance (O&M), alternative systems, and other homeowner education information;
- presentation on the 319 project at farm bureau's "brainstorming breakfast;"
- O&M videotapes mailed to 20 homeowners with alternative system designs (e.g., intermittent sand filter and modified mound designs);
- Board of Realtors three-hour continuing education class on O&M, alternative systems, and land development issues;
- "The Homeowner's Conservation Guide" distributed by Board of Realtors members to new home buyers;
- exhibit booth shared with the Ohio Department of Health at the Ohio Association of Realtors Annual Convention,
- "Alternative Systems Information" packet distributed to owners preparing to build on marginal soils.

The second hidden resource that excited Caudill was Realtors. Caudill said, "They are impressive. We didn't always have a good working relationship because Realtors weren't aware of the need for homeowners to get in touch with the health district about household sewage disposal systems. Providing training to this group not only gave them needed continuing education credits, but it also helped them to understand how a well-maintained system can increase the resale value of a house. These education programs helped to build a good working relationship between the health district and the Realtors. Now they help promote the health district by saying good things about us."



One of the most successful advertising methods was mass mailings. Clermont County figured out a way for mass mailings to be useful even if the recipient never opened the letter. These words were included on the front of the envelope: "This letter will save you money." Across from these words were the meeting dates and times scheduled for homeowner education on sewage disposal systems.

If the envelope was opened, the addressee would find a grid to keep track of system maintenance and a letter explaining the Operation Permit Inspection Program.

Caudill said that most health districts would have difficulty in developing a complete mailing list of unsewered homes in their jurisdictions. For Clermont County, though, the extensive network of public water enabled the health district to enlist the support of the two largest public water suppliers in the county. By cross-referencing sewer service records, Caudill said, water suppliers were able to provide mailing lists of the unsewered properties in their service areas.

The health district combined the lists it obtained from the large, public water companies with a list of addresses from an unsewered township on a smaller water system. The result of this effort was that Clermont County's mass mailings reached an impressive 70 percent of its target audience

Over a six-month period, the health district offered 42 homeowner education meetings, many of which focused on system maintenance. These meetings were equally divided over Clermont County's 14 townships (three meetings for each township). Attendance at these meetings ranged from one homeowner to 30 homeowners, averaging around 15 attendees at a meeting.

What's next?

According to Wildey, the health district is making progress in managing the onsite systems in Clermont County. The current phase of the program focuses on the operation and maintenance needs of semi-public treatment plants, all mound systems not previously on the program, and sand filters with chlorinators.

Wildey pointed out that as of January 1998, all new and replacement systems installed in the county are issued renewable operation permits. By the end of the 319 project, almost half of the 20,000 systems will be included in the Operation Permit Inspection Program.

Wildey can be reached at (513) 732-7499.

What's Your Opinion?

Who wants your opinion? The editor of *Small Flows* does, and not just as a "letter to the editor," either. We are planning to add a section to the newsletter titled "Forum." As the name suggests, this will be a place where readers can share informed, well-thought-out ideas that they feel will be of value to people involved in the treatment of wastewater, both onsite and small, centralized systems.

We are open to all aspects of small-flow wastewater treatment: technology, management, regulation, operation and maintenance. Please send your opinions to the *Small Flows* editor at the address on the staff box on page 19.

Remote Monitoring Keeps Watch for Trouble

by Kathy Jesperson
NSFC Staff Writer

Editor's Note: This is the first article in a two-part series about remote monitoring. The second will include case studies illustrating how remote monitoring may be used.

With today's technology, it is now possible to keep a constant watch on a large number of distant or scattered wastewater treatment facilities or onsite systems from one central location—such as an operator's desktop. This technology, known as remote monitoring, uses remote sensors to monitor conditions within a system, such as power failure, pump operation, and system pressure.

The sensors relay information through a standard personal computer, which has been equipped with remote monitoring software, and a telephone line. Information can also be relayed via radio or leased-line communications, such as a cellular phone or pager.

"Without the ability to monitor and control systems remotely, and thus prevent failures, staffers' time is spent in travel and in gathering information to troubleshoot a system that has already failed or is not performing as expected," noted William A. Cagle, technical sales manager with Orenco Systems, Inc., Sutherlin, Oregon, in his presentation at the National Onsite Wastewater Recycling Association's (NORWA) 1998 annual conference.

Reduces Labor

"Travel time cuts down on the number of systems that can be handled, and if systems are widely dispersed, staff may not be able to respond to service calls right away," he explained.

Cagle said that systems that require frequent monitoring, such as recirculating sand filters, mechanical aerobic treatment systems, or any multi-user or commercial system that uses a pump, must be checked often.

With telemetry, noted Cagle, systems that require such frequent monitoring can be easily inspected from one central location because data can be regularly uploaded via standard telephone lines to the monitoring person's computer. "Unusual conditions and alarms can be reported to that same computer and/or directly to the monitoring person's pager or telephone."

According to Cagle, having this information can make service providers' jobs much easier. Diagnosing the trouble or even making system adjustments, such as regulating pump timers or valve operation, can be done without having to go to the site.

Collection Versus Treatment

"Our company distinguishes between these two applications: wastewater treatment plants and wastewater collection systems," said Doug Osborn, an engineer with Automation Solutions in Houston, Texas.

"Most municipalities or operators have realized the returns for automating wastewater treatment plants, such as reduced energy costs and reduced permit violations," noted Osborn. "Consequently, the automation focus has been on the plants.

"In fact, the automation of the collection system can have greater returns due to the vulnerability of the geographically distributed system and due to the fact that there is often more equipment—pumps for example—involved. However, these returns are not as obvious," he said.

Use What Works

"The plants are generally going to Ethernet Networks that incorporate control products such as PLCs (Programmable Logic Controllers) and HMIs (Human Machine Interfaces) that are marketed by a large number of competitors," he explained. "The waste collection systems may use leased-line, dial-up telephone, dial-up cellular phone, radios of all types, satellite systems, Internet, and transmission controller protocol/Internet protocol (TCP/IP) Ethernet (communications between servers and computers). Basically, whatever works.

"Our experience is that in waste collection systems, when you pick one telemetry method there's always a small percentage of sites that don't fit the ideal. If your automation tools will allow it, an alternative telemetry method can ensure the unqualified success of the project," said Osborn.

"We usually think of the wastewater collection system when we refer to remote monitoring. The monitoring systems that we install usually perform remote control, data acquisition, alarm detection, and data logging on hardware and software that is located at the remote site," he said.

"The remote sites will report to, or be queried by, one or more host computer systems over a telemetry system. The system will cover a geographic region such as a community or a city," Osborn explained.

"Further, we've found that onsite monitoring systems that can perform the remote control, data acquisition, alarm detection and response, and data logging are essential. Because telemetry systems by their nature fail or degrade periodically, the onsite monitoring system must be autonomous," he noted.

Wave of the Future

"We think that the future of remote monitoring or SCADA (Supervisory Control and Data Acquisition) will bring more intelligent onsite systems and greater flexibility in incorporating different telemetry methods into the system. As the industry privatizes and consolidates, the remote capabilities of the systems will be applied to ever larger areas, possibly incorporating many communities over different states," he concluded.

Saves Time

Remote monitoring can manage:

- flow,
- level,
- pressure,
- temperature,
- pH,
- dissolved oxygen, and
- conductivity.

Remote monitoring may also be used to:

- aid in compliance monitoring and reports;
- view the system from the desk top;
- identify alarms;
- dial out to specific telephone addresses during off-hours;
- forecast equipment breakdown;
- monitor equipment logic controls;
- observe equipment parameters, such as voltage, current, and power;
- turn equipment on and off;
- identify unauthorized entry;
- reduce energy consumption;
- lower operating costs;
- make better use of maintenance staff time; and
- provide the basis for maintenance programs.

For more information about remote monitoring, contact Osborn at (800) 227-9707 or Cagle at (800) 348-9843.

The following Web sites contain information about remote monitoring software, hardware, and pricing:

- www.autosoln.com/, *Automation Solutions' site, contains information about SCADA systems in a variety of applications. For more information, call (800) 227-9707 or write 930 Gemini, Houston, Texas 77058.*

- www.remotepossibilities.com/index.html, *Dancer Communications' site, includes information about remote monitoring, telemetry, RTU, alarm, and autodialer systems. For more information, call (610) 543-8066 or write 649 South Avenue, Secane, Pennsylvania 19018.*

Video on Class V Injection Wells Available from EPA

The U.S. Environmental Protection Agency's (EPA) Office of Groundwater and Drinking Water has produced a 15-minute video about "Class V" injection wells. It features citizens and local officials showing how chemical waste discharged to groundwater through shallow disposal systems contaminated their water resources and how it affected their communities. Shallow disposal systems are a common, but often overlooked source of industrial chemicals that have polluted drinking water supplies.

The video, available in English and Spanish, demonstrates simple, preventative steps a community can take to reduce this threat to its water supply. For a copy of the video, contact Harriet Hubbard at *hubbard.harriet@epamail.epa.gov*.

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Nature Takes Care of the Dirty Work

by Kathy Jesperson
NSFC Staff Writer

Editor's Note: This is the first article in a two-part series examining the innovative "greenhouse" technology for wastewater treatment and is meant to serve as an introduction. The second article will use case studies to look at performance and cost factors. The National Small Flows Clearinghouse does not recommend specific manufacturers, and recommendation is not implied by mention in a Small Flows *article. We would like to hear from manufacturers not already in our Manufacturers Database as future sources of data.*

From the outside, it looks like an ordinary greenhouse. But on the inside, it's a complete ecosystem that purifies wastewater. Trees, shrubs, flowers, ferns, and foliage float in rows of tanks. Worms, frogs, fish, and snails clean the sides of the tanks and consume the sludge that accumulates on the plants' roots.

This technology uses controlled ecological and microbiological techniques that duplicate the natural purifying processes of fresh water streams, meadows, and wetlands. (See the April 1993 *Small Flows* for more information on solar aquaculture.)

Within the system, wastewater flows through a series of biosystems where plants, algae, bacteria, and other organisms remove contaminants, such as organics, nutrients, pathogenic bacteria, suspended solids, and biochemical oxygen demand (BOD).

Nice to Look At

These systems also are aesthetically pleasing because they are contained in a greenhouse, which sustains year-round operation. The abundance of plants helps clean the water and air. And the result is a quiet, odorless wastewater treatment plant, which is more applicable for towns, communities, or developments.

John Todd developed the commercial application of this technology at his nonprofit research facility, Ocean Arks International, in Falmouth, Massachusetts. He began working with this concept in 1984 when he experimented with using greenhouses to store solar energy to produce food and purify water without using chemicals, noted Robert Spencer in "Greenhouse Systems: Solar Aquatic Treatment of Septage" in the May 1990 issue of *Biocycle*.

One patented system that is currently in production is the Solar Aquatics System®, which was developed by Ecological Engineering Associates (EEA) in Weston, Massachusetts. "What it does is accelerate the rate at which nature would break down contaminants," said Phil Henderson, EEA's chief executive officer. "This is a concentrated natural system combined with some conventional wastewater treatment techniques."

Henderson explained how Solar Aquatics® works. "There are two basic types of wastewater treatment: suspended growth and fixed film," he said. "We use both in this system. The plant roots provide a high surface area for microbes to attach, and they filter out a lot of the solids or contaminants that you want to break down. What we've done is add natural components to conventional treatment. The high level of active biological components creates an optimal environment for treating waste."

Three Sections Included

According to EEA's Web site, a Solar Aquatics System® includes three main sections:

- headworks—for blending and flow equalizations,
- greenhouse system—for biological processing and removal of contaminants, and
- solids processing—for stabilization and composting of sludge and vegetative waste.

Within the greenhouse system are:

- solar tanks—for optimizing photosynthetic reactions and biological activity within the system,
- solar ponds—to provide slow moving streams that replicate a natural environment, and
- a wetland or marsh—for polishing and purifying.

Plants and animals are contained in the greenhouse and throughout the system, including the solar tanks and ponds as well as the wetlands and marsh. Flora, such as flowers, ferns, foliage, shrubs, and trees, aid in the treatment process. Aquatic life, such as fish, worms, and snails also prove to be valuable in the system.

EEA's Solar Aquatics® treatment process occurs in four stages, said Henderson. Detention time varies depending on the strength of the wastewater and the degree of purification required. Tertiary quality treatment typically requires up to three days.

According to a January 1996 *Biocycle* article, "Biological Machines: Purifying Wastewater in Greenhouses," written by Molly Farrell, wastewater entering one of these systems is first screened and degritted before going to a blending tank. It is then mixed using fine bubble aeration.

This greenhouse facility treats the wastewater for the downtown commercial center of Weston, MA, to groundwater recharge standards (tertiary treatment). (Photo courtesy of Ecological Engineering Associates, Weston, MA.)

"The naturally occurring bacteria, in the presence of air, begin to break down soluble organic chemicals into carbon dioxide and water," noted EEA's Web site. Fats, proteins, and starches are degraded into compounds that can be metabolized by organisms further down the treatment stream. The process keeps solids in suspension so that they will be available for biological break down in the solar tanks and ponds.

In the next stage of treatment, nitrogen and phosphorous are removed and the reduction of suspended solids and BOD occurs. Water flows from the blending tank to the greenhouse. "The streams flow by gravity through rows of interconnecting tanks filled with floating and racked plants," wrote Farrell. The plants' root systems filter out solids from the waste stream and take up nitrogen and phosphorous.

"Once in the solar tanks and ponds, the high concentration of biological components break down contaminants even further," said Henderson. "Very large populations of zooplankton also inhabit the plants' root mass. Bacteria, algae, and higher plants metabolize components of the waste stream.

"Organic nitrogen is mineralized into ammonia, which is then oxidized into nitrates," he continued. "BOD is degraded. Green algae and higher plants take up the nitrates and ammonia, while snails, zooplankton, and other animals feed on the solids."

The next stage is sludge removal and processing. "Residual biomass and recalcitrant solids are removed using clarification," said Henderson. "Some of the secondary sludge is recycled back into the blending tank for reprocessing and microbial reseeding, and the remaining goes to an aerobic digester for thickening and further processing.

"We also have composted the sludge in a reed bed, but often the quantities are so small that it's more economical to dispose of it by pumping it out, just like a septic tank, and having it taken to a commercial plant," Henderson explained.

The final stage of treatment is denitrification. "Nitrogen, phosphorous, and pathogens are reduced even further," he said. "The clarified water then passes through a stone substrata of the marsh. Nitrate is reduced to nitrogen gas, and certain pathogenic bacteria are destroyed by the action of the marsh plants. Phosphorous is taken up by the marsh plants as well, which is absorbed on the marsh substrate."

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Lots of Plants

"A wide range of plants can be used in these systems," said Henderson. "Different plants work better in different environments. We've used creeping primrose, which is a nice flowering plant, and papyrus, mint, flowering ginger, as well as weeping willow trees. We don't use higher-maintenance plants, such as water hyacinth.

"We try to use plants that are native species," he explained. "But nature is self-selective. It will usually tell you which plants are going to do well.

"Another advantage of these systems is that the plants' roots, which extend from one to five feet into the wastewater, provide an optimum habitat for microbes that degrade contaminants," he said. "And the plants use nutrients in the wastewater, which promotes leaf and flower production.

"There aren't any odor problems because the greenhouse and aeration system eliminates them. The plants provide a cover for the tanks that suppresses odors and volatile compounds. At the headworks, the receiving tank is covered and aerated, so the greenhouse smells like a greenhouse.

"Because of the fact that these systems have great biodiversity, they can break down a wider range of contaminants," he said. "Since they're natural, we never have a system go off-line."

"But we're also nice to have in the neighborhood because we have a real concern about sustaining the environment, and the facility is a physically attractive asset to the community," continued Henderson. "The days of the huge megasystems that dispose of large amounts of waste in one area are coming to a close.

"People are becoming more and more aware of the high quality of effluent that is produced through these systems as the number of our installations has grown," he explained. "When the water you put back into the environment is clean and recharges aquifers, it gives the community high sustainability. You don't get the same advantage when you send the effluent through miles of pipe to the ocean."

Living Machines™ Don't Use Chemicals

Another patented system that is based on this idea is the Living Machine™, which is manufactured by Living Technologies, Inc. "The major difference between these two treatment applications is that Solar Aquatics® uses a clear-sided tank and the Living Machine™ uses an opaque one," said Erik Alm, marketing manager with Living Technologies, Inc.

According to Alm, Living Machines™ are far more environmentally friendly than a conventional system because they produce less sludge, use less energy, and do not use chemicals.

"The sludge is pumped out into vertical-flow reed beds, where it's composted and dewatered. It's held there for five to seven years, and it's then considered usable for agriculture since it does not use chemicals." (See the Fall 1998 *Small Flows* for more information on reed beds.)

But they produce less sludge than a conventional system, which is among the features that make Living Machines™ appealing. They also generate effluent that can be reused for various applications, such as irrigation or water to flush toilets, noted Living Technologies' Web site.

Also, depending on the climate, Living Machines™ can be housed in a protective greenhouse, under light shelter, or in open air, noted the Web site. Living Machines™ also:

- enable customers to recycle wastewater or discharge it back into the environment, saving on sewer surcharges and reducing water purchases;
- are biologically diverse and can treat a wide variety of waste streams;
- are naturally resistant to drastic changes or "shock loads;" and
- reduce sludge handling and disposal costs.

Educational Bonus

"Other less tangible benefits are the aesthetic beauty of the systems and educational opportunities that arise when Living Machines™ are used as teaching tools," said Alm.

He said that many different curricula have been developed around the systems his company has installed. "These systems are really botanical gardens," he explained. "There are a lot of possibilities for teachers. One system in New York is actually a part of the Darrow School, and a classroom is set up inside the greenhouse. The school gets its wastewater treated, and courses can be taught in botany and physics as well as other natural sciences."

Henderson agrees that the educational benefits of these systems are tremendous. "We do tours of our systems all the time," he said. "Graduate schools, citizen groups, and garden clubs have been through our facility. Students have used the system to study environmental sciences, chemistry, and biology. They also look at the system's architectural design and landscaping. We've been known for a long time as a positive asset in the community."

With all of the system's positive assets, however, Alm did note that some waste streams are so strong that a Living Machine™ should be employed only to polish the wastewater after it has received some pretreatment.

Solar tanks at the South Burlington, VT, municipal sewage treatment system utilize photosynthetic reactions and biological activity to treat 80,000 gpd. (Photo courtesy of Living Technologies Inc., Burlington, VT.)

"Often when BOD is really high, our systems do only the secondary to tertiary step of the treatment process," he explained. "In other cases, the waste stream is not suitable to our technology. This is often the case with industries which produce inorganic chemicals that are highly toxic to plants and other living organisms."

The Future Depends on Ecology

"The future depends upon ecologically engineered technologies, such as Living Machines™," said Alm. "Because of the cyclical balance which they make possible—food to waste to sludge to compost to food—their efficiency, their educational value, their ability to be located in remote locations, their lack of chemical inputs, their ability to treat to tertiary standards, and the opportunity for coproduction—growing of food or other products in the systems—Living Machines™ will be in great demand in the future.

"We have many very successful installations," said Alm. He noted:

- the Ethel M Chocolates plant in Henderson, Nevada treats 32,000 gallons per day (gpd) of sewage and industrial waste;
- the Body Shop's two systems in Toronto and the United Kingdom, that treat 4,000 gpd and 13,200 gpd of industrial waste, respectively;
- Masterfoods in Wyong, Australia, treats 100,000 gpd of industrial waste; and
- the South Burlington, Vermont, municipal sewage treatment system, treats 80,000 gpd.

For more information about Solar Aquatics®, contact Henderson at (781) 891-5085. Or visit the Solar Aquatics® Web site at www.solaraquatics.com.

For more information about Living Machines™, contact Alm at (802) 865-4460. Or visit the Living Machines™ Web site at www.livingtechnologies.com.

For copies of the articles mentioned in this article, call the National Small Flows Clearinghouse at (800) 624-8301 or (304) 293-4191. Copies are available for 15 cents per page.

- Farrell, Molly, "Biological Machines: Purifying Wastewater in Greenhouses," *Biocycle* January 1996, pages 30–33.
- Spencer, Robert, "Greenhouse System: Solar Aquatic Treatment of Septage," *Biocycle* May 1990, pages 66–70. L#002433.

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Onsite Wastewater Management Systems in the 21st Century

by Anish R. Jantrania, Ph.D., P.E., M.B.A.
NSFC Contributing Writer

Editor's Note: This is the first in a series of three articles dealing with the future of onsite wastewater treatment and management. It focuses on treatment and disposal technologies; the next two articles will focus on regulations and pre- and post-installation issues dealing with the use of onsite systems. Anish Jantrania is a technical services engineer with the division of Onsite Sewage and Water Services at the Virginia Department of Health. His opinions do not necessarily reflect those of the NSFC.

As we are getting ready to enter the 21st century, it is time to evaluate the methods we are using for onsite wastewater management. Such an evaluation should include looking not only at the tools of the trade (onsite wastewater treatment and disposal technologies), but also looking at the process in which the technologies are being used (the regulations, pre-installation issues, and post-installation issues).

The concept of wastewater management started on a small scale, focusing mainly on disposal of human waste using systems such as privies. During this century, the focus shifted to treatment of wastewater prior to disposal using large-scale, multi-million gallons per day pipe-and-plant surface water discharge systems in densely populated areas, with tens of thousands of septic systems in rural areas.

I think that the wastewater industry will most likely continue to move toward onsite decentralized systems during the next century. The prime reason for this trend is the ability of onsite systems to cost-effectively offer adequate environmental and public health protection from wastewater.

Onsite Treatment Is Cost-Effective

With the advances in small-scale collection, treatment, and disposal technology, and in remote monitoring systems, it is now possible to offer the most advanced level of wastewater treatment options in low-density areas at a lower cost than that of conventional pipe-and-plant systems.

Generally, in small communities, houses are spread out, and the density is quite low, which makes the use of an onsite system for an individual home or for a group of homes in a cluster quite a cost-effective option. Wastewater management systems for thinly populated areas can be engineered to minimize the collection cost typically to less than 30 percent of the total cost, by using the currently available onsite wastewater treatment and dispersal technologies.

Septic Systems Cannot Do It Alone

For most of the 20th century, the standard septic tank drainfield system has been the primary means of onsite wastewater management. The use of a pump to overcome gravity when a "suitable" drainfield site was at a higher elevation than the house was probably the first advancement in this technology.

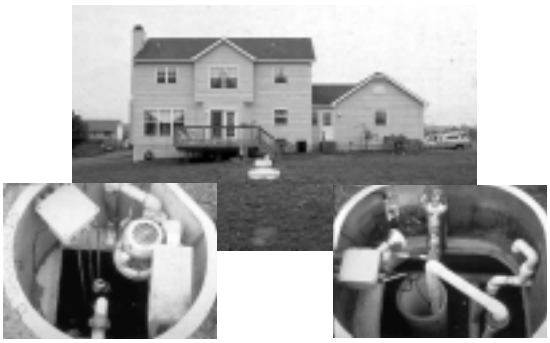
A conventional septic system uses soil to treat primary or raw wastewater that is discharged from a septic tank. No one really knows what kind of treatment is actually achieved by a subsurface drainfield on a long-term basis. It is hard to collect effluent below a subsurface drainfield, thus it is not possible to adequately monitor the performance of such a system.

Research studies have documented how a drainfield works at a given point in time, on a given site; however, the real impact on the environment and public health from the operation of millions of drainfields is not adequately documented. Conservative rules for locating and sizing a septic system as specified in state or local regulations are the primary reason why no major environmental or public health problems have been associated with the use of millions of individual septic systems so far.

As we realize that onsite systems will be used on a permanent basis and will be needed in areas not suitable for treating primary or raw sewage (no perc land), we must look for what I consider "real" onsite wastewater treatment systems for treating wastewater to a secondary or better quality. We also need site assimilative systems for safe dispersal of treated effluent into the environment.

Onsite Treatment to Secondary and Tertiary Levels

The mound system (drainfield on top of the ground instead of in the ground) and the low-pressure pipe system are among the most revolutionary ideas to come out of the second half of this century. It was not until recently that the ability to treat wastewater onsite to a significantly higher degree than that of a septic tank was developed.



A pre-engineered and pre-packaged aerobic treatment unit, recirculating gravel filter, and ultraviolet disinfection unit are installed in the backyard for this house. Both the aeration chamber (left insert) and the ultraviolet disinfection unit (right insert) are accessible above ground. (Photo courtesy Anish Jantrania.)

As we approach the end of the 20th century, the idea of treating wastewater to a secondary or tertiary quality before discharging into soil is drawing a lot of attention. Today, there are a number of off-the-shelf wastewater systems available that will treat wastewater to a degree that will allow the subsurface disposal of the effluent on any site in a manner that will protect public health and the environment from such a discharge.

We are no longer limited to the availability of "percable" land for the use of onsite wastewater systems. Any site that is suitable for a house or a business can have a wastewater system, provided the owner is willing to pay for the necessary costs associated with the engineering, installation, and operation of such a system. A wastewater solution for any site is no longer a dream, it is a reality.

Raw wastewater or septic tank effluent can be treated to either secondary or tertiary levels using a variety of treatment systems currently available on the market. Treatment technologies can be grouped into the following categories:

- aerobic treatment units (ATUs)
  - suspended growth: flow-through or sequencing batch
  - attached growth: trickling filter with forced aeration
- media filters: sand, peat, foam, textile, etc., primarily with natural aeration
- natural systems: wetland, green house, evapotranspiration, etc., for polishing secondary effluent or ultimate dispersal
- waterless toilets: composting, incinerating, etc., as an alternative to flush toilets
- disinfection systems: UV light, chlorinator, etc., for treating secondary effluent

Aerobic Treatment Units

ATUs offer an alternative to septic tanks, and they can treat raw wastewater to secondary treatment standards (lower organic pollutants in the effluent). There are a number of pre-engineered ATUs currently available, and they are generally used for sites that are declared unsuitable for a septic drainfield system, based on soil and site evaluations.

Typically, the effluent from such ATUs, after further polishing treatment and disinfection, is allowed to be discharged into a surface waterbody or into a dry ditch, resulting in a point-source discharge instead of a nonpoint discharge into an adequately sized subsurface system.

Subsurface disposal of secondary-quality effluent is technically possible on sites that are not suitable for primary-quality (septic tank) effluent. Actually, subsurface dispersal of secondary effluent using concepts such as a filterbed or a drip system will reduce the impact on the receiving environment (RE) compared to surface discharge. When not adequately operated and maintained, however, any ATU, or for that matter, even a septic tank, will discharge inadequately treated sewage into the RE.

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Media Filters

Media filters are primarily used for treatment of septic tank effluent and sometimes for polishing of ATUs' effluent. Sand filters (single pass or recirculating) are the most commonly used media filter. But now the use of other types of media such as peat, synthetic foam, or textile media has been evaluated for treating septic tank effluent to a better-than-secondary-quality effluent.

As with ATUs, we now have access to pre-engineered, prepackaged media filters that can be installed easily in the field and used for advanced treatment of septic tank effluent for individual homes.

The performance of any media filter will depend on the quality of media, the distribution system for spreading septic tank effluent on top of the media, the quality and maintenance of the septic tank and filter (watertight tanks, use of effluent filter, regular pumping, etc.), and adequate ventilation to maintain the aerobic condition in the media filter itself. Depending on the type of media used, one may need to change the media after a certain number of years.

Media filters are demonstrated to be very effective for reducing organic and bacteriological contaminants from septic tank effluent. They can also convert most of the nitrogen to a nitrate form (nitrification), thus maximizing the potential for plant uptake if the effluent is adequately dispersed into the shallow root zone using a shallow trench or drip dispersal system.

Pre-engineered and pre-packaged peat filters (right) have been installed in the front yard of this house, beneath the landscaped mound. Septic tank effluent is time dosed on top of these filters, and as the effluent passes through the layer of peat material, it gets treated to a high degree and is discharged into a gravel pad that is under the filter boxes. Homeowners can landscape and still allow adequate access to the top of the boxes for maintenance. (Photo courtesy Anish Jantrania.)

Natural Systems

The use of natural systems such as a wetland for treating septic tank effluent for a single-family home or a community-scale system has been demonstrated in some parts of the country (mainly in southern states). The performance of wetland-type systems is quite dependent on the climate, however, and it is practically impossible to obtain uniform quality of effluent consistently with such a system.

The use of greenhouse-type systems (a wetland operated in an enclosed and controlled environment) can lower or eliminate dependence on climatic conditions and can offer a reliable treatment mechanism that can produce high-quality effluent on a consistent basis. Under certain conditions, greenhouse or evapotranspiration beds can be used for significantly lowering or eliminating discharge of effluent into the RE by using plant uptake and evaporation as the primary mechanisms for assimilating effluent into the environment.

Most of the time, natural systems can be used in a cost-effective manner for further treatment of secondary-quality effluent (discharge from ATUs or media filters) to reduce the impact of nutrient and bacteriological pollutants on the RE. In general, use of natural systems for treating primary effluent such as septic tank effluent should be avoided, specifically in environmentally sensitive area.

Waterless Toilets

The use of waterless toilets such as composting or incinerating toilets can reduce the quantity of wastewater generated from a facility and can also change the quality of wastewater. However, one needs to deal with the residual products from such a facility (either composted material or ash) for final disposal by using (recycling) compost in the yard as a fertilizer or by sending the ash to a landfill.

The remaining wastewater from the facility is called "graywater," and it may be treated adequately by using natural systems such as a media filter or a wetland prior to subsurface dispersal. Typically, pollutant loads in the graywater are more than that in the effluent from a well-maintained media filter or an ATU; hence, adequate treatment and disposal of graywater must not be overlooked.

Use of waterless toilets is quite adequate for remote areas that are nonresidential (e.g., golf courses or rest areas in parks, etc.), where access to both water and wastewater facilities is costly.

Disposal/Dispersal Technologies

Most likely an onsite wastewater treatment system will need a mechanism for the discharge of treated effluent. As noted earlier, subsurface disposal/dispersal (nonpoint source discharge) is the primary mechanism used for disposing effluent from onsite treatment systems. Disposal/dispersal technologies available for onsite systems can be grouped as follows:

- trenches or beds filled with gravel or other media: gravity fed or pressure dosed;
- gravelless trenches or beds with chamber system: gravity fed or pressure dosed;
- at-grade or above-grade: shallow trench, filterbed, etc.;
- drip dispersal: subsurface or surface;
- spray dispersal: above ground;
- minimum or zero discharge: evapotranspiration or green house; and
- point source discharge into surface water or on the ground.

Use of Soil for Treatment Is Not Required

Since the septic system depends mainly on soil for the treatment of primary effluent, soil evaluation has been an integral part of the onsite wastewater business. However, with the availability of a variety of treatment systems, we no longer need to depend on soil for treating septic tank effluent.

The installation of small, shallow, filterbed, drip, spray, or minimum or zero discharge systems for adequately treated effluent can be achieved on almost any site when adequate space is available. Performance of such disposal systems is not dependent on type, depth, or color of soil present at the site.

In the 21st century, emphasis needs to be put on the use of appropriate onsite treatment and disposal systems and the permanent operation and maintenance of those systems rather than on the acceptance or rejection of a lot for an onsite system based on soil evaluation and soil criteria.

Assimilation: Subsurface Disposal of Effluent

The most important consideration for a subsurface disposal system following an onsite treatment system is the site's ability to assimilate adequately treated effluent (or moisture) in a manner that does not create any aesthetic or public health concerns, such as ponding or runoff of effluent (water that has indication of sewage) from the site under normal conditions. Thus, we need to consider such a system as a site assimilative system (SAS) and not just a soil absorption system.

How to determine the operational adequacy of any SAS is a challenge. The primary intent of regulations for onsite systems is to protect public health and environmental quality. I propose that we keep this intent in focus and develop easy to understand performance standards for any SAS.

I believe we all can agree that an SAS must not create any of the following:

- a point-source discharge (i.e., a stream flowing out of the area where the SAS is installed);
- a public nuisance (e.g., a puddle of water on or around the area where the SAS is operating, mainly during dry weather conditions);
- an obvious or even a perceived health hazard; or
- ground or surface water contamination due to organic, inorganic, or bacteriological contaminants that are discharged into the SAS.

Access to Technologies Requires Regulatory Agreement

Once such an agreement is reached among the regulatory

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management

Septic Tanks in the U.S.

How many are there, where are they, and are they working properly?

by Natalie Eddy
NSFC Staff Writer

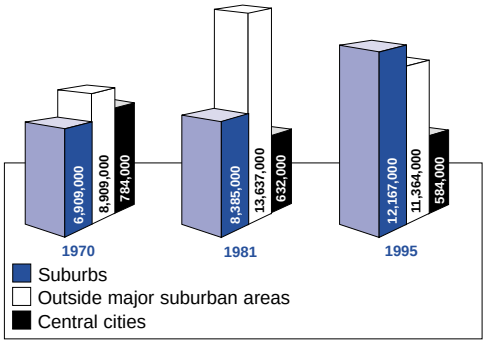
Approximately one fourth of the estimated 109 million housing units in the United States are served with septic tanks or cesspools, according to a 1995 American Housing Survey (AHS).

During 1995 alone, more than 2.5 million septic tanks in America were reported as malfunctioning (or having a total breakdown of the system). As you read this article today, there will be some 7,000 septic tank malfunctions reported.

These facts and many other interesting data are included in the survey, which is conducted by the U.S. Commerce Department's Census Bureau and sponsored by the U.S. Department of Housing and Urban Development (HUD).

Graham Knowles, program coordinator for Phase IV of the National Onsite Demonstration Program (NODP), has been organizing the AHS data, specific to wastewater treatment, as part of the NODP mission to focus on promoting small community management programs for onsite systems.

His report, *SepticStats–An Overview*, uses AHS data to outline how many housing units are served by septic systems, who has them, where they are located, and how many are failing.



Trends in housing units on septic systems or cesspools.

Knowles commented, "*SepticStats* is intended to become an all-inclusive, online, one-stop database of relevant information on the status of onsite systems in America today."

He hopes the project will aid in the dissemination of a series of user-friendly tools to set the backdrop, as well as stimulate dialogue, for development of management programs.

Survey Information

National data for the AHS are collected every other year and published on the third year. Residents of approximately 55,000 housing units in 47 selected metropolitan areas are surveyed.

By definition in the survey, a "housing unit" may be a house, an apartment, a group of rooms, or a single room occupied or intended for occupancy as separate living quarters.

The survey is conducted by personal interview from a selected list of questions. The AHS returns to the same housing units year after year to gather data.

For the purposes of the survey, wastewater disposal is divided into three categories: public sewer, septic tanks or cesspools, and other means.

How many are there?

Knowles's report states that in 1995, there were 109,457,000 housing units in the U.S. Of those, septic tanks or cesspools serve 25,635,000. (The pollsters made no differentiation between septic tanks and cesspools, which for the rest of this article will be labeled simply as septic tanks.)

Out of the housing units with septic tanks, 24,115,000 are "year-round" housing units and 1,521,000 are "seasonal."

Survey definitions of "year-round" housing units include all units occupied by one or more persons for whom it is their usual residence and all vacant units that are intended by the owner for occupancy at any time of the year. For example, if a unit in a resort area is intended for occupancy on a year-round basis, it is a year-round housing unit, even if vacant.

"Seasonal" units are defined as units that are intended by the owner to be occupied only during certain seasons of the year. That means they are not anyone's usual residence and include units occupied entirely by persons with a usual residence elsewhere.

Looking closer at the 24,115,000 year-round housing units served with septic tanks, the report notes that 22,296,000 are "occupied" housing units and 1,819,000 are "vacant."

Of those 22,296,000 year-round occupied housing units with septic tanks, 85 percent were owned, and 15 percent were rented.

Under the parameters of the survey, a housing unit is classified as occupied if a person or group of persons is living in it at the time of the interview or if the occupants are only temporarily absent (on vacation); however, if the unit is occupied by persons with a

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Onsite Wastewater Management Systems in the 21st Century

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agencies and the wastewater professionals working in the private sector, it will be relatively easy to develop monitoring requirements and performance standards for any onsite system. It is only then, I believe, that people will have adequate access to all the available technologies for managing wastewater onsite.

Such a performance-based monitoring and regulatory system can also help all of us to "weed out" the inappropriate wastewater systems that may be out there.

As with any industry, there are "bad apples" in the onsite wastewater industry. With the current regulatory approach that focuses mainly on the pre-installation issues and typically ignores ongoing performance monitoring of onsite systems, however, it is hard to separate the bad apples from the good apples most of the time until it is too late.

A wastewater system that works in an acceptable manner throughout its life span is what is needed for managing wastewater onsite, as is the regulatory system that focuses on the performance of a wastewater system rather than on the details of site evaluation, design, and installation of the system.

Onsite Technology Is Ready for the 21st Century

So, there are a number of onsite systems one can use to manage wastewater from individual homes or small businesses in areas where a centralized wastewater system is not available. There are a number of companies who offer pre-engineered, pre-packaged treatment and disposal systems that one can purchase and have installed with a service contract for operation and maintenance. These companies are capable of meeting the market demand in terms of the number of treatment and disposal units that may be needed annually in the U.S. into the next century.

Most of the public, however, does not have easy access to such products or services, largely due to the state and local regulatory framework that currently exists in most parts of the country.

A regulatory overhaul from the ground up is needed to move the onsite industry into the 21st century and to raise the overall performance standard of onsite wastewater systems from the traditional septic system to a real treatment and disposal system that allows for adequate maintenance and performance monitoring.

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usual place of residence elsewhere, the unit is classified as vacant.

Where Are They?

A location breakdown of the estimated 25 million year-round housing units with septic tanks includes

- central cities: 584,000,
- outside major suburban areas (rural): 11,364,000, and
- suburbs: 12,167,000.

Over the past three decades, trends have shown a significant increase in the number of suburban housing units with septic tanks. (see graph on page eight.) Between 1991 and 1995, 6.5 percent of all new construction consisted of housing units with septic tanks.

Are they working properly?

One interesting fact noted by Knowles is that seven percent of the year-round occupied housing units with septic tanks (or 1,560,720) have moderate to severe physical problems to the housing unit itself.

He said the condition of the housing units is very important because if a house is well taken care of, the owners are more likely to be concerned about whether the septic tank is functioning properly.

A "severe physical problem" classification was given to a housing unit if it had any of the following five problems:

- plumbing lacking hot or cold piped water or a flush toilet, or lacking both bathtub and shower inside the structure for the exclusive use of the unit;
- heating having been uncomfortably cold last winter for 24 hours or more because of breakdowns;
- having no electricity or all of the following problems: exposed wiring, a room with no working wall outlet, and three blown fuses or tripped circuit breakers in the last 90 days;
- having any five of the following six maintenance problems: water leaks from outside, leaks from plumbing fixtures, holes in the floors, holes in the walls or ceiling, more than 8 by 11 inches of peeling paint or broken plaster, and signs of rats or mice in the last 90 days; and
- having all of the following four problems in public areas: no working light fixtures, loose or missing steps, loose or missing railings, and no elevator.

The "moderate physical problem" classification was given to a unit if it had any of the following five problems, but none of the severe problems:

- toilets broken for more than six hours within the last three months;
- unvented gas, oil, or kerosene heaters as the primary heating source;
- having any three or four of the overall list of six maintenance problems listed above under severe physical problems;
- having any three of the four problems with public areas listed above;
- lacking a sink, refrigerator, or either burners or oven inside the structure.

A housing unit's septic tank was classified as malfunctioning in the AHS survey if it was a "reported" failure or total breakdown of the system.

According to the survey, the "reported" malfunction rate of occupied housing units with septic tanks in 1995 was:

- 10.2 percent malfunctioned at least once during the year,
- .5 percent malfunctioned twice during the year,
- .06 percent malfunctioned three times during the year, and
- .37 percent malfunctioned four times or more during the year.

Of those properties with reported malfunctioning septic tanks:

- 77 percent were owner occupied and 23 percent were renter occupied,
- 18.7 percent were occupied by people living below the poverty level,
- 15.9 percent experienced moderate to severe physical facilities problems,
- 15.7 percent were mobile homes,
- 12.6 percent were occupied by people 65 years or older, and
- 7.7 percent of the properties were new construction (built within the past four years).

Additional Facts

Other facts listed in Knowles's report include the following:

- Some 22.1 percent of the year-round occupied housing units with septic tanks are occupied by the elderly, people 65 or older.
- Fifteen percent of the year-round occupied housing units with septic tanks are mobile homes.
- Some 12.5 percent of the year-round occupied housing units with septic tanks have occupants living below the poverty level. (Poverty thresholds are updated every year to reflect changes in the Consumer Price Index.)

Knowles noted that the income statistic may be important because if someone's income is listed below the poverty level, that person may not be able to pay for repairs, replacement, or even maintenance of a septic system.

What does all this mean?

As Knowles's report indicated, in 1995 more than 25 million housing units in the U.S. used some form of a septic tank system to treat and dispose wastewater. More than 10 percent of these systems were reported as malfunctioning that same year.

The report adds that approximately two million housing units with septic tanks were constructed between 1991 and 1995, with nearly eight percent of these systems reported as malfunctioning during 1995 alone.

Causes of system malfunction include inadequate system design and installation, lack of routine maintenance, and system misuse. All of which can be avoided with proper education.

Designers and installers must be knowledgeable of governing regulations and should be trained (on procedures) to ensure the onsite system is constructed properly.

Regulatory authorities must participate in the process by being available to answer questions and conduct pre- and post-installation inspections. Homeowners or end-users must be aware of their wastewater system, what kind of system it is, how to take care of it, and what maintenance requirements accompany the system.

Many of these issues can be addressed with the implementation of a management entity—one that ensures that proper system design, installation, and routine maintenance are performed.

Knowles's report notes that more and more housing units are being constructed in suburban areas, many relying on onsite wastewater treatment and disposal. The majority of homes in rural America rely solely on onsite systems to treat and dispose their wastewater.

What does all this mean? Homes will continue to be built in places where, logistically speaking, onsite is the best choice for treating wastewater. Proper design, installation, and maintenance will eliminate system malfunction and will ensure the wastewater is being properly treated before entering back into the environment.

For more information about the report, contact Knowles at the National Small Flows Clearinghouse at (800) 624-8301 or (304) 253-4191.

New Issue of The Small Flows Journal Available

The Spring 1999 issue of *The Small Flows Journal* was recently published and is available free upon request from the National Small Flows Clearinghouse (NSFC). The journal includes juried technical papers devoted specifically to small community wastewater issues.

Articles in this latest issue include the results of a study on the peformance of biofilm reactors in the treatment of wastewater high in butterfat, as is typically found in dairy discharges. Another article describes the conception and design of an automated influent flow monitoring and autosampling system developed for a two-year field study of onsite systems in New Mexico.

Each journal issue also includes news about the NSFC and other information of interest to small communities, researchers, and wastewater professionals.

To receive a free copy of *The Small Flows Journal*, vol. 5, issue 1, Spring 1999, contact the NSFC at (800) 624-8301 or (304) 293-4191 and request Item #SFJRNL05. Shipping charges will apply. Current and past journal issues also can be downloaded for free from the NSFC's Web site at *www.nsfc.wvu.edu.*

management

Animal Feeding Operations Targeted for Better Nutrient Management

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measure should be tailored to the site and specific circumstances at the AFO.

USDA and EPA estimate that 15,000 to 20,000 higher risk AFOs will need permit coverage, 10 times the number of permits issued to farms today. Concentrated animal feeding operations (CAFOs) are already required to have National Pollutant Discharge Elimination System (NPDES) permits due to specifications of the Clean Water Act. A livestock facility is designated a CAFO when it confines more than 1,000 animal units (calculated by the number of head of livestock times a conversion factor related to weight) or confines 301 to 1,000 animal units and discharges pollutants into waterways.

What about smaller farms?

For the most part, owners of smaller farms don't need to worry about having permits, but they do need to make sure that their farms are not contributing to water pollution. For example, farms in Kansas that confine less than 300 animal units and are not required to have designed pollution control facilities, are advised by the state's Department of Health and Environment (KDHE) to adopt the following pollution control practices to minimize the possibility of polluting:

- Divert uncontaminated runoff away from areas where animals are confined.
- Direct runoff from confinement areas through a solids settling or filtering device, then through a vegetated buffer or filter area.
- Clean manure frequently from the confinement area.
- Do not confine animals close to streams, lakes, wells, and groundwater recharge areas.
- Avoid overgrazing pastures.
- Plant cover vegetation when temporary or intermittent confinement areas are not being used.
- Avoid or minimize woodland grazing.
- Provide alternatives to stream watering sites.

Farmers (AFO operators) will need to check their own state's pollution control guidelines. That same AFO in Kansas housing 300 animal units or less, or that has little potential to cause a pollution problem, may voluntarily register with the KDHE. But, any livestock operation that confines more than a total of 300 animal units, or any livestock operation that presents a significant potential to cause a water pollution problem, is required to register with KDHE. The KDHE will then determine if the operation needs a pollution control system. The solution could be a wastewater and stormwater runoff containment structure or a treatment device such as a vegetative filter, settling basin, or other system.

If a pollution control system is not needed, KDHE will issue a "certification of compliance" stating that the operation is not expected to cause water pollution problems. The certification is valid as long as the operation remains the same as it was when the certification was issued.

If a pollution control system is called for, construction plans, specifications, and a waste management plan need to be submitted to KDHE for review and approval. Following approval of the plans, a water pollution control permit, lasting for a term of five years, is issued to the operation. Periodic operation reports may need to be submitted, and KDHE may perform inspections.

Strategies to Curb Pollution

When an AFO does need a pollution control system, lagoons have traditionally been the method of choice. Constructed wetlands and composting also can help convert waste material into a usable resource.

Harold Watson, agricultural engineer with the Alabama Cooperative Extension Service at Auburn University, has outlined some of the features of lagoon construction. Lagoons include aerobic, anaerobic, and mechanically aerated systems. In an aerobic lagoon, algae and microorganisms decompose organic materials in animal waste into simpler compounds like water, carbon dioxide, nitrates, and sulphates. A naturally aerated lagoon gets its oxygen from the air and through processes of plants and algae that live in the water.

In the cycle of decomposition, the algae in the lagoon consume the nitrate nitrogen produced in the aerobic process and produce more oxygen to fuel the system. The lagoon is designed to maximize the absorption of air and sunlight, with a surface area proportional to processing needs. Lagoons should only be three to five feet deep so that sunlight will penetrate the water. More detailed information on lagoon construction can be found in the spring 1997 issue of *Pipeline* published by the National Small Flows Clearinghouse (NSFC).

Much research is being done at land grant universities across the country to find new and better ways of dealing with livestock waste. Odor is a big concern in areas with large AFOs. Researchers at the University of North Dakota are exploring the use of barley straw covers and walls as odor control measures in swine production facilities and treatment lagoons. Construction-grade bamboo stands are being irrigated with high-nutrient livestock waste effluent in parts of the South. Research into producing other forest products using effluent nutrients is also being conducted at North Carolina State University.

Scientists with the Southeast Watershed Research Laboratory in Tifton, Georgia, are exploring the use of riparian buffer systems in treating agricultural effluent. Swine effluent is being run through grass buffers positioned upslope from forest vegetation. Continued research with constructed wetlands is proving that this treatment method is a viable alternative to la-goon systems where odors might present a problem for local residents. Wetlands may also require less construction, operation and energy costs—features that livestock producers would be most interested in.

Livestock Waste Management Plan

A livestock waste management plan outlines the way animal waste material will be dealt with. It describes:

- systems for storing, treating and transporting manure,
- characteristics of the manure and/or wastewater,
- topography and amount of land available for application,
- methods and times of land application,
- crop rotations, and
- the nutrition and condition of the soil.

(from Ohio State's Agriculture Extension Web site www2.ag.ohio state.edu)

Contamination from livestock manure can disrupt aquatic environments, contribute to water quality problems in streams and ponds, and contaminate drinking water supplies. Frankly, there are no blanket solutions. What may work effectively in one state with one kind of livestock waste may not work somewhere else. Measures appropriate to specific sites need to be used to help make our country's waters cleaner.

The Draft Unified National Strategy for Animal Feeding Operations *can be downloaded from the USDA's Web site at* www. nhq.nrcs.usda. gov/clean water/afo/. *To order copies of the Spring 1997* Pipeline, *volume 8, number 2 from the NSFC, request item #SFPLNL09. The price is 20 cents per copy plus shipping and handling.*

For further Web resources on AFOs, see page 22.

Pipeline Celebrates Ten-Year Anniversary

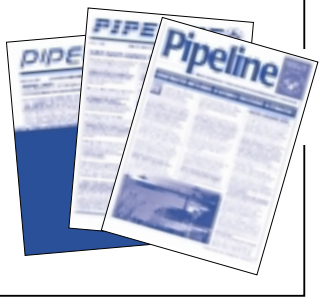
"Informative, practical, and understandable by nonengineers." "It's a good educational tool." "I use it."

These comments by *Pipeline* readers explain why the newsletter is popular with community officials, engineers, and homeowners alike.

Now in its tenth year, each *Pipeline* issue presents an overview of a single wastewater topic written for the general public. Readers are invited to reprint articles in local newspapers, flyers, and handouts.

"We receive calls from realtors, bankers, homeowners' organizations, and other groups asking to reuse our articles," says Cathleen Falvey, *Pipeline*'s editor. "But most calls come from wastewater consultants and health officials who want to use *Pipeline* for public education."

Subscriptions to Pipeline *are free, and back issues are available for 20 cents each plus shipping. Refer to page 5 of the products insert for a list of back issues, and contact the National Small Flows Clearinghouse at (800) 624-8301 or (304) 293-4191 to order.*



National Onsite Demonstration Project Succeeds in Helping Small Communities

by Jill A. Ross
NSFC Contributing Writer

Editor's Note: This article also appears in the Spring 1999 Small Flows Journal, *another publication of the National Small Flows Clearinghouse.*

Since its first funding in 1993, the National Onsite Demonstration Project (NODP) has become a successful model for introducing onsite wastewater treatment technologies to small communities. Now, six years later, four additional phases of the project have been funded based on the success of Phase I of the project.

The NODP is designed to help communities across the U.S. to protect public and environmental health by successfully demonstrating alternative onsite wastewater treatment and management programs.

"Our overall experience has shown that demonstration projects are a wonderful way to transfer good information and technology to small communities," said John L. Mori, Ph.D., NODP Phase I program coordinator. "The model that has been created is successful. It gets results."

Phase I Success

The U.S. Environmental Protection Agency (EPA) has provided funds to the National Small Flows Clearinghouse (NSFC) to administer the NODP. According to Mori, what began as a technology transfer project to bring diverse onsite wastewater treatment technologies to small communities evolved into a community empowerment project.

"By unanimous consent of everyone involved, the real importance of the demonstration project is the empowerment of the community," said Mori. "The communities got smarter, better, energized. The communities themselves became experts."

Mori cited the experience of Gloucester, Massachusetts, an NODP Phase I community. Based on its successful experience with the project, Gloucester has already installed 60 new systems since the original demonstration project was completed.

Another example of NODP participants being empowered is Richard Piluk, who worked on the NODP Phase I project in Anne Arundel County, Maryland. Piluk, a county health department official, now serves on the expert panel for Phase II based on the expertise he acquired by being involved with Phase I.

In addition to empowering communities, the NODP has had other unexpected impacts, said Mori. "We learned there is a great need for education across the board—for everyone from the homeowner to the local official to the engineer. And the education has to happen in concert with the project."

At the Paradise, CA, NODP site, students from California State University, Chico installed suction lysimeters to monitor groundwater contamination. Here, a student takes samples. (Photo by Stewart Oakley.)

As part of the contract to have a demonstration project, each selected community was asked to develop an educational component. Mori said every Phase I community not only developed educational components, but did a better job than was expected of them.

"These communities have become magnets, drawing thousands of visitors interested in onsite systems. Over 3,000 individuals have visited these sites and thousands more read about the project in our publications," he said.

The project did fulfill its technology transfer lesson, said Mori. "We have learned technical lessons. We learned the value of risk assessment, site evaluations, technology selection, monitoring, and technical training for installers."

Phase I of the NODP has resulted in the compilation of a mass of engineering and scientific data that is housed at the NSFC. Mori encourages anyone with technical questions about the NODP to call the NSFC and speak with a technical assistant. A free report, *National Onsite Demonstration Project, Summary Report: Phase I*, also is available from the NSFC.

"The benefits of this project are twofold," said Robert Mayer, president-elect of the National Onsite Wastewater Recycling Association. "First, the participating communities become aware of various alternative onsite systems. Then, other communities nationally benefit from dissemination of the outcomes."

Additional Phases

Additional phases of the NODP were funded based on interest expressed from other local communities that wanted to have demonstration projects and support from the U.S. Congress, said Mori. "As word got out about the project, it had a ripple effect."

To date, the NODP has served 13 states. "By 2002, we will have served half of the states," said Mori.

By the time Phase II was funded in 1996, "we had learned to narrow our focus," said Mori. To that end, Phase II targeted environmentally sensitive areas. It also added more emphasis on education and training and the task of developing a database of all known onsite demonstration projects.

According to Mori, two-thirds of the technologies have been installed, monitoring has begun, and training is occurring for communities involved in Phase II of the NODP. The project is expected to go on for another year.

According to Clement Solomon, Phase II program coordinator, "These demonstrations to single-family dwellings, small communities, and others have far-reaching benefits. The long-term effect of integrating different groups (public officials, manufacturers, regulators, researchers, citizen groups, and the general public) through these demonstration projects builds consensus in developing and implementing sound environmental policies for rural and suburban areas."

An interesting development in this phase of the project was Vermont's approach to administering the funding to communities, said Mori. "While in Phase I needy communities were selected for the project, Vermont solicited proposals and communities competed for the funding. People were willing to get involved in the process."

Phase III of the NODP, funded in 1997, is giving Alaska, New York, Oregon, Vermont, and West Virginia the opportunity to increase their capacity to deal with onsite wastewater issues.

According to Mike Aiton, Phase III program coordinator, this phase is less about showcasing technology and more about helping states to develop the capacity to implement them. "Direct technical assistance is being provided to communities, a failure analysis of home aerobic treatment units is being conducted, a limited number of technology demonstrations will be implemented, and seed money is being provided to start onsite training centers."

The project is moving forward, said Aiton, with a number of projects approved, some projects pending, and four onsite training center projects proposed. "Vermont has been approved for a training center and has already received funding," said Aiton. He added that the failure analysis of home aerobic treatment units has been completed as well.

Phase IV of the NODP began October 1, 1998, and will run for three years. This phase differs significantly from the other phases in that it will not be installing or demonstrating technologies, but rather will focus on developmental processes that enable small communities to develop management districts for onsite systems, said Graham Knowles, program coordinator for Phase IV.

"Our mission is fourfold. Firstly, to increase community awareness of the potential public health benefits of onsite system management programs. Secondly, to establish a national state-of-the-art repository of institutional, technological, and managerial resources for small communities striving to establish management programs. Thirdly, to diffuse the management program innovation through focused educational materials that will share ideas to selected national audiences. Finally, we are striving to

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research

North Gloucester, Massachusetts NODP Phase I Completed

by Timothy Suhrer
Small Flows *Editor*

The National Onsite Demonstration Project (NODP) has concluded its Phase I demonstration project in North Gloucester, Massachusetts. Pollution from failed onsite wastewater treatment systems there has been threatening the local marine environment for decades. This four-year project was initiated to show that this problem could be solved by rehabilitation of the systems, and that development can proceed in lower-density areas without the need for expensive conventional sewers.

The NODP is funded by the U.S. Environmental Protection Agency (EPA) and managed by the National Small Flows Clearinghouse (NSFC) to assist small communities in funding, installing, monitoring, and managing model onsite systems as cost-effective, viable alternatives to centralized sewage systems.

North Gloucester is an environmentally sensitive coastal area, with shallow, glacial soils and high groundwater levels. Located along the Atlantic coast on Cape Ann in northeastern Massachusetts, 40 miles north of Boston, the area is primarily residential.

The downtown areas are sewered and served by a public wastewater treatment plant that serves about 40 percent of Gloucester residents. The North Gloucester project area is less densely developed and is primarily served by onsite wastewater systems, including cesspools on small lots (less than 0.25 acre).

For years, North Gloucester's failing onsite systems and cesspools have leaked effluent into storm drains or directly into the ocean, polluting clam flats. High levels of fecal coliform in the surrounding waters resulted in the closing of the area's shellfishing beds in the late 1970s.

The community is currently under a consent decree to clean up the pollution from failing septic systems and comply with federal and state water quality standards by 1999. Initially, the consent decree required that North Gloucester be connected by sewer pipes to the centralized wastewater treatment facility, but construction was halted when the Federal Construction Grants program was phased out in the 1980s.

The Gloucester Board of Health Septic Regulations and subsequently the Massachusetts Department of Environmental Protection regulate wastewater systems in Gloucester.

Before it was modified in 1995, the State Environmental Code for onsite systems contained siting, design, construction, repair and replacement, as well as inspection and maintenance criteria for conventional systems, but no guidelines for alternative systems. The local code (Gloucester Board of Health) has additional requirements including installer qualifications, standards for materials to be used, specific construction requirements, and distance from drinking water sources.

City residents and local officials were convinced that installing centralized wastewater systems in these areas would be too expensive in terms of both installation and operational costs. They petitioned the state Department of Environmental Protection to allow the field testing and monitoring of pilot alternative systems. In 1992, the consent decree was amended to allow the City of Gloucester to field test alternative wastewater systems and to identify areas where these systems could cost-effectively treat wastewater before disposal.

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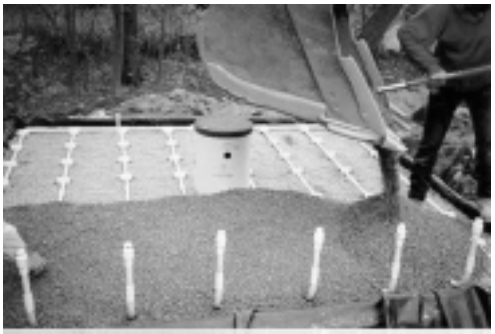

A pre-engineered, pre-packaged intermittent sand filter is installed at a North Gloucester NODP site. (Photo courtesy of Anish Jantrania).

National Onsite Demonstration Project Succeeds in Helping Small Communities

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assist interested communities with practical, hands-on technological and management expertise, thus facilitating community onsite system management programs that meet particular local needs," said Knowles.

According to Knowles, this phase of the NODP will create a wide range of quality products such as brochures, videotapes, a CD-ROM, and an interactive Web training site. These materials will be designed to share the onsite management concept with individuals, communities, local officials, and regulatory agencies. He expects the project to culminate in the development and dissemination of a series of user-friendly tools to set the backdrop, as well as to stimulate dialogue, for interested individuals, local leaders, proactive agencies, and small communities.

"We are really excited about Phase IV," said Mori. "We have been able to assemble some of the best people who will give excellent, practical guidance to the communities involved in this phase."

According to Mori, money has been appropriated by Congress for Phase V of the NODP that will begin in October 1999. The goal of this phase is to target services toward the must underserved, neediest counties in Appalachia.

Future of the NODP

According to the January 1999 *Report to Congress: The National Onsite Demonstration Project*, "In the five-year NODP experience, demonstrations have been invaluable in the process of introducing technologies to empower communities to solve their wastewater issues. Similar to ripples in the water, both successes and challenges of the participating communities have benefits for other similar communities in other states."

So far, states the report, the NODP has had financial benefits, improved public and environmental health, stimulated private sector development, empowered communities, educated local officials and the public, enhanced the quality of life for citizens, and verified technologies.

The NODP transfers technology and information to small communities in a systematic and consistent way," said Mori. "We believe that every state would benefit from it."

According to the NODP report to Congress, without intervention, more than four million onsite systems may be malfunctioning each year by the year 2025. "Clearly, there is a need for other states to benefit directly from the NODP project," states the report.

Mori said he would like to see projects in all 50 states in the next five to 10 years, including an emphasis on serving special populations, such as Appalachia, Native Americans, and the colonias.

"This project has proven that demonstrations have a good, useful role and they need to be continued," said Mori. "This is a great model and there still is a lot of need."

For more information about the NODP, call the NSFC at (800) 624-8301 or (304) 293-4191 or visit the NSFC's Web site at www.nsfc.wvu.edu.

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In addition to several alternative systems funded and initiated by the city in October 1993, the NSFC awarded an NODP Phase I grant that was initiated in November 1994 and includes four additional alternative onsite systems.

"Three of the sites could not handle conventional systems because of their characteristics," said Gloucester Department of Public Works staff member Ellen Katz, "and while one of them could have [system 1], we chose to use it to try out the synthetic foam biofilter, which had only been used in Canada. We were the first to use it in the U.S."

Expert panel members and NSFC staff provided technical support and conducted periodic site visits during the planning, installation, and monitoring of the systems.

The new demonstration systems replaced failing septic systems on three residential sites and one public building. These sites were selected from 42 homeowner applications solicited by the City of Gloucester, based on typical characteristics of the area, such as shallow soils, proximity to sensitive areas, and limited lot size or steep slopes. The systems were designed according to the following considerations:

- Shallow depth of bedrock in certain areas required aboveground installation of the disposal systems.
- Limited available drainfield area required that the effluent be treated to a very high quality before disposal.
- Close proximity to the ocean, wetlands, and other environmentally sensitive areas required reduction in nitrate and pathogen levels before disposal to prevent contamination.
- To be cost-effective, alternative system installation and operational costs needed to be less than those for centralized sewer systems. For this area, rock removal for centralized sewer can be cost-intensive relative to the use of onsite systems.

"With 220 gallons per day of water consumption, a typical three-bedroom homeowner on a sewer system pays about $360 per year," said Anish Jantrania, Ph.D., P.E., consulting engineer with the City of Gloucester from 1994 to 1996. "In comparison, operational costs for two of the three residential systems installed in Gloucester range from $36 to $50 each year. Maintenance services are also much lower than average sewer bills."

David Pask, P. Eng., NSFC project coordinator, added a note of caution to his assessment of the project's results. "This project has demonstrated that secondary treatment has the potential to reduce groundwater contamination, but the high, spring groundwater levels have also reinforced the maxim that pretreatment has no effect upon the hydraulic capacity of a site. The area of the soil absorption system can be reduced, but the layout must still be designed based upon the principles of subsoil hydraulics."

System 1. Septic Tank with Synthetic Foam Biofilter and Gravity Trench

This single-family house on a 28,360-square-foot lot has a limited disposal area, with a depth to bedrock of more than six feet, no indication of groundwater, and well-drained soil. The treatment objectives are to remove organic wastes such as biological oxygen demand (BOD_5) and total suspended solids (TSS) to prevent the disposal field from clogging and to reduce bacterial contaminants such as fecal coliform to minimize the migration of bacterial contaminants into coastal waters.

The treatment and disposal system consists of a 1,500-gallon fiberglass septic tank, an effluent screen vault that is also used as a pump chamber, a synthetic foam filter unit, a distribution box, and a gravity trench.

In 24 months of sampling, the system removed approximately 90 percent of organic wastes (92 percent of BOD_5) and 87 percent of TSS). The biofilter also removed 99 percent of fecal coliform from 99,628 to 1,377/100 ml. A sample taken after three and a half years indicated that the system was still operating at high efficiency, removing 96 percent of BOD_5 and 96 percent of TSS.

System 2. Septic Tank with Recirculating Trickling Filter (RTF) with Pressure-dosed, Sand-lined Trench

This single-family house on a 48,000-square-foot lot has well-drained shallow, glacial soils, a steep slope, and high groundwater that surfaces for a brief period during the spring season. The treatment objective is to reduce organic waste and bacterial pollution.

The treatment and disposal system consists of a 1,500-gallon septic tank designed to accommodate the RTF over the tank at the inlet end and two pumps in the effluent screen vault; an effluent screen vault that is also the pump chamber; an RTF; a pressure-dosed, sand-lined disposal trench; a 1/3-horsepower pump for recirculating septic effluent through the RTF; and a 1/2-horsepower pump to dose the sand-lined disposal trench.

The recirculated effluent was disposed in the sand-lined trench, and samples were taken from a point after the septic tank/trickling filter unit and also from the trench bottom. The level of total nitrogen leaving the septic tank/trickling filter unit was 32.1 mg/1, 60 percent lower than the level leaving the septic tank of systems 1 and 3. This demonstrated that, to reduce total nitrogen, a recirculating trickling filter can be added to a septic tank. For organic contaminants, the system removed 86 percent of BOD_5 and 53 percent of TSS. Fecal coliform was reduced from 70,399 to 23,018/100 ml, a 67 percent reduction.

System 3. Septic Tank with Intermittent Sand Filter (ISF) and Pressure-dosed, Shallow Trench

This single-family house on a 21,000-square-foot lot has four feet of depth to bedrock, with top and subsoil (the first two feet from the surface) composed of fill material, well-drained soil, with groundwater more than three feet below the surface, except during spring, when groundwater comes within a foot of the surface. The treatment objective is to reduce nutrients such as nitrogen and phosphorus.

The treatment and disposal system is made up of a 1,500-gallon fiberglass septic tank; an effluent screen vault that is also used as a pump chamber; a high-rate ISF; pressure-dosed, shallow, gravelless trenches; and two 1/2-horsepower pumps (one in the septic tank and the other in the sand filter).

During 24 months of monitoring, the sand filter removed 94 percent of BOD_5 and 89 percent of TSS. Fecal coliform was reduced from 211,584 to 5,182/100 ml.

System 4. Septic Tank with RTF with a Shallow, Gravelless Trench

This nonprofit library and community center had shallow, well-drained soil and limited area. The treatment objective was to accommodate a reduced-area soil absorption system.

The treatment and disposal system consists of a 1,500-gallon septic tank designed to accommodate the RTF, an effluent screen vault also used as a pump chamber, an RTF, a 1/3-horsepower pump for recirculating septic effluent through the RTF, and an existing cesspool to be used until the new disposal system is installed.

This system is currently being monitored quarterly.

Educational and Technology Transfer Program

The City of Gloucester's educational program was unique. Advertisements placed in the local newspaper soliciting homeowner participation for pilot sites also educated local citizens about options other than central sewer and conventional onsite systems.

Nearly 30 area contractors were invited via mail to attend a prebid meeting at the city's engineering office, which involved a discussion of the proposed technologies and a hands-on demonstration of the system components.

The engineering department of the City of Gloucester oversaw the construction of the systems and subcontracted electrical and carpentry aspects of the project.

"We learned a lot about construction and carried over the techniques to the sewer system we are building," said Katz.

Throughout the construction process, local contractors were invited to attend installations. In addition, tours of the sites organized by the city have attracted hundreds of homeowners and members of citizens' groups to view the systems in operation. Representatives of state and local

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profile

Job Duties Vary for Sanitarians

by Natalie Eddy
NSFC Staff Writer

Sanitarian is defined in the dictionary as a public health or sanitary expert, but that definition doesn't seem large enough to encompass the multi-functional duties and responsibilities of those practicing in the field today.

Depending on the size and location of the county, a sanitarian may do everything from inspecting onsite systems to investigating dog bites.

In addition to those duties, a typical sanitarian's job description might list inspections of various establishments, such as restaurants, grocery stores, schools, barber and beauty shops, and even swimming pools. It also might require the candidate to be able to set mosquito light traps and investigate the different species of mosquitoes or even to know the latest methods of rat control.

Add to this mix the ability to deal with the public and serve as teacher, counselor, and public relations specialist, and you might begin to scratch the surface of what sanitarians across the country do every day.

This story will give three different views of life as a sanitarian. Although county size and regional differences come into play, there are a lot of similarities. The central theme that seems to run through all three viewpoints is a feeling of satisfaction in helping the environment and the public.

Volusia County, Florida

"If we're doing a good job, people don't know we even exist," said Charles Luther, a sanitarian with the Volusia County Health Department in Florida. "Then, suddenly through some circumstance—if someone wants to build a house, has a problem with their drinking water, or becomes ill from a food-borne disease—we become visible.

"The fact that we aren't very visible might be our fault. We need to promote ourselves more as a profession. People don't know we're in the business of preventing environment-related diseases. I think environmental health across the nation needs to do more public relations so the public knows what we do and understands why it's important for us to be here."

Located 40 miles east of Orlando, Volusia County includes Daytona Beach and has a population of 400,000, which doubles during spring break or the Daytona race week.

Luther has been with the health department there since January 1981. He holds a bachelor's degree in criminal justice and was working in a completely different field when he saw a job listing for environmental health and "decided to go for it."

Charles Luther's duties as a sanitarian take him far afield. Here he inspects a drainfield on a final repair. (Photo courtesy Charles Luther.)

He said, "Back when I came on, I'm not sure they even had a requirement for a four-year degree. When I applied, they asked for my transcripts. I had a background in science courses and biology, and they hired me."

He started as a sanitarian aid doing sanitary nuisance jobs, such as animal bite investigations and taking water samples and investigating failed onsite systems.

He currently holds the position of environmental manager in charge of the county's onsite sewage and limited use drinking water programs. He also directs the SUPER (State Underground Petroleum Environment Response) Act, a state program that investigates drinking water contamination from petroleum storage tanks.

The Volusia County Health Department is divided into four field offices, employing approximately 40 people.

"I would say my job is a balance between trying to provide good customer service and education to the public and meeting state requirements," Luther explained. "A lot of people are very wary of government. There's a lot they don't understand and don't know. Instead of trying to take a stiff regulatory posture, I believe it's better to try to educate people—then they can understand the rules and are more likely to comply with them."

Because there are 18 cities within the county, Luther attends a variety of meetings to push his educational agenda. He is also a member of several soil and water advisory boards and development review committees.

"A good part of my day is spent on the phone or computer doing e-mail with various staff on different problems," said Luther.

"The rest of the day might be spent conferring with county officials or people within the health department. I spend the bulk of my day troubleshooting or assisting staff. The other part is working on training staff and doing quality assurance through visiting offices and making sure things are running smoothly."

His profession puts him into almost daily contact with septic contractors, building inspectors, staff, other county officials, and the public.

Luther said that approximately 40 percent of the county has onsite sewage systems, noting that there is heavy building development activity in the southwestern part of the county.

"Soil conditions in a lot of areas are pretty good," he added. "One problem we have is with lot size. Many of the lots were drawn up back in the 1950s. It's challenging to come up with a proper system on smaller lots. Also, like most of Florida, we have a shallow water table and rapidly percolating sand. That makes it critical for us to have the proper elevation on site evaluations."

Despite sandy soil conditions, Luther said his job is made easier because of the forethought of county and city officials who developed wellfields inland to provide sufficient, safe drinking water to the entire area.

The majority of onsite systems are standard subsurface treatment units; however, Luther said there are approximately 40 aerobic treatment systems and numerous mound systems in areas near surface water.

Despite the challenges, Luther said he enjoys his job. "I like working with the staff. They are really enthusiastic, dedicated, knowledgeable, and very professional," he said.

"I have seen an evolution in this field from when I entered it until now. We have a lot of staff getting master's degrees in public health. They are very career minded in environmental health."

The other aspect of the profession he enjoys is being able to help the public. "There are a lot of times when you're able to help the public. It's a good feeling. But there are also a lot of times when you're put into an adversarial position. When people don't understand the rules and regulations, those parts are not enjoyable. I try to think in terms of how I would want to be treated."

Lake County, Illinois

Tony Smithson is a sanitarian in Illinois for the Lake County Health Department, located north of Chicago.

He began his career in 1974 in a small town in Kentucky. Like Luther, he did not set out to become a sanitarian. "I really just

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stumbled into the job. They were advertising for someone with a biological sciences degree. I had just graduated from the University of Tennessee and really hadn't given this field much thought," he said.

Later, Smithson received his master's degree in public health. "As it turns out, the job fits my personality. I sometimes wonder how I'm still doing this, but the variety we encounter every day fits my personality," he added.

The Lake County Health Department employs 60 people in the environmental health division alone. The county's population is 570,000. Since it is a larger county, Smithson, like Luther, is able to specialize in onsite systems. The majority of Smithson's time is spent as coordinator of the county's onsite systems, interpreting ordinances and dealing with problem sites.

In an area where the cost of a one-acre lot alone can exceed $100,000, the issue regarding the approval of wastewater treatment is imperative.

"People's attitudes have changed toward the disposal of onsite wastewater," he explained. "They are beginning to realize it is something important and has a great deal of impact on the value of their homes."

Approximately 25 percent of the county's homes utilize some type of onsite treatment system. "We've done everything from lagoons and wetlands to low-pressure pump systems, drip irrigation, and spray irrigation," he added.

Smithson supervises two soil scientists, two full-time plan reviewers for onsite systems, and a number of other sanitarians who work intermittently on onsite programs.

"We are a very urbanized county in some ways, and yet we issue more onsite permits than any county in the state of Illinois," said Smithson.

To make the situation more difficult, Smithson said, the county's land area is small, and like Volusia County, Florida, many of the lots developed years ago are too small for a traditional onsite system. Adding to the problem is the steady increase in population, growing approximately 15 to 18 percent over the last few years.

Although Smithson said there is a lot of pressure to come up with onsite solutions for residents, he feels lucky to have two soil scientists on the staff. "It's probably a rarity in the regulatory business," he added.

"The only thing I try to do is to stay focused and try not to get lost in the everyday trials of the bureaucracy. It is easy to lose track of what you're doing on a daily basis and what environmental health has accomplished over the past 75 years. The best part of the business is having a real sense that we're helping people."

Garrard County, Kentucky

Randall Carrier, environmental supervisor of the Garrard County Health Department in Lancaster, Kentucky, has been a sanitarian for 24 years.

Like Luther and Smithson, Carrier got into the environmental field when it was just developing. "It was just opening up as a new, strong environmental field," said Carrier. "It was just something I was inclined to."

Carrier holds bachelor's and master's degrees in geography, also focusing on geology.

Unlike Volusia and Lake counties, Garrard County's population is relatively small, approximately 14,000. Carrier said currently he is the county's only sanitarian, adding that the focus of the job usually depends on the size of the county. "Sanitarians in smaller counties cannot just specialize in certain areas," he added.

"I do inspections of stores, schools, restaurants, and any kind of food service. I also do rodent control and onsite sewage inspections of private septic systems."

However, because of a booming economy (the result of an overflow growth from Lexington), 80 percent of Carrier's time is spent dealing with onsite systems and new construction.

"We've done 190 permits this year, approximately 20 a month. As part of the permitting process, we've done 350 site evaluations so far this year," he added.

"We do the soil evaluations, assist in the design of systems, and then make inspections. We get a number of calls from people who live in old homes with failing systems. People move in and want an upgrade. We have to deal with that, too."

Carrier is also very involved with the Kentucky Onsite Wastewater Recycling Association and is a charter member. "It has been a very rewarding experience. I have learned a lot and dealt with a lot of fine people," he added.

With this busy schedule and the amount of time he spends in the field, Carrier sets aside an hour and a half a day in the office to be available to builders, installers, and the general public.

Carrier's greatest satisfaction in his job is the good environmental health of his area. "It really has grown into a much greater responsibility than anybody anticipated. When you look around and see a lot of functioning, properly working septic systems in the neighborhood, knowing you're involved in it gives you a good feeling," he said.

"The ultimate goal is water quality. The biggest impact on water quality is through local health departments."

Odd But True Stories from Sanitarians

Sanitarians are often involved in odd situations working with the general public about various health issues.

Over the years, Luther of the Volusia County Health Department in Florida recalls many bizarre requests and disputes he has been involved in. He said frequently the health department is drawn into neighbor-to-neighbor battles.

"One lady called us to come to her house. She wanted us to stop her neighbor because his tree was dropping acorns onto her tin roof, and it was driving her nuts," Luther said.

"Another time, a man built a tall masonry wall around his hog farm because of new neighbors moving in around him. The neighbors complained, and because of zoning ordinances, he was forced to tear it down. He didn't like that so he moved all his hogs into his front yard and bought a giant industrial-type fan and started blowing the hog smell to the neighbors. There was nothing we could do about it because his land was zoned agricultural.

"I guess the neighbors should have let him keep the wall and not agitated the guy," Luther added with a chuckle.

Luther said sometimes things get just plain bizarre. "We had a lady come into the office saying her neighbor was shooting a laser beam into her bedroom. She also said the ducks were coming out of the lake and defecating on her lawn. She said the residue they left burned her feet. She wanted us to come down and round up the ducks and tell her neighbors to stop shooting lasers," he added.

The health department also had to deal with a man after he encouraged 100 rats to move in with him by feeding them cat food. He thought they were cute. The house had to be fumigated, and the man was taken to a facility for treatment.

Smithson also said he has witnessed some odd events in his years as a sanitarian. In a former position as sanitarian in Owensboro, Kentucky, he recalls getting a call one day about a cow stuck in a tree.

The Ohio River had flooded upstream and after the waters had receded, a cow had become tangled in a tree 30 to 40 feet above the water line. Unfortunately, the animal was killed in the incident.

A rescue squad had to free the animal and tow it down the river until it could be safely loaded into a truck for disposal.

Smithson commented, "As any sanitarian can tell you, there are a lot of things that happen in this job you can't talk about."

EPA news

EPA Helps Underserved Communities: an Interview with Gary Hudiburgh

by P.J. Cameon
NSFC Contributing Writer

Editor's Note: This article also appears in the Winter 1999 issue of E-train, *a publication of the National Environmental Training Center for Small Communities.*

For the past year, Gary Hudiburgh has served as chief of the Municipal Assistance Branch in the U.S. Environmental Protection Agency's (EPA) Office of Wastewater Management. One of the main roles of the branch is getting information, financial resources, and technical assistance to underserved populations around the country.

Gary Hudiburgh, chief of the Municipal Assistance Branch in EPA's Office of Wastewater Management.

Hudiburgh stresses two new initiatives in discussing how EPA can help small, underserved communities meet their wastewater treatment needs.

The first initiative Hudiburgh cited is the *Clean Water Action Plan* to restore and protect America's waters. The plan, prepared by several federal agencies including EPA and the U.S. Department of Agriculture (USDA), outlines how the federal government and the public can work together to ensure clean, safe water for all Americans. "*The Clean Water Action Plan* is an important tool we are using at EPA to move forward in improving surface water quality and public health," Hudiburgh said. EPA and the USDA published the plan in February 1998.

The second initiative Hudiburgh stressed is described in EPA's *1997 Response to Congress on the Use of Decentralized Wastewater Treatment Systems.*

He said it is important for the branch to tackle new initiatives based on these documents, but without lessening existing assistance efforts. "We will not ignore the existing work we do with regard to smal community outreach, technical assistance, and financing."

Clean Water Action Plan

The Clean Water Action Plan proposes "aggressive new actions" to ensure that the nation continues to make progress in restoring and protecting its water resources. Among these actions are some basic assurances: that beaches are safe for swimming, water is safe to drink, and fish and shellfish are safe to eat.

The action plan emphasizes watershed management and enhancements to the overall health of aquatic systems. The action plan further states that the federal government can provide technical and financial help to advance watershed management, but these efforts will be successful only if states and tribes, the private sector, and the public work together.

Hudiburgh echoed the need to cooperate if the watershed approach is to be successful. "The plan calls for a lot of partnering and collaboration. Clearly, we cannot do it ourselves," he said.

The plan also contends that the public must have access to reliable information about water quality. Hudiburgh mentioned the wealth of such information available from the EPA Internet site and other sources. And he was quick to point out how organizations such as the National Small Flows Clearinghouse (NSFC) can help spread the word to underserved populations that have few resources to gather that information on their own.

Decentralized Wastewater Treatment Systems Report

The *1997 Response to Congress on the Use of Decentralized Wastewater Treatment Systems* mentions several barriers that inhibit the use of decentralized wastewater treatment systems. These barriers include a lack of homeowner and developer knowledge about decentralized systems as well as legislative and regulatory constraints that deter or prohibit use of decentralized systems.

EPA has committed to taking some specific steps to support the use of decentralized systems. These include:

- developing voluntary guidance on centralized management of onsite systems,
- preparing a revised design manual for onsite systems,
- providing guidance on the use of Clean Water State Revolving Fund monies for onsite system purposes, and
- funding projects to demonstrate the applicability of onsite management programs.

While the lead for these efforts is with other parts of the agency, Hudiburgh's branch is playing an important support role, primarily because of its management of the NSFC, National Onsite Demonstration Program (NODP), and the National Environmental Training Center for Small Communities (NETCSC) projects.

Role of Municipal Assistance Branch

An important function of the Municipal Assistance Branch is to assist small, underserved communities—or areas with fewer than 10,000 people and inadequate wastewater collection or treatment systems. The branch works with small communities across the country including Indian tribes, Alaskan native villages, and the economically disadvantaged colonias along the U.S.-Mexican border.

"The branch is involved in a wide variety of activities associated with assisting small and underserved communities," Hudiburgh said.

Training activities include the Operator Training Program "to provide hands-on technical assistance and operator training to address compliance matters at small publicly-owned treatment works." The program is often referred to as the 104(g) program, after the section of the Clean Water Act that authorized its formation. Other training activities include a cooperative agreement with NETCSC.

Branch technical assistance efforts include funding the NODP, which is managed by the NSFC. The NODP demonstrates the effectiveness of alternative onsite wastewater technologies. Technical assistance also includes a cooperative agreement with the Rural Community Assistance Program (RCAP), a national network of nonprofit groups that helps small communities meet Clean Water Act requirements.

Branch outreach efforts include funding support for NSFC. The NSFC operates a toll-free technical assistance hotline, produces the *Small Flows* newsletter and other publications, maintains an Internet site, and conducts other outreach activities that serve as resources for small communities. The branch staff maintains the Small Community Outreach and Education (SCORE) information network that serves as the branch's outreach and information conduit for other small community activities.

The branch's other functions include water conservation activities under the Safe Drinking Water Act and Clean Water Act, Title 2 construction grants program, and special project grants contained in various Congressional and agency appropriations, including Mexican border activities.

Support for Tribes Emphasized

The branch provides direct grants and other financial assistance to Indian tribes and Alaskan native villages for wastewater treatment projects, and it is involved in an extensive effort to help the colonias areas on the U.S.-Mexican border.

Hudiburgh said EPA is working with NSFC and NETCSC to improve outreach and technical support to tribes. And under the operation and maintenance program, the agency is also looking to establish a training center at a tribal educational entity, he said.

"We have a goal to reduce the number of homes in Indian country that have inadequate wastewater treatment by six percent by the end of 2000," he said. Funding for this effort has been earmarked from the Clean Water Act State Revolving Fund set-aside program.

Successful Colonias Efforts Highlighted

Hudiburgh said the effort to assist the colonias is a great success story for EPA as well as the states of Texas and New Mexico. Colonias are small, isolated communities on the U.S. side of the border with Mexico.

"There has been a large number of projects constructed to provide sewage treatment to the colonias," Hudiburgh said. "There's been concrete poured, there's been dirt

continued on next page

NODP Sponsors Onsite Presentations at July NEHA

The National Environmental Health Association's (NEHA) 63rd Annual Educational Conference and Exhibition is slated for July 6–9 at the Renaissance Hotel and Nashville Convention Center in Nashville, Tennessee. On July 8, the National Onsite Demonstration Project (NODP) is sponsoring the afternoon onsite wastewater sessions.

According to Graham Knowles, program director of Phase IV of the NODP, the Onsite Wastewater Section of the NEHA Conference will focus on onsite wastewater management issues.

Knowles, who spearheads this multi-year, EPA-funded project, said, "The sessions will offer an excellent opportunity to explore the value, merits, and benefits of establishing onsite wastewater management systems at the county level. Great efforts have been made to gather practical 'hands on' experts in the field from across the nation."

Knowles is confident that local health officials could gain from attending the afternoon sessions sponsored by the NODP.

"Presentations and panel discussions will focus on the practical challenges of establishing an onsite management system at the county level," Knowles explained. The sessions are intended to have a practical orientation with a high degree of attendee participation.

"I believe the exchange of ideas and free flow of facilitated dialogue will provide a groundswell of interest in onsite management issues," Knowles said. "Managing onsite systems will greatly assist communities in ensuring public health and improving water quality. I encourage all interested local health officials to attend the sessions, engage in the discussion, and utilize the impressive resource of expertise assembled at the conference to address onsite wastewater management."

For the latest information about the conference, visit the NEHA Web site at www.neha.org, *call (303) 756-9090, or fax (303) 691-9490.*

New Book Describes Low-Water and Waterless Composting Toilet and Graywater System Options

The Composting Toilet System Book: A Practical Guide to Choosing, Planning and Maintaining Composting Toilets, an Alternative to Sewer and Septic Systems by David Del Porto and Carol Steinfeld is a new book offered by the Center for Ecological Pollution Prevention (CEPP).

Composting toilet systems and other ecological wastewater management methods are emerging as viable and cost-saving alternatives to wastewater disposal systems worldwide. The book explains how to choose, install, and maintain them.

It includes:

- descriptions of more than 40 systems—both manufactured and site-built—and their sources;
- compatible toilet stools and micro-flush toilets;
- tips on choosing, planning, installing, and maintaining your composting toilet system;
- the experiences of owner-operators worldwide;
- graywater reuse systems; and
- regulations and advice about getting your system approved.

Co-author David Del Porto has sold and serviced several models and brands of composting toilet systems since 1972. He has also helped write regulations and performance standards for these systems and has designed composting toilet and graywater systems for Greenpeace and for developing countries.

This 8.5" x 11", 240-page book (ISBN 0-9666783-0-3) has more than 300 photos and illustrations. Price including shipping: $33.25 US (USA), $41.95 US (EUR 38.60) (International). CEPP cannot take credit cards at this time.

To order or for further information, contact The Center for Ecological Pollution Prevention (CEPP) P.O. Box 1330 Concord, MA 01742-01330 or e-mail EcoP2@hotmail.com *or phone (978) 369-9440.*

EPA Helps Underserved Communities: an Interview with Gary Hudiburgh

continued from previous page

moved, and many of these operations are up and running."

Hudiburgh said the colonias activities have addressed the needs of many people in a relatively short period. According to EPA statistics, more than 280,000 colonias residents have benefited from these projects. "And there are many projects that are early in the planning and production stage. We're eager to complete those projects."

Right now the program is successful in addressing needs of colonias close to existing infrastructure, he added, cautioning that a real challenge will be down the road as the assistance effort focuses on more remote colonias. Alternative technologies may be needed to meet needs in the more isolated areas.

To date, approximately $320 million in federal funding has been earmarked for colonias projects.

One specific border activity that interests Hudiburgh is providing support for municipal wastewater treatment facilities near industrial operations. EPA hopes to provide training and technical assistance for pretreatment efforts so industrial effluent does not overwhelm those municipal facilities.

Partnering with NSFC

Hudiburgh emphasized the need for local partners, stakeholders, and residents to fully participate in all of these small and underserved community activities. "While the branch will certainly continue its efforts in these various projects, the real work to make changes to improve public health comes at the local level."

Hudiburgh said he is proud of the community involvement he sees in local wastewater treatment issues around the country. He said that NSFC has outreach tools and connections that help spread news about these efforts to a broader small community audience.

"NSFC plays a vital role in getting technical assistance to the audience," Hudiburgh said.

For more information about the Office of Wastewater Management's Municipal Assistance Branch, see the branch Internet site at www.epa.gov/ OWM/smallc.htm. *To contact Hudiburgh, write to him at U.S. Environmental Protection Agency, Office of Wastewater Management (4204), 401 M St. S.W., Washington, D.C. 20460 or via e-mail to* hudiburgh.gary@epa.gov.

NETCSC Training Skills Handbook Available

NETCSC Training Skills Handbook: A Reference Guide for Environmental Trainers is available from the National Environmental Training Center for Small Communities (NETCSC).

The handbook is a compilation of the training skills articles published in E-train, NETCSC's quarterly newsletter, from the August 1992 issue through the Winter 1998 issue. The articles provide training tips, techniques, and information. Chapter headings include Adult Education, Designing and Developing Curricula, Using Training Aids, Training, and Evaluation.

The three-hole-punched guide is comprehensive and includes graphics. The 8 1/2- by 11-inch format is easy to file, fax, copy, and update.

Cost for the handbook is $8.50. Request Item #TRBKTR13. It also may be viewed and downloaded from NETCSC's Web site at *www.netc.wvu.edu*.

To purchase the handbook or for more information, call NETCSC at (800) 624-8301 or (304) 293-4191.

events

1999 Calendar of Events

If your organization is sponsoring an event that you would like to have promoted in this calendar, please send information to the Small Flows *editor at the address printed in the staff box on page 19.*

JUNE

***Troubleshooting and Optimizing Wastewater Treatment Systems in Small Communities* (Activated Sludge and Lagoons)**
by National Environmental Training Center for Small Communities
June 5–6
Providence, Rhode Island
(800) 624-8301 or (304) 293-4191 ext. 5536
smiller@wvu.edu

26th Annual Water Resources Planning & Management Conference
by American Society of Civil Engineers
June 6
Tempe, Arizona
(561) 659-1676

***Building Bridges to Tomorrow* (Teleconference)**
by New England Interstate Water Pollution Control Commission and the Rhode Island Department of Environmental Management
June 6–9
Providence, Rhode Island
(800) 624-8301 or (304-293-4191 ext. 5536
smiller@wvu.edu

Plant Operations: Maximizing the Performance of Small & Medium-Sized Wastewater Treatment Plants
by Water Environment Federation
June 6–9
Milwaukee, Wisconsin
(703) 684-2400 ext. 2473

Society of Wetland Scientists
by The South Atlantic Chapter of the Society of Wetland Scientists
June 6–12
Norfolk, Virginia
(757) 441-7777

Managing a Drinking Water System: A Short Course for Local Officials
by National Environmental Training Center for Small Communities, the Minnesota Section of the American Water Works Association, and the Minnesota Department of Health
June 8
St. Louis, Minnesota
(800) 624-8301 or (304) 293-4191 ext. 5536
E-mail: smiller@wvu.edu

Southeast Focused Ground Water Conference
by National Ground Water Association
June 9–10
Tampa, Florida
(800) 551-7379

Technical Exhibitors' Program
by Mississippi Water Environment Association
June 9–11
Jackson Hilton and Convention Center in Jackson, Mississippi
(601) 495-4674—Allen Pate

Pollution Prevention Conference
by Florida Department of Environmental Protection and the University of Florida
June 9–11
Jacksonville, Florida
(352) 392-9570

Florida Water Quality Association Annual Meeting
by Florida Water Quality Association
June 10–12
Lake Buena Vista, Florida
(941) 688-6286

The FEMA National Flood Insurance Program
by American Society of Civil Engineers
June 16–18
St. Louis, Missouri
(800)- 548-2723

Assessing Wastewater Options for Small Communities
by National Environmental Training Center for Small Communities, St. Louis University, the National Onsite Demonstration Project, and the Colorado School of Mines
June 17–18
Denver, Colorado
(800) 624-8301 or (304) 293-4191 ext. 5536
smiller@wvu.edu

American Water Works Association Annual Conference & Exposition
by American Water Works Association
June 20–24
Chicago, Illinois
(303) 347-6209

Eastern Water Quality Association Conference & Trade Show
by Eastern Water Quality Association
June 24–26
Pocono Manor, Pennsylvania
(520) 323-6144

Water Environment Federation/Purdue Industrial Wastes Technical Conference
by Indiana Water Pollution Control Association
June 27–30
Indianapolis, Indiana
(703) 684-2475
jbruce@wef.org

JULY

National Environmental Health Association 63rd Annual Education Conference & Exhibition
by National Environmental Health Association
July 6–9
Nashville, Tennessee
(303) 756-9090

Onsite Wastewater Systems Conference
by National Environmental Health Association
July 6–8
Nashville, Tennessee
(303) 756-9090

Assessing Wastewater Options for Small Communities
by U.S. EPA Region VII, The National Onsite Demonstration Project, The National Environmental Training Center for Small Communities, and Saint Louis University
July 8–9
Morgantown, West Virginia
(800) 624-8301 ext. 5536

Southern Illinois University Rivers Project
by National Science Foundation
July 18–23
Chicago, Illinois
(618) 650-3788

Texas Water Quality Association Annual Meeting
by Texas Water Quality Association
July 22–24
Kerrville, Texas
(512) 479-0425

The FEMA National Flood Insurance Program
by American Society of Civil Engineers
July 23
Anaheim, California
(800) 548-2723

ASCE-CSCE Conference on Environmental Engineering
by American Society of Civil Engineers and Canadian Society of Civil Engineers
July 25–28
Norfolk, Virginia
(800) 548-2723

Intermountain States Onsite Wastewater Treatment Symposium
by Utah Onsite Wastewater Treatment Training Center, Utah Water Research Laboratory, and Utah State University
July 27–29
Utah State University in Logan
(435) 797-3159
(435) 797-3663
siverson@cc.usu.edu

AUGUST

South Atlantic Well Driller's Jubilee
by South Atlantic Well Drillers
August 1–3
Myrtle Beach, South Carolina
(540) 740-3329

Southern Illinois University Rivers Project
by National Science Foundation
August 1–6
Edwardsville, Illinois
(618) 650-3788

1999 Adirondack Waterfest
by Washington County Soil and Water Conservation District (SWCD), Saratoga County SWCD, and the Greater Adirondack Resource Conservation and Development (RC&D) Council
August 3
Fort Hardy Park, Schuylerville, NY
(518) 623-3090—Marc Usher of the Greater Adirondack RC&D Council
(518) 885-6900—Doreen S. Clemens at Saratoga County SWCD
(518) 692-9940—Laurie Deyoe at Washington County SWCD

LETTERS TO THE EDITOR

Editor's Note: The following letters were received in response to an article in the Winter 1999* Small Flows, *"Attention Readers: Help solve a Community's Problem." The article described the search by the town of Yacolt, Washington, for a long-term wastewater treatment plan that will allow for community expansion while saving the groundwater supply from possible nitrate contamination and asked readers to submit solutions.

Re: Yacolt, Washington Dilemma

Dear Editor,
The best solutions to such problems are nonstructural solutions (where possible), and the best nonstructural solution in Yacolt's case would be to increase the minimum lot size for new residences to 10,000 square feet or more—perhaps even to 18,000 square feet. Population projections, together with the need for new onsite systems, will be drastically reduced.

That was done in Gearhart, Oregon, 20 years ago, at a time when the state's department of environmental quality was concerned about nitrate pollution of the groundwater aquifer here. It was shown that by doubling the minimum lot size, the town could continue to grow without exceeding an overall nitrate limit of 5 ppm. Most owners of vacant land had at least two adjoining 5000-square-foot lots; those few who had single, separate lots were granted a "grandfather" exception. Real estate and development interests, of course, objected, predicting that the citizens would never accept such limits on their ability to develop property. The ordinance, however, was submitted to a popular vote and passed by a three-to-one margin.

Groundwater protection is only one consideration in the passage of such an ordinance. Other factors are the need for open space and small town "livability," along with better fire protection (fires can't spread when buildings are not too close together). The costs of growth in terms of police protection, utilities, and schools are also reduced.

Business development should not be hindered in the commercial zone, since businesses generate far less wastewater than residences. The exceptions are restaurants and laundromats; a cap should be put on such establishments.

Yacolt should be very cautious about accepting population growth estimates for its area. These are often generated by major utilities (gas, electric, etc.) in hopes of increasing rates to "prepare" for population expansion. In the case of sewer promoters (major land developers and spec builders), of course, the growth projections are self-fulfilling: new population is needed to pay for the sewers, which are built most often to facilitate development of vacant land rather than to solve an existing environmental problem. And their high cost effectively "gentrifies" the community, replacing it with a new, more affluent population.

I hope this information is useful to the people of Yacolt. Obviously, like the people of Gearhart, they don't want, don't need, and can't afford a sewer.

Sincerely,
Bill Berg
Gearhart, Oregon

Dear Editor,
The Yacolt, Washington, problem has three components: collection, treatment, and interface with regulatory authority.

Collection can be accomplished much cheaper than with conventional sewers. Since functional, regularly inspected septic systems are in place, and a capability to reduce nitrate going into groundwater is the only new requirement, one need only divert the outputs from selected septic tanks for central treatment. Full flow would normally go through a basket strainer into a dosing tank of 20 gallons, then through a dosing siphon into a 1-inch individual line, then through collectors starting at 2 inches. If terrain suggests the possibility of backup into lower fields, include a check valve. The dosing system assures intermittent high velocities to prevent sedimentation. In case of a clogged strainer (which would be inspected with the tank) or temporary collector backup, effluent would go to the local fields as before.

Treatment is not my field, but if the input is only clear fluids plus colloids, and the only requirement is nitrate reduction, some combination of anaerobic plus aerobic, perhaps followed by a biofilter lagoon, should do the job. Effluent should ideally go to fields to minimize regulatory requirements. The system handles no solids and need not serve the whole town, so land requirements are reduced. It should be possible to run it unattended except for inspection and sampling.

Regulatory Interface: Since groundwater nitrate is currently acceptable, initial requirements should be met by demonstrating an acceptable technology on a small scale and negotiating with the regulatory authority what criteria would be used to trigger increasing the scale of the system. Using groundwater nitrate as the only criterion would be functional and the lowest cost option. Development would be another; if the plant removed all nitrate, connecting one house to the plant for each new lot developed would prevent an increase of nitrate. It need not be the new house that is connected; areas with the lowest connection cost should be done first.

A demonstration plant should be large enough for some economies of scale, say 10 houses. It should be sited where development density is high to minimize collection costs and its outflow can be accommodated. There should be room for expansion, as dictated by the topography of the potential collection area. But acreage requirements are reduced because this is not a full, solids-handling treatment plant.

Capital costs of system expansion should ideally be paid by a fee on each new lot developed, but some may balk at having their fee go to connect someone else's house in a higher density area. These people could be given the option of paying to have a collector extended to their lot instead, but to preserve the fail-safe aspects of the system I have described, they should be required to install fields.

I hope these ideas are helpful in discussions of how to minimize costs for Yacolt.

Sincerely,
Norman R. Olsen
New York State Department of Transportation
Poughkeepsie, New York

advice

The National Small Flows Clearinghouse, established by the U.S. Environmental Protection Agency under the federal Clean Water Act (CWA) in 1977 and located at West Virginia University, gathers and distributes information about small community wastewater systems. *Small Flows* is published quarterly.

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Morgantown, WV 26506-6064
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www.nsfc.wvu.edu

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West Virginia University

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advice

NSFC Hotline Q&A

Drainfield Clogging and Rehabilitation

Editor's Note: This column is based on calls received over the National Small Flows Clearinghouse (NSFC) technical assistance hotline. It was researched and written by Todd Olson of the technical assistance staff. If you have a question, call (800) 624-8301 or (304) 293-4191 and ask to speak with a technical assistant.

I think my drainfield is failing. What are some of the causes and signs of drainfield failure?

Drainfield failure is often the result of one of five common causes: 1) hydraulic overloading, 2) excessive biomat formation, 3) poor site evaluation and system design/installation, 4) compaction, and 5) soil-mineral bonding.

Hydraulic Overloading

Hydraulic loading is a condition wherein the soil in the trench below the drainpipe becomes saturated when loaded with wastewater. This saturation greatly restricts how quickly the wastewater can flow through the soil absorption area (drainfield), slows the rate at which it can be applied to the drainfield, and forces it to find alternate subsurface flow routes. The result is that wastewater can be forced up through the soil to the ground surface where it "ponds," or backs up into the system. A homeowner may also notice toilets, bathtubs, or sinks that drain slowly. Unfortunately, in some instances, sewage can back up into the home, leaving the hapless home- owner with a mess and a substantial cleanup bill. Incorrect soil hydraulic testing, improper design, inefficient water use, and water runoff from springs and storm gutters directed toward the drainfield can cause hydraulic overloading.

Hydraulic overloading to a drainfield can be prevented in a number of ways. Whether you are installing a new system or upgrading/expanding an existing system, make sure the person designing or installing the system is licensed, certified, or recognized by the local permitting regulatory agency. This will help ensure that the designer/installer has experience with the system.

If you are having hydraulic loading problems with an existing drainfield, try reducing the amount of water you use. Low-flow shower heads, toilets, and appliances will all help in reducing the amount of water going to your drainfield. You can also divert runoff from a hillside, spring, or a house gutter if it happens to flow toward your drainfield.

Another strategy is to use a segregated wastewater system that allows water from bathtubs, showers, and washing machines to discharge to a completely separate wastewater system. Keep in mind that using this last strategy will require some replumbing of the house for the second wastewater system.

Excessive Biomat Formation

As septic tank effluent is discharged, solids that don't settle in a septic tank find their way to the drainfield. Over time, these suspended solids build up into the anaerobic layers of a biological clogging layer or "biomat." The biomat is biologically active and comprised of fresh suspended solids, dead microorganisms, cellular material, minerals, polysaccharides, and polyuronides. Biomats tend to restrict the flow of effluent through the drainfield, but are crucial because they filter out viruses and pathogens. However, if a biomat gets too thick, it can restrict flow through the drainfield altogether, resulting in a backup of sewage to the septic tank or surface ponding above the drainfield area.

Biomat formation cannot be prevented, but septic tank filters and proper maintenance of the septic tank can slow the rate at which it forms in the drainfield. Septic tank filters prevent excess suspended solids from flowing into the drainfield and can be retrofitted to existing systems. Overall their cost is small in comparison to installing a new drainfield (approximately $100 or less compared to several thousands for a new field).

Other maintenance that should be performed on the septic system includes having the system inspected and the tank pumped at regular intervals. Systems should be inspected yearly, unless a pump or a secondary treatment unit is used. In these cases, inspection intervals could range from three to six months, depending on the complexity of the system. Check your local/state regulations and manufacturer's specifications for the exact time period. The cost of pumping a standard septic tank depends on where you live and should be done approximately every three years, depending on occupancy and water usage, or based on the recommendations after inspection.

Excessive biomat formation can be dealt with in a number of ways. A high-pressure air injection system can be used to reopen soil pores and infiltration paths through the biomat. Improving the oxygen will allow the introduction of aerobic bacteria to the environment, which results in a faster breakdown of the biological material comprising the biomat.

Another option available to correct a clogged drainfield is to install a second or alternative drainfield if there is enough land area available. This allows the first drainfield to "rest" while naturally occurring microorganisms can feed upon and break down the collected solids. The homeowner then has the option to dose each drainfield periodically, allowing rest periods for the alternating drainfield areas.

Other options include chemical and biological treatments that have long been sold as common remedies for septic system failures or as part of a maintenance strategy. Check with your local regulatory authority before using such treatments (chemical or biological) to ensure that they do not affect the drainfield in any way and for regulatory restrictions in your county or state.

Poor Site Evaluation and System Design/Installation

Poor design is a cause of system failure that can be prevented. Unfortunately, it can be difficult to diagnose until too late. Designs should be checked by permitting agencies for approval and all permeability testing (the main component of a site evaluation) should be performed to an approved method before anything goes in the ground. *Remember that all areas of the U.S. have specified laws regarding the construction and permitting of onsite systems, whether at a state, regional, or local level.* The best form of protection against this cause of failure is doing your homework before hiring an installer or designer. Learn the major steps involved in permitting a wastewater system, or at least ask your designer to explain them, and then double check with the permitting authority. Never be afraid to ask a designer questions.

The best defense against poor design is to check for references and ask lots of questions to any potential hire. Homeowners should be wary of a designer that does not go through a state, regional, or local permitting process. Often, this is done under the pretext that the homeowner will save hassle and money. In reality, a homeowner is more likely to experience problems if a health department or permitting agency has not approved the plans for a system or inspected it prior to backfilling. Along with design, proper installation is another key factor in avoiding drainfield failure.

Compaction

Compaction failures of onsite systems are relatively common. Compaction occurs when a compressive force is placed on a soil, thereby decreasing the pore spacing between the soil particles. Water is conveyed through the soil via soil pores (commonly referred to as voids or void space). When compressed, the soil void space becomes smaller, constricting water movement through the soil into ever-smaller flow channels. This decreases, or in some cases, completely eliminates the permeability characteristics of the soil. Compaction is most critical in soils with high organic content or clay. When these soils compact, they do not return to their original volumes.

Compaction can be prevented in the following ways:

- Never drive over any portion of the drainfield.
- Do not put anything with a substantial load over the drainfield. Examples include parking lots, tennis courts, driveways, aboveground pools, and patios.

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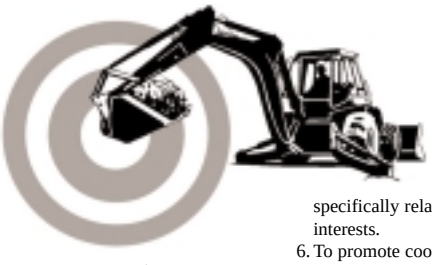

AIM—A New Association for Installers and Manufacturers

The Association for Installers and Manufacturers (AIM) is a non-profit corporation providing conference, educational, and local-association organizational management services to the onsite wastewater industry, focusing on the needs of installers and national manufacturers.

The Purpose of AIM

1. To promote membership in the local onsite association.
2. To provide management and consultant services to local associations and training centers.
3. To provide practical educational programs designed for training installers in the following skills: (a) how to build their business, (b) how to understand and meet local codes, and (c) how to properly install and maintain conventional and advanced treatment systems.
4. To provide the opportunity for national manufacturers to educate installers about the correct use and application of their onsite products.
5. To provide installers and national manufacturers a forum to address issues and concerns specifically related to their interests.
6. To promote cooperation with other national onsite wastewater associations and resource organizations.

Membership Benefits

AIM is working to provide each member with the following benefits:

1. The *AIM Onsite Magazine*
2. An AIM-endorsed small business insurance package
3. A national educational certification program
4. A national forum to address issues and concerns
5. A governmental liaison to address national legislative concerns
6. AIM logo materials for stationary and equipment
7. Homeowner educational materials

Onsite Training Center Support Services

AIM will muster the private financial and human resources of national manufacturers and local installers to support local and regional onsite training centers. AIM members will be asked to take the "AIM Onsite Training Center Pledge" to provide onsite training centers with products and services at no charge. A list of members who have made this commitment will be furnished to each onsite training center on request.

State Association Support Services

1. New Associations
   (a) AIM provides seed money to start new local associations.
   (b) AIM provides the state association starter manual.
2. All Associations
   (a) AIM provides shared profits for local conferences.
   (b) AIM produces newsletter for local membership.
   (c) AIM provides the state association financial management services.
   (d) AIM serves as an organizational consultant to the local association.

Educational Conference Support Services

An onsite association may engage AIM to manage their conference and/or co-sponsor an AIM educational conference in their region. AIM provides the following services:

1. AIM develops the educational program to comply with state CEU requirements in consultation with the local association.
2. AIM contracts with the hotel or conference facility.
3. AIM promotes the program to the onsite community.
4. AIM promotes membership in the local association at the conference.
5. AIM provides a free exhibit booth for the local association.
6. AIM finances the conference and takes the risk for any financial loss.
7. AIM shares a percentage of the profits with the local association.
8. Where there is no local association, AIM commits a percentage of conference profits as seed money to start a local association and provides association management services.
9. Each person that registers receives a year's free AIM membership.

AIM Membership

1. Individuals may join for $15.
2. An AIM member may sponsor a student with a current student ID for a free membership.
3. Company-sponsored memberships are available for $500, $1,000, $2,000, and $3,000. These memberships may be used to sponsor a local association, with company employees, or given as company-sponsored guest memberships for any onsite industry professional.

For further information, call (877) 323-5AIM, fax (502) 369-9647, or e-mail AimOnsite @aol.com.

Q&A: Drainfield Clogging and Rehabilitation

continued from previous page

- Know the location of the drainfield in order to prevent the preceding situations. If you don't have an accurate diagram of the system, hire a private wastewater system inspector to locate your field or check with your local regulatory/permitting agency for plans or drawings in their file of your system.
- In the case of new construction, do not allow heavy equipment in the area where your onsite system will be placed.
- Find out what areas of the property have been selected (if any) as alternative drainfield locations in case of a primary field failure. Treat this area just as you would a drainfield that was already present.

If your system has already been compacted, there are no remedial methods that can be used to restore the functionality. Prevention is the only way to avoid compaction problems. Unfortunately, most onsite system owners find this out too late, and the only solution is an entirely new drainfield or a more expensive alternative than originally planned.

Soil-Mineral Bonding

Soil-mineral bonding is the least understood cause of drainfield failure. Mineral bonding with soil is a phenomenon whereby native soil cations are replaced with other cations. The cation exchange causes changes in the soil chemical properties, which can result in formation of impermeable "slime" layers or hard, impenetrable mineral crusts. Examples of common cations include sodium (Na^+), calcium (Ca^{++}), and magnesium (Mg^{++}).

Even though the mechanism by which this failure occurs is known, the effects on soil permeability are not well known. Data exist that show that some salts can have positive effects on the permeability of clay soils. NaCl, $CaCl_2$, and $MgCl_2$, for example, have been shown to increase the permeability of bentonite clay. Smaller cations, like NH_4^+ and K^+, generally tend to decrease the permeability of soils because they can exchange places with larger ions more easily.

If you suspect that mineral bonding could be causing a problem with your septic system, try these strategies:

- Separate the discharge line from your water softener so that it can drain in a segregated drainage trench away from your current septic system.
- Use liquid detergents for washing machines instead of powdered versions. Powdered detergents tend not to solubilize completely, especially with cold water wash cycles. Don't use more detergent than necessary to complete the job.

A properly designed, constructed, and maintained drainfield can effectively treat and dispose wastewater for many years. Once it is installed, regular monitoring and maintenance can lengthen the life of the system and provide an early warning to identify and remedy minor problems before they escalate and cause the system to fail.

Therefore, problems with your drainfield should not be ignored, and corrective action must be taken as soon as possible. Contact your health department, a trained sanitarian, certified soil scientist, or other qualified professional who can diagnose the problem and make recommendations for corrective action.

resources

Wastewater Information Available on the Web

Editor's Note: There is an ample supply of wastewater-related sites on the World Wide Web. The following sites are only a sample of information that is available. At the time of publication, these sites were current, but due to the dynamic nature of the Web, they may have changed, moved, or disappeared.

The Georgia Water & Pollution Control Association, Inc.
www.gwpca.org/
GW&PCA is a non-profit group founded in 1932 that has grown to include more than 5,200 operators, owners, contractors, manufacturers' representatives, engineers, elected officials, industry representatives, and others concerned with water resources. The organization's purpose is to educate and assist people with an interest in water and wastewater.

The Septic Snooper
www.frisella.com/septic.html
This is a Web site that may be useful to educate consumers about septic tanks and their proper functioning. Lists of do's and don'ts direct people away from practices that may cause problems. Other sections include answers to frequently asked questions about septic systems and a monthly newsletter.

Water Technical Guidance Document
www.pca.state.mn.us/water/pubs/rmwtp.html
"Reliability for Mechanical Wastewater Treatment Plants" These recommended guidelines address the reliability of major treatment units for both activated sludge and fixed film reactor processes as well as electric power system reliability. The objectives of these guidelines are to ensure that an inventory of biological growth will be maintained in the system and to protect the receiving stream.

National Safety Council (NSC), Occupational Safety and Health
www.nsc.org/osh.htm
The NSC is a private, nonprofit service organization that offers training and educational resources and seminars on safety, including workplace safety. The group publishes several periodicals and researches safety issues. For more information, contact them at Headquarters, National Safety Council, 1121 Spring Lake Drive, Itasca, IL 60143-3201; e-mail: osh@nsc.org; or call (800) 845-4672.

National Institute for Occupational Safety and Health (NIOSH)
www.cdc.gov/niosh/homepage.html
NIOSH provides information about workplace safety, such as confined space guidelines and the use of personal protective equipment. For more information, call (800) 356-4674.

Red Cross Workplace Safety
www.redcross.org/
The Red Cross workplace safety courses are customized to fit the needs of a particular occupation. Courses include CPR and standard first-aid training. Course fees start at $20.

Instrument Testing Association (ITA)
www.instrument.org
ITA is an international, nonprofit organization that promotes the understanding, selection, improvement, and cost-effective use of instrumentation and automation applications for monitoring and controlling water, wastewater, and industrial systems. Their Web site provides information on instrumentation and automation technologies.

Animal Feeding Operations—Resources on the Web

Unified National Strategy for Animal Feeding Operations
www.epa.gov/owm/finafost.htm

On March 9th, the final version of the National Strategy for Animal Feeding Operations (AFO) was posted at the above address. This strategy, developed by both the EPA and the USDA, is part of the Clean Water Action Plan. It strives to limit the public health impact that AFOs may have on surrounding waterways. Under this plan, a national performance expectation is established for all AFO owners and operators. It also presents a series of actions that the USDA and the EPA will undertake to improve water quality and at the same time ensure the long-term sustainability of livestock production. The page includes a table of contents that allows users to click on a link to a chapter or sub-chapter. The draft for the strategy is available at *www.cleanwater.gov/afo/*. Also available at this page are links to the press release, highlights, a comments section, and a Spanish version of the draft.

National Cattlemen's Beef Association (NCBA): Environment
hill.beef.org/cnsrvt/consvrt.htm

The NCBA is a marketing and trade association for cattle farmers and ranchers. The above address is for NCBA's environmental issues page. This page includes links for the Senate and House bills regulating animal feeding operations. Under its News section, there are links to news summaries covering environmental issues. The page includes five "Fact Sheets/Position Papers," including one covering EPA's increased focus on AFOs. Another section includes regulatory, legislative, and judicial updates. At the left of the page is a list of 15 links that cover such topics as cattle health, endangered species, Federal lands, food safety and health, policy, and states. The states link leads to detailed information for each state, including agriculture department information.

Dairy Farming and the Environment, National Milk Producers Federation (NMPF)
www.nmpf.org/environ.htm

The NMPF, an organization serving America's dairy farmers, deals with policy issues affecting the dairy industry. In their Dairy Farming and the Environment page, NMPF provides a number of links dealing with the effects of AFOs on the environment. It includes links for NMPF's comments to the EPA and USDA regarding the draft for the Unified National Strategy for Animal Feeding Operations, a lengthy fact sheet regarding compliance with regulations for concentrated AFOs, and a case study article titled, "Cove Farm: A Lesson in Environmental Dairying." At the bottom of the page is a list of 16 links to articles from NMPF's newsletter, "News for Dairy Co-ops." Most of these articles deal with the effects of animal waste.

Water Quality: Concentrated Animal Production, U.S. Department of Agriculture (USDA)
www.nhq.nrcs.usda.gov/land/env/wq5.html
This USDA page provides a written summary of the environmental problems resulting from concentrated animal production. Below the summary is a Maps and Facts section. This section includes links to a U.S. map of "confined livestock concentration," a study titled "Trends in the Potential for Nutrient Loading from a Confined Livestock Concentration," and an article on how nutrient management systems reduce environmental risk. This is part of a larger web site titled "State of the Land" covering water, soil and land use issues.

Tribal Environmental and Natural Resource Assistance Handbook Available Online

The Tribal Environmental and Natural Resource Assistance Handbook was developed by the Domestic Policy Council Working Group on American Indians and Alaska Natives. This handbook is a compilation of the federal sources of financial and/or technical assistance programs available for tribal environmental management. This handbook is intended to benefit tribal environmental staff and to inform federal, regional, state and local government employees about the sources of environmental assistance available in order to improve customer service to the tribes. A significant section on the U.S. Environmental Protection Agency is included in the handbook.

Sources of assistance span various environmental categories, including; air, water, plants and animals, toxics/hazardous waste, solid waste, pollution prevention, emergency preparedness and response, and environmental education. The document is available at www.epa.gov/indian/tribhand.htm on the Internet.

New Book Published on Stormwater and Water Systems Management

A new book, *New Applications in Modeling Urban Water Systems*, is available from Computational Hydraulics Int. (CHI). It consists of 20 chapters selected from papers presented at the International Stormwater and Urban Water Systems Conference held annually in Toronto, Canada and edited by Dr. William James of the University of Guelph. This hardcover, 450-page monograph has been peer-reviewed and comprehensively indexed. The book is of interest to a broad audience of environmental professionals, including civil and environmental engineers, city and landscape planners, municipal engineers and planners, and educators.

The book is the seventh in a series on managing stormwater and covers such topics as

- the use of state-of-the-art com puter models for resolving real pollution problems and for ecorestoration,
- surface water quality modeling,
- modeling impacts on aquatic ecosystems and habitats,
- stormwater and pollution management modeling,
- urban drainage system design and analysis,
- wetlands and BMPs,
- field data monitoring and emerging instrumentation,
- GISs,
- decision analysis systems, and
- policy legislation, permitting, and enforcement.

The book is available only in glossy hard cover (ISBN 0-9697422-9-0) for $65 CDN or $55 U.S., plus shipping and handling. To order, or for more information, contact CHI at (519) 767-0197, fax (519) 767-2770, or e-mail info@chi.on.ca. *Their Web site is at* www.chi.on.ca.

Updated Environmental Law Handbook Announced

Government Institutes Division, ABS Group Inc., has announced the release of the updated *Environmental Law Handbook, Fifteenth Edition*. Written by 15 nationally recognized environmental legal experts, this new edition maintains the first edition's original goal to provide users with reliable, accurate, and practical compliance information by addressing all changes made to the laws in the past two years.

Using a minimum of legal jargon, this 700-page reference provides readers with a foundation for understanding the obligations of the laws. The *Fifteenth Edition* also explains and details noncompliance penalties, including administrative fines and criminal prosecution for violations of all acts and newly increased fines for negligent violations of the Clean Water Act.

The authors focus, however, on the 14 major environmental, health, and safety laws affecting U.S. businesses and organizations and detail, in more than 90 new pages, all recent changes made to those laws. Such changes include explanations of the Joint U.S. Environmental Protection Agency/State Innovations agreement, which the EPA and senior state environmental officials established and signed in 1998 and the revised TSCA Model Reporting Rule, which took effect June 30, 1998. In addition, this new *Environmental Law Handbook* details the revised national ambient air quality standards for ozone and fine particles and the new and revised air toxics control requirements.

Special features include a 25-page table of contents and a 35-page index for quick searching. Publishers' review copies and previously printed reviews are available upon request.

The cost of the book (ISBN 0-86587-650-9) is $89 plus shipping and handling. For further information or to order, call (301) 921-2323 or fax (301) 921-0373 or e-mail giinfo@govinst.com. *Their Web site is at* www.govinst.com.

North Gloucester, Massachusetts NODP Phase I Completed

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agencies such as EPA, the Massachusetts Bay Program, U.S. Department of Agriculture, and the Pilgrim Resource Conservation and Development Area Council, Inc., have visited the sites, along with area and out-of-state engineering consultants and contractors.

"Before this project," said Katz, "the state law, Title V, had no mention of alternative systems. This project was one of the contributing factors in changing that. Now there is a set of approved alternative systems and guidelines on how to apply them, and 60 new systems have been installed. The state made a 180-degree turn in the right direction, but it still has a long way to go."

Lessons Learned

Widespread community support is essential for alternative onsite or smaller cluster systems to be used. In Gloucester's case, the community members worked actively with the city to convince the regulatory agency to evaluate various alternative systems.

Local contractor training is another key aspect that can increase the success of alternative onsite and smaller cluster systems for environmentally sensitive and sparsely populated areas. Most often, onsite systems fail due to lack of proper installation and ongoing maintenance. In the case of Gloucester, local contractors had minimal experience installing alternative onsite systems.

Training and development of a local maintenance industry or management program for the community is one of the essential elements needed to ensure the successful long-term use of onsite and smaller cluster systems. Currently, the concern in Gloucester is the development of a maintenance structure, such as a management program for long-term maintenance of the systems installed.

Regulatory agency commitment and support is also needed. Even though the regulatory agency has included certain types of alternative systems in its code, more progress in the area of training of regulatory personnel in the installation, maintenance, and effective use of alternative systems is necessary.

For more information about the North Gloucester demonstration project or other NODP sites, call the NSFC at (800) 624-8301 or (304) 293-4191. Updates on the project will be included in future issues of Small Flows.

EPA Newsletter Reports on Regulatory Issues

Enforcement Alert, a new electronic newsletter from the U.S. Environmental Protection Agency (EPA) Office of Regulatory Enforcement, informs the public and regulated community about important environmental enforcement issues, recent trends, and significant enforcement actions.

According to EPA, this information should help the regulated community anticipate and prevent violations of federal environmental laws and applicable regulations.

Among the laws covered in the newsletter are the Clean Air Act, the Clean Water Act, the Safe Drinking Water Act, and the Toxic Substances Control Act.

Enforcement Alert can be downloaded in PDF or HTML from the EPA Web site at *www.epa.gov/oeca/ore/enfalert/*. Readers can also receive an e-mail version of the newsletter by e-mailing a request to *bueno.virginia@epamail.epa.gov*.

For more information, call Virginia Bueno, EPA Office of Regulatory Enforcement at (202) 564-8684.

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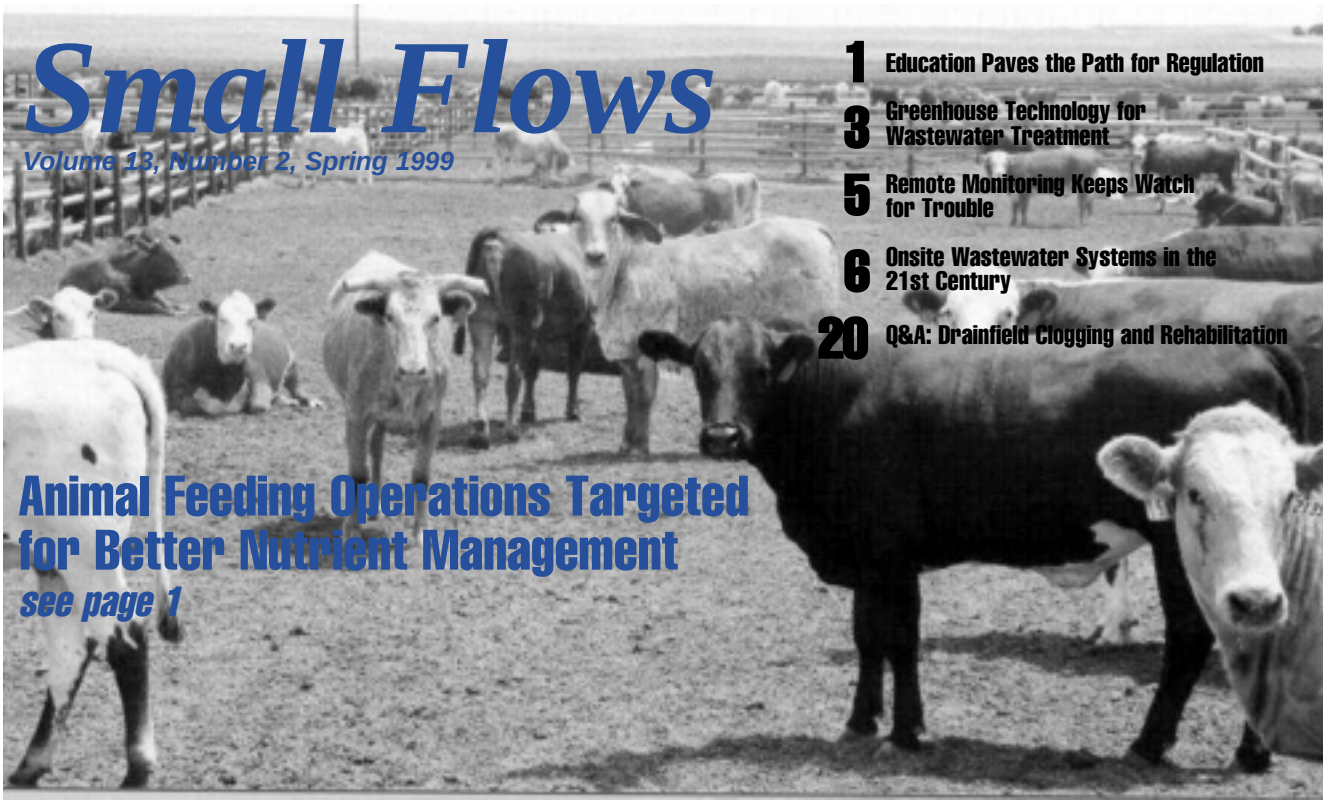

Animal Feeding Operations Targeted for Better Nutrient Management

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