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Clusters of Concern

To the Editor:

I have been concerned for some time about very large and cluster systems that seem to be so popular today. Aside from some very real construction problems, of more concern is the dynamics of flow through the soil.

I refer especially to the numbers for the large systems described in the article "Serving a Community" in the August *Onsite Installer*. The values commonly used for designing onsite soil treatment systems were developed for small systems. The values reflect the rate of liquid movement through a developed biomat. This would be through the trench or seepage bed bottom and sidewalls.

These values, such as 0.345 gal./sq. ft./day, also assume that there will be sufficient oxygen in the soil for soil bacteria to continue to break down the biomat on the soil side of the trench or bed. These soil acceptance rates do not apply to an application over a broad area of soil. For example, in the August issue a system is being designed with drip irrigation using the rates of 0.18 gal./sq. ft./day and 0.345 gal./sq. ft./day.

The system capacities are to be 92,400 gpd and 320,000 gpd. This is a lot of liquid! The amount of 92,400 gallons applied at a rate of 0.18 gal./sq. ft./day would require 11.8 acres of area. The application rate of liquid would be 0.29 inches per day, or 106 inches per year. For 320,000 gallons, 41 acres of area would be required.

This is 106 inches of liquid being applied to that area each year. This amount is in addition to the rainfall that might be received. Does the soil profile have the capability to transmit this amount of liquid downward to the water table?

The water table is indicated to be at a depth of 6 feet. This will complicate the dynamics of flow in the soil, and much of the applied liquid will need to move laterally away from the application area. If the soil characteristics do not allow the liquid to move laterally, then the liquid will move laterally on the surface of the soil.

The point here is that design values used for soil acceptance rates in small underground trench and seepage bed systems simply do not apply to large systems. This is to say nothing about the nutrients, salts and other compounds that may be in the liquid flowing down to a shallow water table. If the water table is used as a water supply for nearby residents or municipalities, there may be serious problems.

Wisconsin found out many years ago at Westboro that large seepage beds failed. The beds were sized using design values for small systems. These values simply did not apply to seepage beds 100 feet or more wide. The failure of the large seepage beds was reported in a paper titled "Performance Characteristics of a Community Wastewater Absorption System" by R.L. Siegrist, D.L. Anderson, D.L. Hargett and R.J. Otis. This paper was presented at an Agricultural Engineering Symposium on Individual Sewage Treatment Systems.

Minnesota at present is hiring consultants to diagnose the failure of some large systems designed by engineers. The problem is that engineers do not understand that the design values for individual onsite treatment systems do not apply to large systems that apply large quantities of liquid over a relatively small area. The engineers who design these large systems also apparently do not understand the dynamics of flow through porous media, both laterally and in the downward pattern toward the water table.

I also believe your editor over-simplified matters in his August column in stating to installers that "If you know the basics of single-family systems, you also know most of the fundamentals of large-scale and cluster systems." I also cannot accept the statement that "the soil does its absorptive work in large systems just as in those you now design and install." There is a vast difference in the fluid dynamics of small and large systems.

I think that Ontario has the right idea with its Municipality Responsibility Agreement. The provisions are such that if a large onsite system fails, the nearby municipality agrees to take over the treatment responsibilities. An agreement like this is desperately needed where these large systems are being designed and installed in the United States.

I realize that there is a vast movement in the onsite industry today toward large cluster systems. For the sake of the onsite industry, I hope they are properly designed and I hope they work. I do have real serious doubts about the future of the industry moving in the direction of these large systems. There have already been some serious problems.

Roger E. Machmeier
Chisago City, Minn.

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Teachable Moments

A good time to educate customers about onsite treatment is when a system is failing. But there's another time that's even better.

By **Ted J. Rulseh**

It's amazing at times how many people misunderstand septic systems, and the depth of the misunderstanding.

In one rural community where I lived, a tradition after a house party was for the guests to chip in enough money to have the septic tank pumped — the assumption being that all those people using the bathroom filled it up.

And maintenance contractors, upon completing a pumping job, have often heard a homeowner ask, "Was it full?"

Other homeowners, of course, don't even think of the concept of "full" when they use significantly more water than their system was designed to handle. Arguably that kind of ignorance is worse.

In any case, many homeowners' knowledge of the onsite system starts and stops at the septic tank. That's a big, heavy, physical object that's pretty easy to grasp. It's the thing that gets dug up or uncovered every few years when that big tank truck comes into the driveway.

It's harder for them to envision that network of trenches and pipes where the bulk of treatment happens — until sewage starts surfacing in the yard.

Getting attention

In this month's Basic Training column, Jim Anderson and Dave Gustafson talk about the importance of educating homeowners at

the time they face an ailing or failing drainfield.

That is, after all, a teachable moment. When the yard is damp with wastewater, a person can easily grasp the connection between that condition and excessively long showers every day or too many loads of laundry on the weekends.

Jim and Dave describe a case in which a homeowner, horrified at the prospect of cutting down beautiful mature trees to make way for a new drainfield, was readily convinced to monitor usage with a water meter, then change household habits to fit the system. In the end, the trees were saved.

It would be better if such teachable moments never had to happen, because when they do, damage already has been done. To that end, there's another teachable moment that installers should take advantage of at every opportunity, and that's the day an owner moves into a new house.

The problem for installers is that often their customer is the builder. It's the builder who turns over the property; the installer isn't around on moving day. Unless the builder is an unusually strong advocate for onsite professionals, the homeowner may be only marginally familiar with the onsite system and its care.

That extra mile

Many people move to country

homes from the city and are not used to worrying about their wastewater. Some will remain blissfully ignorant if allowed to. After all, who wants to worry about sewage?

But maybe this is where the professional installer has to draw a line in the sand. Maybe the installer who wants to be just that little bit better will never let a homeowner take possession of a house without personally giving a half-hour lesson on the septic system and its care.

actually the builder who wrote the check for the installation?

All-the-time thing

It's more difficult under such conditions to give the tutorial because the homeowner in a certain sense is not the installer's customer — the builder is. But where there's a will, there's a way.

If you installed the system, you know where the homeowner will live. You can arrange for that Onsite

Many top installers already meet with the customer sometime between the end of the installation job and the owner's first day in the home. The question is: Are there exceptions?

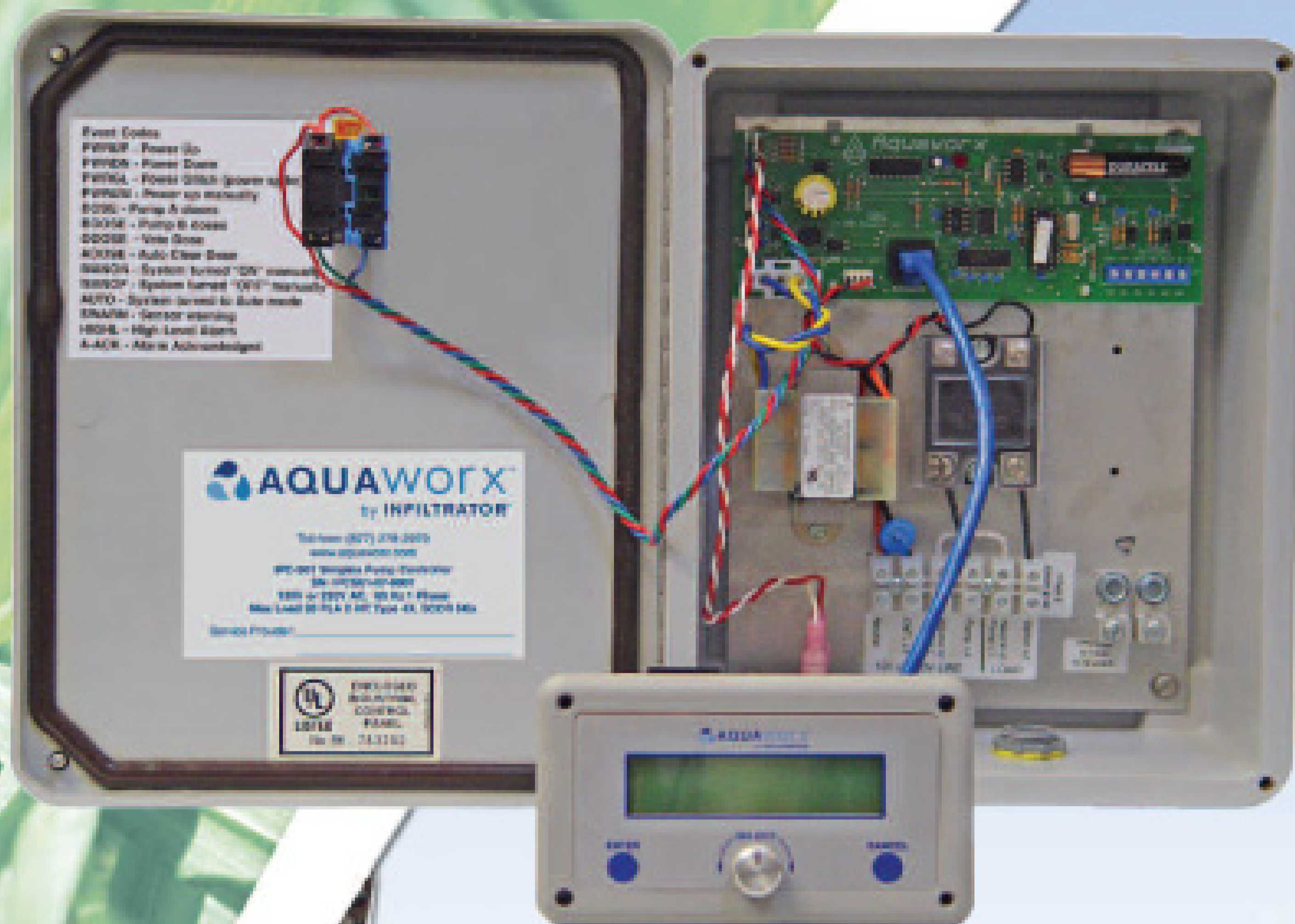
It isn't a complex subject. For a basic, conventional septic system, just about everything the homeowner needs to remember fits on one side of a sheet of paper. (For more complex systems, the story isn't all that much different. There are more moving parts to think about, but the most important thing to know is the phone number of a highly professional maintenance provider.)

Many top installers already meet with the customer sometime between the end of the installation job and the owner's first day in the home. The question is: Are there exceptions? Does the homeowner get the tutorial even when it's

101 meeting, even if that means finessing things a little with the builder. Sure, it takes a little extra time and costs a little extra money. But it's not hard to envision that investment coming back in great word-of-mouth. And what helps you in this instance also helps out the builder, who will have reason to see you in an even better light than before.

So perhaps the industry's unwritten rule should be: If you install the system, you give its new owner the necessary instruction. It's a way to take advantage of one teachable moment, and in the process prevent another one sometime down the road. ■

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Jim Anderson and David Gustafson are with the University of Minnesota's widely recognized onsite wastewater treatment education program. Anderson is director of the university's Water Resources Center and Gustafson is the university's extension onsite sewage treatment educator. Readers are welcome to submit questions or article suggestions to them at ander045@umn.edu.

Bringing It Back

Changing usage habits and improving effluent quality can be workable alternatives to replacement of failing systems

By Jim Anderson, Ph.D., and David Gustafson, P.E.

The most common question when talking with a homeowner about options dealing with a failed soil treatment system is: Can you do anything to make the existing system work?

You need to approach the answer carefully and remember that it is very site-specific. The answer also depends on factors that are sometimes hard to determine. First, was the system well constructed to begin with? What are the flow characteristics in the house? How have they changed?

Has regular maintenance been performed? Does the system comply with current state and local codes? Often, the most cost-effective solution is to replace the system and use the occasion as time for homeowner education.

Changing usage

Before recommending the new system, it is always good to talk with the owners about their water use patterns and to evaluate where they can make changes for the benefit of the onsite treatment system.

This homeowner evaluation of water use starts the discussion of what the future system should look like and how big it needs to be. Here is an example. A frantic call came from a homeowner that sewage was surfacing in the backyard. It turned out that the system was on a beautiful lot with many mature evergreens. These trees were in the only place on the lot where a new system could be built to replace the failing trenches.

The homeowner said there were three teenagers in the house and

that they all took long showers every day. When the owner asked if anything could be done to avoid cutting the trees to replace the system, an obvious suggestion was to put on a water meter to measure the daily flow and to take steps to reduce usage. This was also the time to point out that systems have a finite capacity and exceeding it creates problems.

In the first week, the water meter showed that while the system was designed for 450 gpd, it was receiving nearly 700 gpd. The homeowner set out on a water-conservation plan that included timing showers and cutting off the hot water after five minutes. Lo and behold, the surfacing stopped, and they did not have to replace the system.

This outcome isn't possible in all cases. But the example illustrates that household water use can have a major impact on system performance and should be looked at as part of any potential system renovation. It also shows that a water meter can be very helpful in identifying potential problems and devising solutions.

Better effluent

Another area to look at in soil treatment area renovation is improving the quality of effluent coming from the house. If the septic tank was not maintained regularly or is too small for the house, or if use patterns are such that the effluent BOD exceeds 175 mg/l, the system can be potentially renovated by providing a cleaner effluent.



New techniques for saving water in homes with onsite systems include toilets that allow the owner to choose a half flush or a full flush.

Since BOD is a measure of the organic loading to the system and contributes to development of a thicker and more resistant biomat, reducing the organic loading can increase system performance over time.

One way to renovate the system would be to rest it for a while to reduce the biomat and restore some infiltrative capacity. This, along with reducing the organic loading from the house and increasing septic tank capacity to reduce the BOD, can be effective. This is why having the ability to manage where effluent is delivered is an effective management strategy.

In recent years, to help clean up effluent, installers have moved to adding pretreatment devices to knock down the BOD and fats, oils and grease (FOG). One example was a failing set of trenches installed in fill and disturbed soil.



A textile filter like this one provides additional treatment to septic tank effluent.

There was limited space on the lot, so the solution was to install a recirculating sand filter and as much additional linear footage of trenches as possible within the area available. The bottom line: The filter worked so well that the system recovered and the additional trenches never saw a drop of effluent. And this was on a very tough site.

with more septic tank effluent. Effluent is pumped repeatedly through the filter and then back to the recirculation tank. Ideally, the recirculation ratio is at least 5:1 before the effluent is released to the soil treatment area.

The filter is in a watertight liner or container. Although the liner can be made from a number of materi-

Before recommending the new system, it is always good to talk with the owners about their water use patterns and to evaluate where they can make changes for the benefit of the onsite treatment system.

Workings of filters

Recirculation means cycling the wastewater through a filter a number of times, improving waste removal and increasing bacterial decomposition. Wastewater moves from the house to the septic tank and then by gravity to a recirculation tank. From there, the water is pumped to the filter (sand media in the previous example, but peat and textile filters work too).

After passing through the filter, the water is pumped back to the recirculation tank, where it mixes

als, 30 mil polyvinyl chloride (PVC) is the most common and reliable. The filter is composed of 12 inches of drainage media. Outflow is provided by a 4-inch pipe surrounded by drainfield rock. The depth of the outflow should be 12 to 18 inches below the bottom of the filter media. Effluent must drain freely out of the media, since saturation reduces filter effectiveness.

In future articles, we will explain installation of different media filters. ■

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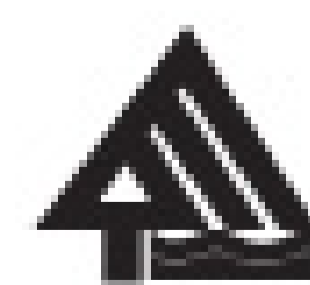
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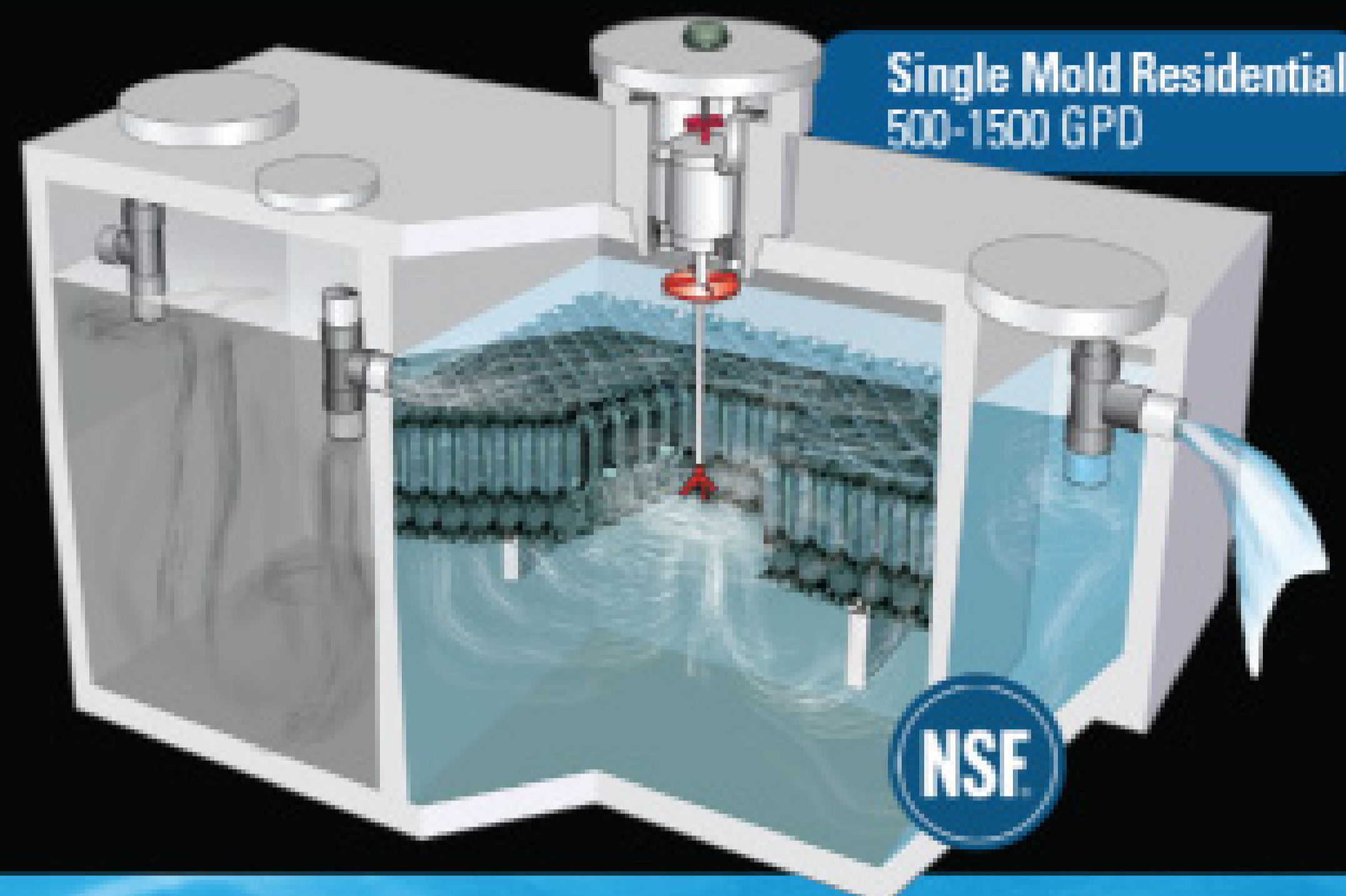
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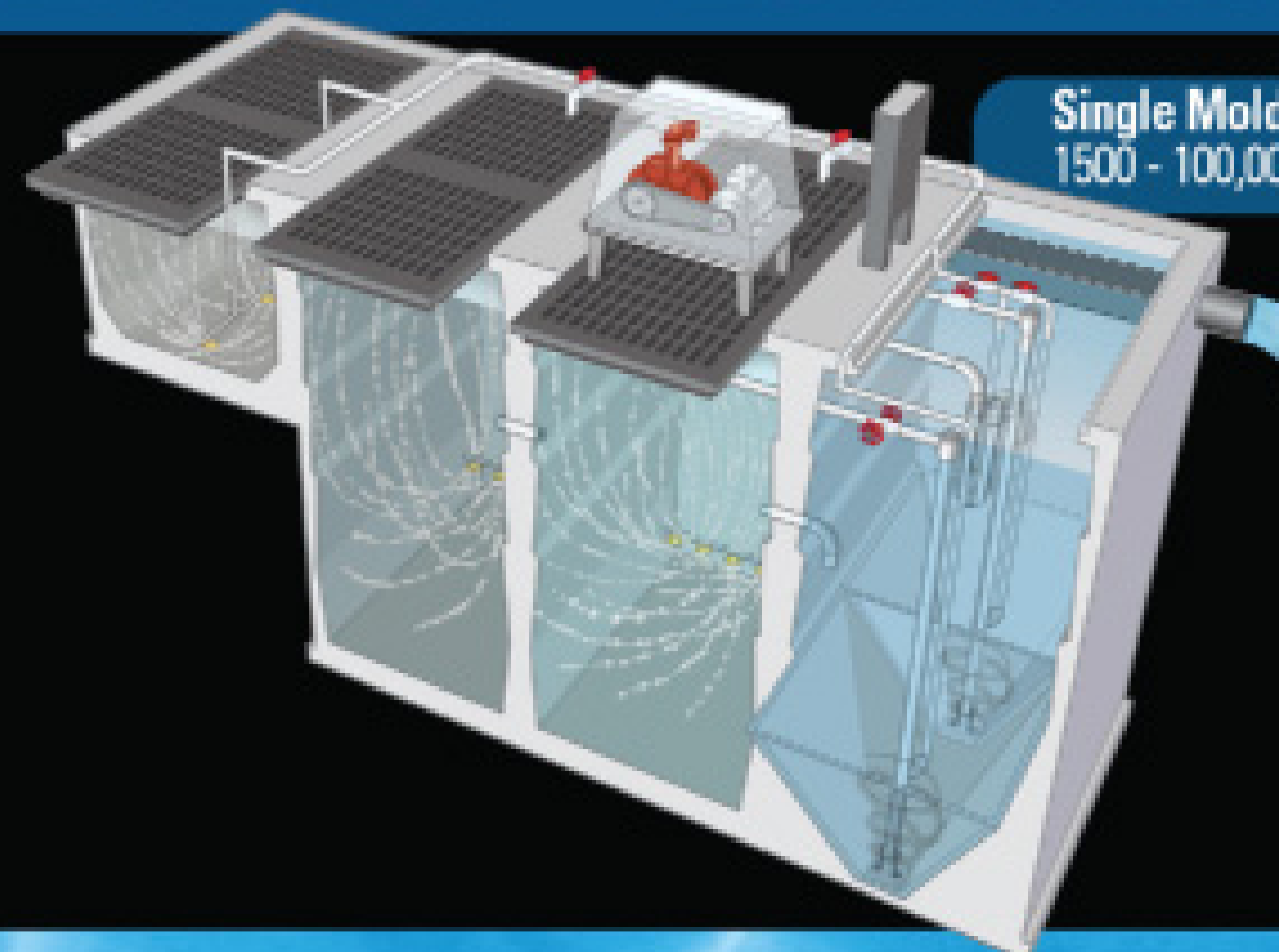
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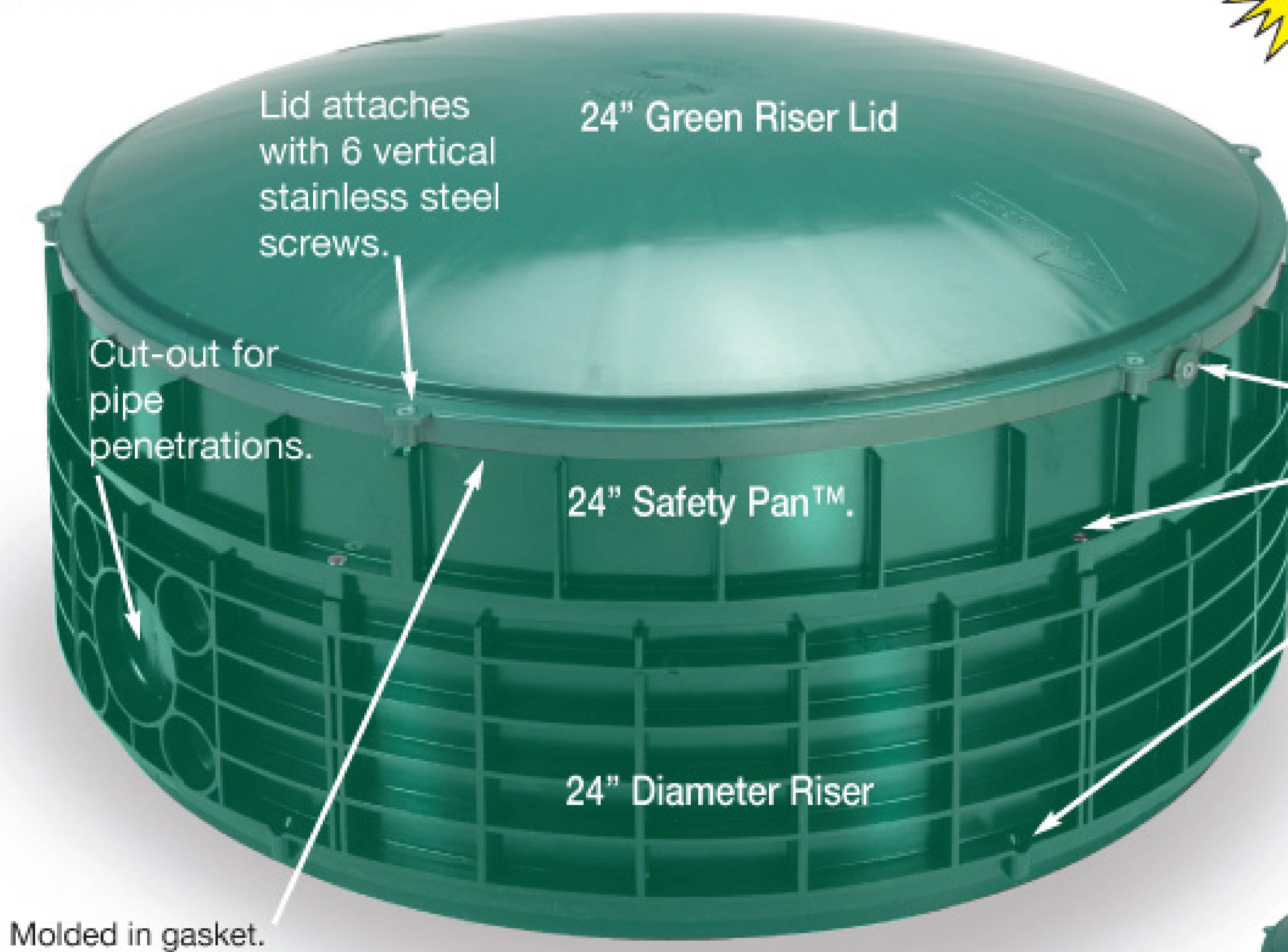


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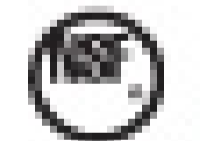
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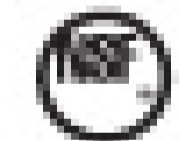


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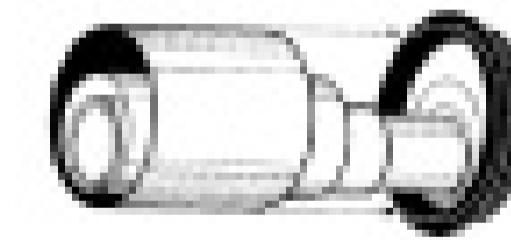
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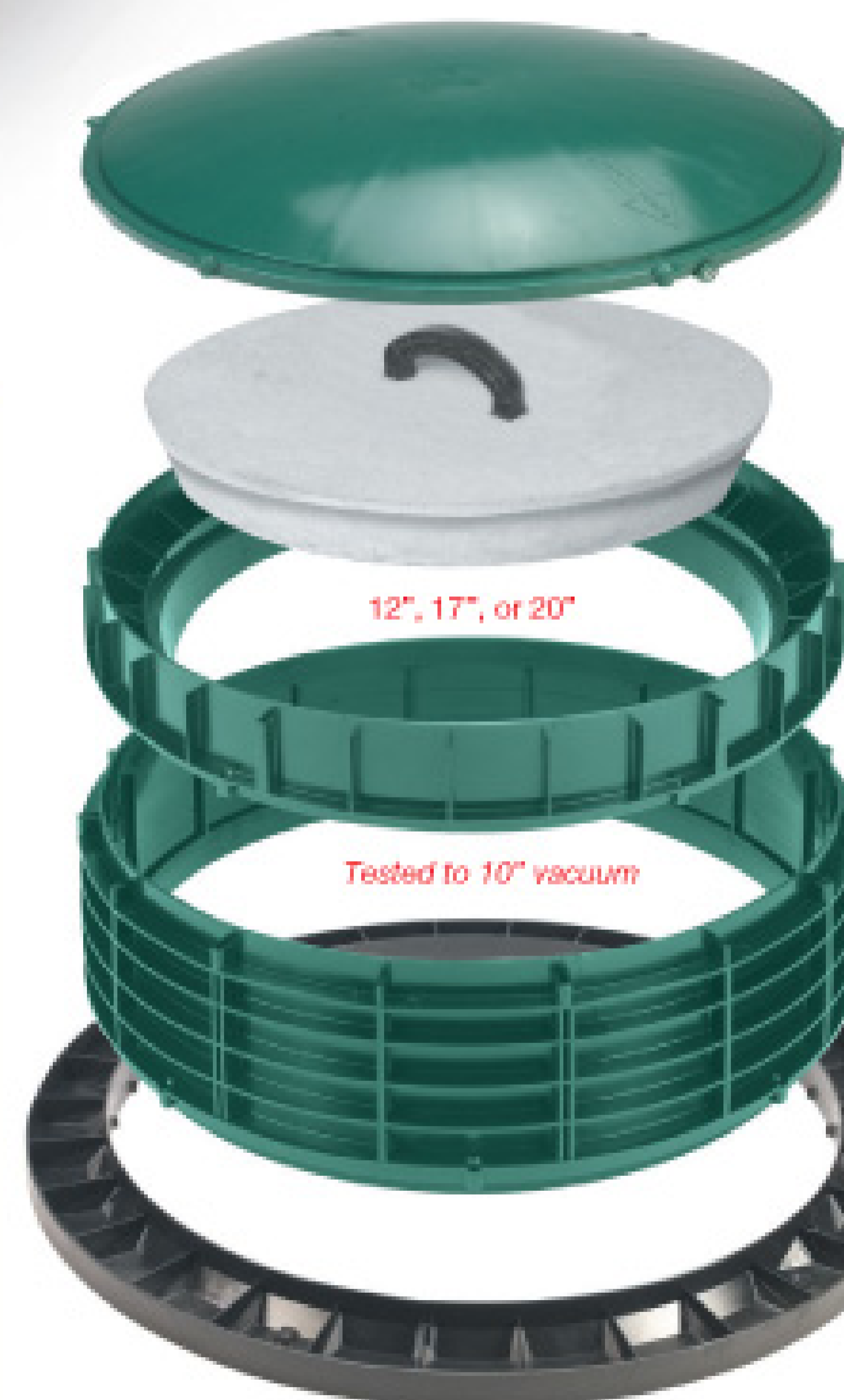


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"Rules and Regs" is a monthly feature in Onsite Installer™. We welcome information about state or local regulations of potential broad interest to onsite contractors. Send ideas to editor@onsiteinstaller.com.

Nebraska Revisits Onsite Regulations

By **Scottie Dayton**

The Nebraska legislature approved an interim study resolution to examine the Onsite Wastewater Treatment System Contractors Certification and System Registration Act, and the general adoption and enforcement of installation standards.

The study, which will make no recommendations, is based on concerns that the Department of Environmental Quality (DEQ) has failed to increase its management of installations, service and repair, and failed to educate the public on the risks associated with hiring contractors who underbid others by not complying with installation standards.

Since most fieldwork is done by the Department of Health and Human Services under a memorandum with the DEQ, the study is considering a greater reliance on HHS field staffing, and the new and expanding local and regional health organizations across the state. The Nebraska On-site Waste Water Association is requesting that those with field experience or program service issues provide information for the study or attend the public hearing. Comments should be directed to Lee Orton, NOWWA executive director, by calling 402/476-0162 or e-mailing lee@h2oboy.net.

On June 21, the Department of Environmental Quality increased system registration fees to \$140 with a \$25 late fee. The legislature passed a bill allowing a separate fee structure for subdivision reviews, an inspector clause for testing and certifying governmental inspectors, and allowing smaller community and county inspectors to start or continue inspecting onsite systems.

Wisconsin

The Wisconsin Department of Commerce is proposing raising fees for onsite plan and product reviews, last updated in 1992. Plan reviews would increase by 50 percent. Sanitary permits would increase from \$116 to \$141, or 22 percent. Onsite product approval fees would increase by 25 percent. The fee for filing a notice to disturb soil would increase from \$25 to \$200.

License application fees would increase from \$10 to \$15, and examination fees from \$20 to \$25. The license, application and certification fees for soil testers would increase from \$25 to \$35, \$50 to \$75, and \$240 to \$300, respectively. The registration fee for maintenance providers would increase from \$60 to \$90. According to the department, the proposed rate hikes would result in 18 percent more revenue, sufficient for four years.

Proposed changes to the plumbing code include allowing the recycling of wastewater discharged from toilets and urinals, expanding grease and oil treatment requirements for restaurants, and expanding the requirement for demand regeneration controls for water treatment devices to those that discharge to municipal sewers.

California

The Water Environment Federation (WEF) filed a friend-of-the-

court brief in the Kern County biosolids litigation supporting three southern California public agencies that are asking the appeals court to maintain a district court judge's ruling that allows their land application programs to continue. The brief documents the scientific, technical and regulatory foundation for the safety of land application. The appellate decision, the first ever on whether bans on biosolids are legal under the U.S. Constitution, could affect such programs in every state.

Oregon

The state Building Codes Division (BCD) is proposing new rules to the Oregon State Plumbing Board that would allow homeowners to install systems that reuse gray water. Current codes allow homeowners to collect and reuse rainwater for inside uses such as flushing toilets. The new rules would help ease concerns about using treated drinking water to flush toilets. Standard reuse systems contain their own filtering and treatment systems. If the BCD proposal succeeds in the legislature, Oregon would join Arizona and New Mexico in adopting standards for reuse of gray water.

Florida

Three proposed bills would continue to research cost-effective methods to reduce nitrogen levels in the state's springs. These include directing the Department of Health to evaluate onsite nitrogen reduction systems and alternative nitrogen reduction media in drainfields; requiring onsite systems installed before 1983 to be pumped and inspected every five years; and creating a grant program of up to \$10,000 per person in the Wekiva basin to aid with any new requirements the department may impose on homeowners. ■

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SECOND OF TWO ARTICLES

Regulator Relations

Working effectively with regulatory agency representatives means developing and sustaining open dialogue and professional respect

By Gary Barnes, REHS

The first of these two regulator relations articles appeared in the August 2008 issue of *Onsite Installer*.

As a contractor, are you at the mercy of regulators? By no means. In fact, you have considerable power to manage reviews and inspections. You can achieve positive outcomes by following a few simple guidelines.

You can take the first step before the regulator sets foot on your jobsite by developing and maintaining contact with the agency. This transforms you from a name signing off on design plans to a real, live professional. It will distinguish you from contractors who do not follow the codes and do not take reasonable care.

You can use your initial contact to judge the supervisor's people skills. Is the regulator flattered by your visit? Annoyed? Somewhere in between?

During your visit, find out what rules, regulations and guidance documents the agency uses as a basis for its work. Ask for copies. If they are not available on the spot, ask how to get them. Most codes and guidance manuals are available over the Internet.

Find out also how plans and installations are evaluated. Checklist? Risk-based? Obtain copies and use them for plan submissions and self-inspection during construction. Your plan submissions will fly through the review process if they address everything the regulator evaluates.

Ask for a yearly summary of the onsite program statistics. Most regulatory agencies are computerized and can provide a listing of systems installed, violations and enforcement actions. If they cannot provide these details, that tells you something about their level of sophistication.

After making the contact, write a short thank you letter to the supervisor. Send your business card and e-mail address.

Open the door

Invite the supervisor to a jobsite or to your home base to provide a consultation inspection. Many agencies do this and will not document observations as deficiencies. Note how the supervisor responds. A good regulator will jump on the invitation as a way to train new staff. Don't be surprised if a few fresh faces arrive for the consultation. Your own crew can observe the inspection process and be introduced to the regulatory staff.

Use terms like collaborate, cooperate and partnership. Ask if the agency provides in-service training and, if so, invite a speaker to address your staff. Many regulators are flattered by such requests. These in-services are often free. Many regulators would rather provide an hour of training than an hour of enforcement inspection. The payoff is that your staff returns to the field armed with knowledge and ownership of the requirements.

Ask to be on the agency mailing list for legislative updates. Use the agency as a resource to track changes in legal requirements.

In all these steps, your goal is to operate out of mutual respect and let the regulator know your efforts are directed toward protecting your customers' health and safety and providing quality installations.

Being proactive

After these introductory meas-

ures, there are several proactive steps you can take. First of all, know the code. Just as you must know the rules of the road before you drive, you must know all relevant onsite codes before you install. This includes your staff.

Regulators cringe when the reply to a verified error is, "I didn't know that was required." Many installers operate across jurisdictions and deal with numerous codes. Maintain a separate file for each jurisdiction and keep each code and all needed forms handy.

At a new jobsite, review all unique requirements with your crew before starting beginning layout and construction. For example, "We're in Jones County, and they require a 12-foot setback of the septic tank from the property line." This can save embarrassing and costly construction mistakes.

Attend every local and state-sponsored training event and code-review meeting. Use the time to network with regulators and fellow contractors. Take as many of your staff as possible to keep them informed and engaged in the process.

Conduct self-inspections as jobs progress. Obtain the regulator's inspection format and require staff to complete frequent quality assurance inspections. By engaging the staff, you create ownership of the installation and acknowledge them as professionals.

Educate your staff. Crewmembers not familiar with the code may overreact to a deficiency pointed out by a regulator. Since you often have several jobs going, your crew

leaders need to be code-competent.

Use the regulatory agency as a consultant and source of information. Call and seek advice, even from the jobsite. Make immediate contact if a severe situation arises. Many regulators will not cite you with a deficiency if you call first and seek consultation.

Network with other contractors inspected by the same agency and compare notes.

Being inspected

Your behavior also can influence the course and outcome of an inspection. You may or may not have notice of an inspection. Some regulators schedule them, and others show up unannounced. The solution is to install so that you can withstand inspection at any time. After all, you should install to standards at least as high as the minimum code.

Plan for times when you or your crew leader must withdraw from the hands-on work to accompany the regulator and verify observations. Good regulators welcome this two-way communication.

Greet the regulator with professional courtesy. If you have introduced yourself properly, you should recognize the inspectors. Don't be offended if the regulator has less-than-perfect people skills. The focus is the installation and the code — not personalities.

Let the regulator know you appreciate the evaluation and verification of your work. Retrieve your quality assurance documentation — it makes a strong statement of reasonable care and installing to design.

Introduce your staff members by name. They deserve to be recognized as professionals and not just stepped around.

If the regulator documents something that doesn't register as a violation, make this request: "When you have time, could you show me where this is in the code? I'd like to share this information with my staff." You not only avoid an argument, you put the burden on the regulator to find the code requirement while allowing him or her to save face. A competent regulator will then provide the requested reference or, if he or she was wrong, apologize.

Taking action

Correct violations right away. If it is in the code and is verified during inspection, it may be documented even if you make corrections before the regulator leaves. This includes issues that may have nothing to do with the overall design or success of the installation. Remember, some regulators have been ordered to "See it, cite it."

Don't expect the regulator to provide solutions. Some agencies instruct inspectors to not prescribe solutions. Don't be offended if you ask for a solution and the reply is, "That's for you to decide." Regulators can lose protection under their agency's liability insurance if they step outside their regulatory role.

Review all issues with the regulator before he or she leaves. Judge the tension level and trust your radar. If the tension is high, take the regulator aside for a private discussion. Review major issues and ask for code clarification on any defi-

ciency statements you do not understand.

If you feel you have been given an improper inspection and cited for irrelevant issues, consider:

- Is this in the code? If so, you may need to take the deficiency and make corrections.
- Where do I want to draw the battle line? What is the outcome for you and your business to have a particular citation on record?
- Do I have any recourse? If you have made positive contact with the regulatory supervisor, you may be able to discuss the issue or ask for an administrative hearing. Check with other contractors inspected by the same party and compare deficiency statements. A letter of complaint or hearing request will carry more weight if it is signed by several contractors.

Not all these tips and suggestions will work in all situations. The contractor-regulator interaction is not always clear-cut and simple. Just remember the question: How do you eat an elephant? And the answer: One bite at a time.

Gary Barnes, a registered environmental health specialist, has more than 30 years of experience in the onsite industry, from installing systems to writing regulations. As a sanitarian, he has conducted site evaluations, plan reviews and installation inspections on hundreds of systems. He now works as a consultant in Arizona helping local agencies establish ordinances and hire and train staff. Reach him at gbarnes6614@msn.com. ■



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The Dope on Diesel

Market conditions and other factors drive up the price of fuel for heavy trucks and equipment. Expect prices to remain high in the foreseeable future.

By Greg Northcutt

Diesel prices have been taxing for onsite installers and anyone else who depends on diesel-powered equipment and trucks. From July 2007 to July 2008, the national average price of diesel fuel in the United States increased 65 percent from \$2.89 to a record \$4.76 per gallon before dropping slightly a week or so later.

And forget the traditional price advantage that diesel once had over gasoline. During midsummer, peak-demand time for many installers, the average retail price of diesel was 66 cents higher than that of regular gasoline.

The reason for the rise in diesel prices comes down to supply and demand. Supplies are limited by diminished refinery capacity and areas of strife in oil-producing regions. And demand is up all over, especially in China and India,

where construction is ramping up and more people are driving cars. And demand for diesel is growing over gasoline because it is the fuel of choice for autos in Europe and elsewhere.

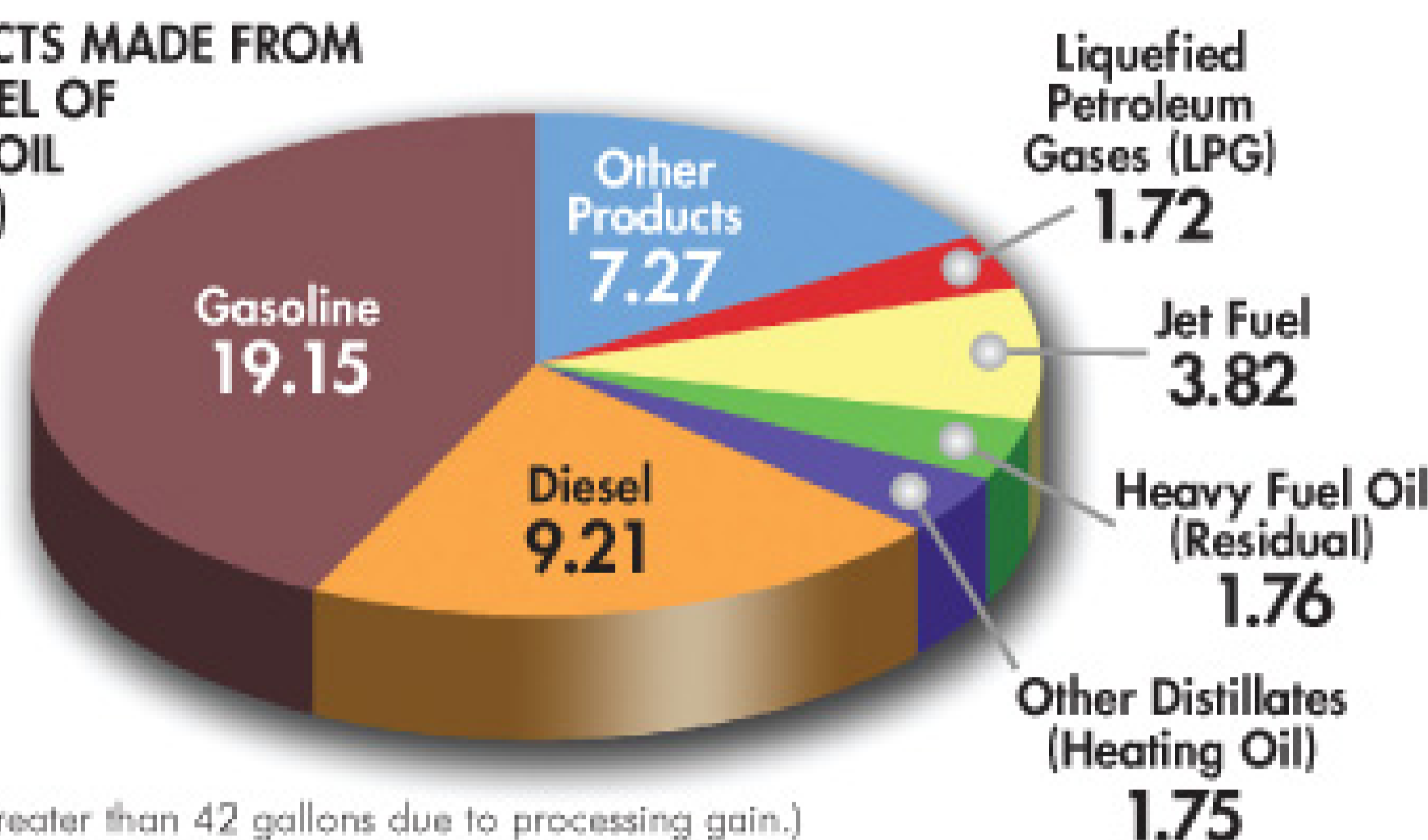
While experts say a little price relief may come, it's not just around the corner. They say fuel prices will probably never drop to where they were a few years ago.

If there is any good news, it is that analysts with the U.S. Department of Energy's Energy Information Administration (EIA) expect the *rate* of increase in diesel prices — which increased about 40 percent during the first half of 2008 — will taper off significantly between now and the end of 2009. But that's barring further changes in crude oil supplies or demands — a big if these days.

A closer look

Supply and demand issues have affected the petroleum industry in general. Lucian Pugliaresi, president of the Energy Policy Research Foundation, said at a May hearing before the U.S. House of Representatives: "Over the last 10 years, the world oil market has clearly experienced an unprecedented number of new and sustained impediments to development. At the same time, global oil demand has grown robustly."

PRODUCTS MADE FROM A BARREL OF CRUDE OIL (gallons)



(Total is greater than 42 gallons due to processing gain.)
Source: Energy Information Administration

Ben Montalbano, a senior research analyst for the foundation, adds, "It's basically a matter of supply and demand forces at work, but the main point to realize is that demand for diesel is being met. There have been no shortages."

Diesel is one of several middle distillates refined from crude oil. The price of No. 2 distillate, the main source of motor diesel fuel in the U.S., is affected by various factors, the largest being the price of crude oil, which accounts for nearly two-thirds of the retail price. "The rule of thumb is that every one-dollar change in the price of crude results in a 2.4-cents-per-gallon change in the price of diesel," says Tancred Lidderdale, a senior economist with the EIA.

Even then, the EIA says, diesel prices on the West Coast tend to be higher and more variable than elsewhere in the country. That reflects

higher state and local taxes and relatively few refineries, which can lead to tight supplies and higher prices, if more than one experiences operating problems. In addition, transportation costs increase with long distances from refineries in other countries and from the Gulf Coast, source of nearly half the diesel produced in the U.S.

The price of crude oil, in turn, is affected by a number of other factors.

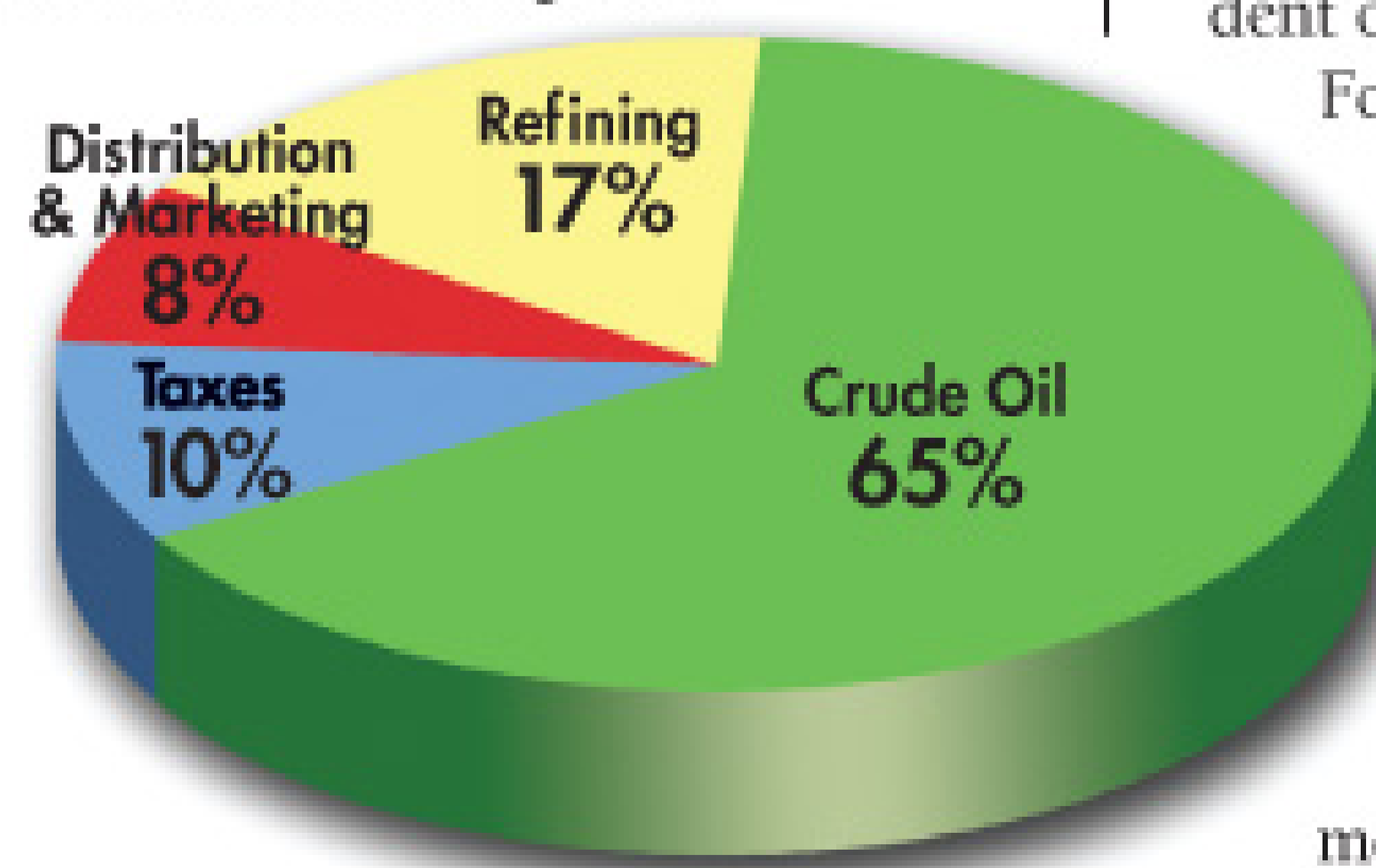
Growing demand

World oil consumption continues to grow despite seven consecutive years of increasing prices, the EIA reports. Rising incomes in many areas of the world, including India and China, have increased the demand for diesel significantly. In fact, most other countries rely more heavily on diesel fuel than the U.S. does.

"There's been a huge worldwide

WHAT WE PAY FOR IN A GALLON OF DIESEL FUEL

(June 2008)
Retail Price: \$4.68/gallon



Source: Energy Information Administration

Innovation on the Way

Biodiesel and hybrid drive trains for trucks and construction equipment offer some long-term promise to help equipment users deal with diesel fuel prices.

Most biodiesel is made from soybean oil, although it can be produced from other oil crops, animal fats, recycled cooking oils and trap greases.

"Biodiesel is one of the best-tested alternative fuels and the only alternative fuel to meet all the testing requirements of the Clean Air Act," says Amber Pearson, with the Biodiesel Board. "Biodiesel can be operated in any diesel engine with little or no modification to the engine or the fuel system."

Biodiesel is typically blended with petroleum diesel fuel at concentrations up to 20 percent (B20). Nearly all U.S. engine makers accept at least B5. Case, Cummins, Caterpillar and John Deere have approved B20 or higher in some or all engines, Pearson notes. New Holland supports B100 in all equipment with New Holland-manufactured diesel engines, including electronic injection engines with common rail technology.

"Thanks to the June approval of biodiesel blend levels by the standard-setting organization ASTM International, engine makers will be more receptive to adding to their warranty statements higher blend levels of biodiesel, like B20," Pearson says. Biodiesel is also helping to keep a lid on petroleum prices. "Earlier this year, a commodity strategist with Merrill Lynch estimated that oil and gasoline prices would be about 15 percent higher if producers of biodiesel and other biofuels were not increasing their output," Pearson says.

In January, Mack Trucks demonstrated the use of hybrid technology in a 64,000-pound truck. Hybrid drive systems convert braking energy into electrical power, which then supplements engine power, saving on fuel.

"This project has persuaded us that hybrid systems can have a major impact on reducing the more than 38 billion gallons of diesel fuel the U.S. trucking industry consumes every year, but only if our industry and government apply creative thinking to the commercialization of this technology," says Paul Vikner, Mack president and CEO. "Our research indicates that hybrid electric systems in heavy-duty trucks could save as much as 35 percent of the fuel consumed by conventional vehicles."

Meanwhile, diesel fuel-saving hybrid vehicles are starting to show up in construction equipment. For example, New Holland Construction, in cooperation with Kobelco Construction Machinery America Co. Ltd., has developed a prototype hybrid 7-ton hydraulic excavator. Last March, Volvo unveiled a prototype of its L220F Hybrid wheel loader. Two months later, Komatsu introduced the PC200-9 Hybrid excavator to the Japanese market.

increase in oil demand, particularly in developing countries," says Tavio Headley, staff economist with the American Trucking Associations.

Demand is also being driven by other factors, Headley reports. China, for example, stockpiled diesel to power backup generators to provide electricity for the summer Olympic Games in case of power grid problems. The country also has been using diesel fuel to power equipment for repairing damage in the Sichuan province caused by an earthquake in May.

Government subsidies for gaso-

line and diesel have also pushed up demand for crude oil. "These fuels are heavily subsidized in many countries," says Montalbano. "In Venezuela, motorists are paying 12 cents a gallon for gasoline. In a lot of the oil-exporting countries in the Middle East, the pump price for gasoline is about 40 to 50 cents per gallon."

Tight supplies

The oil market remains tight, as shown by rising prices, low surplus production capacity, and concern that global supply growth may not

keep pace with demand growth, at least in the short run. Two years ago, the U.S. consumed 20.7 million barrels of petroleum products per day, 60 percent imported. Almost half the imports came from the Western Hemisphere.

Today the EIA estimates the world supply of crude oil at 86.5 million barrels per day. "The market these days is calling for just about all of that supply immediately," says Montalbano. What's more, he

partially because Middle Eastern demand for crude has risen quickly," he says.

Risks to production

The price of diesel is also tied to the actual and perceived risks of a reduction in supplies of crude or refined oil. Those risks range from war and weather-related threats at production and transportation facilities to government policies affecting development of oil

"It's basically a matter of supply and demand forces at work, but the main point to realize is that demand for diesel is being met. There have been no shortages."

Ben Montalbano / Energy Policy Research Foundation

notes, world oil supplies are about 2.5 to 4.5 million barrels per day less than predicted at the beginning of this decade. Montalbano attributes that to a variety of factors, including:

- Attacks by rebels on Nigeria's oil infrastructure.
- Fighting in Sudan, which has slowed development of new production in many oilfields.
- Declining oil production in Argentina since the country's oil sector was nationalized in 2004.
- Forced renegotiation of contracts with foreign oil companies by Kazakhstan, which could hinder investment in oil production in that country.
- Declining oil production since 2004 in Mexico, where lack of funding for the country's state-owned oil monopoly, Pemex, prevents exploration and development of new fields.

"The refining capacity for diesel and other middle distillates is just about maxed out," says Montalbano. "There will be significant new capacity in the next two years, which might, depending on crude oil prices, ease the refining burden."

In 2002, OPEC-member countries had an excess oil-pumping capacity of 5.8 million barrels per day. That has fallen to about 2 million, says Montalbano. "Saudi Arabia has increased production twice in the past few months, and fuel prices still continued to go up,

resources. The higher the risks, the more money oil investors and buyers demand.

"These risk premiums are more of a factor than they were several years ago," Headley notes. In fact, risk factors conspired around midyear to cause crude oil prices to swing wildly. Over a three-day period in July, oil spiked 8 percent from \$136 per barrel to a record \$147. The reasons included fears of possible disruptions in supplies caused by tensions between the U.S. and Iran, the threat of a strike in Brazil, and another drop in the value of the U.S. dollar against other major currencies. Five trading days later, crude had fallen by almost 11 percent to \$131, the biggest one-week drop ever, as fears subsided.

Cleaner-burning fuels

The phase-in of U.S. EPA standards to reduce sulfur content in diesel fuel helped pressure diesel prices upward, according to the EIA. These standards require all on-highway diesel fuel sold in the U.S. to be ultra-low-sulfur diesel (ULSD) by Dec. 1, 2010.

Phasing in of clean-fuel requirements for off-highway began last year. Nearly all diesel fuel used in the U.S. must be ULSD by the end of 2014. In the meantime, the costs of preventing or correcting any contamination of ULSD with higher-sulfur diesel, and the higher costs of producing ULSD, could continue to influence prices, the EIA reports.

Market speculators

Rising crude oil prices have prompted calls in the U.S. Congress for closer scrutiny of trading in oil futures contracts and for limiting the role of speculators. Critics charge that speculators are manipulating oil prices. As the value of the U.S. dollar has fallen, says Headley, investors have been buying petroleum futures contracts as a hedge against inflation. "The big question is how much this is

\$140 per barrel in the fourth quarter before declining to \$127 by the fourth quarter of 2009.

Analysts expected a similar trend in the refinery price of diesel fuel, rising from \$3.67 per gallon in the second quarter to \$4.01 in the fourth quarter, then falling to \$3.53 by the fourth quarter of 2009.

In their July 2008 *Short-Term Energy Outlook*, the analysts reported, "WTI prices, which averaged \$72 per barrel in 2007, are projected to

"We don't see the global forces pushing up oil prices over the past four years letting up immediately. ... There's always a certain degree of uncertainty in the world oil market. So many things can happen to prove us wrong."

Tancred Lidderdale / Energy Information Administration

contributing to the run-up in crude oil prices," he says. "The federal Commodity Futures Trading Commission is looking into the matter."

Diesel overtakes gasoline

Historically, the pump price for diesel has been lower than that of regular gasoline, except during some winters when demand for heating oil was high. However, since fall 2004, diesel prices have generally been higher than gasoline prices. One reason is an increase in federal tax on diesel fuel. Another is increasing global demand.

European countries, for example, have used taxes to encourage use of cleaner-burning diesel over gasoline. This has resulted in excess production of gasoline in that part of the world, notes Montalbano. "When you refine crude oil into diesel, you also produce a certain amount of gasoline," he says. "There's not enough demand in Europe for all this gasoline, so they export it to the U.S. Those imports have helped keep gasoline prices in the U.S. from rising as much as they would have otherwise."

No sudden price decreases

By late summer, there were signs of moderation in diesel fuel prices. In July, EIA analysts projected the rate of increase in the spot price of West Texas Intermediate (WTI) crude oil to moderate, peaking at

average \$127 per barrel in 2008 and \$133 per barrel in 2009. Diesel fuel retail prices in 2008 are projected to average \$4.35 per gallon, up from \$2.88 per gallon last year, and increase to an average of \$4.48 per gallon in 2009."

EIA's Lidderdale observes, "We don't see the global forces pushing up oil prices over the past four years letting up immediately." The higher prices reflect demand for diesel, particularly in emerging markets, which has significantly increased the margins between diesel prices and crude oil costs from those of last year, the analysts noted.

Lidderdale attributes the slowing price increases through the rest of this year and into early next year to increased production in the U.S. as two oil platforms in the Gulf of Mexico come on line, and to new production in Brazil and the Siberian region of Russia.

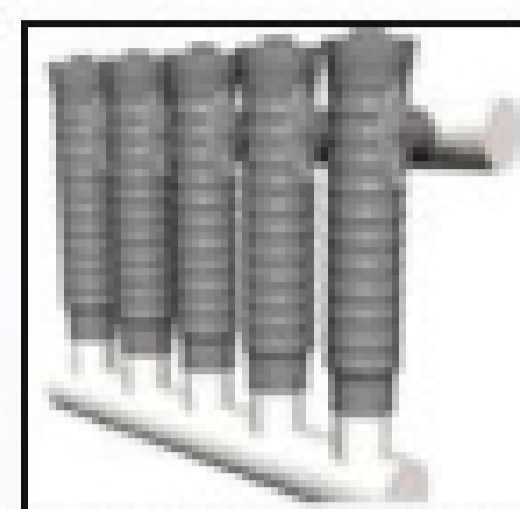
However, he advises caution. "There's always a certain degree of uncertainty in the world oil market," he says. "So many things can happen to prove us wrong."

Greg Northcutt is a freelance writer based in Port Orchard, Wash. He can be reached by e-mailing this publication at editor@onsiteinstaller.com. ■

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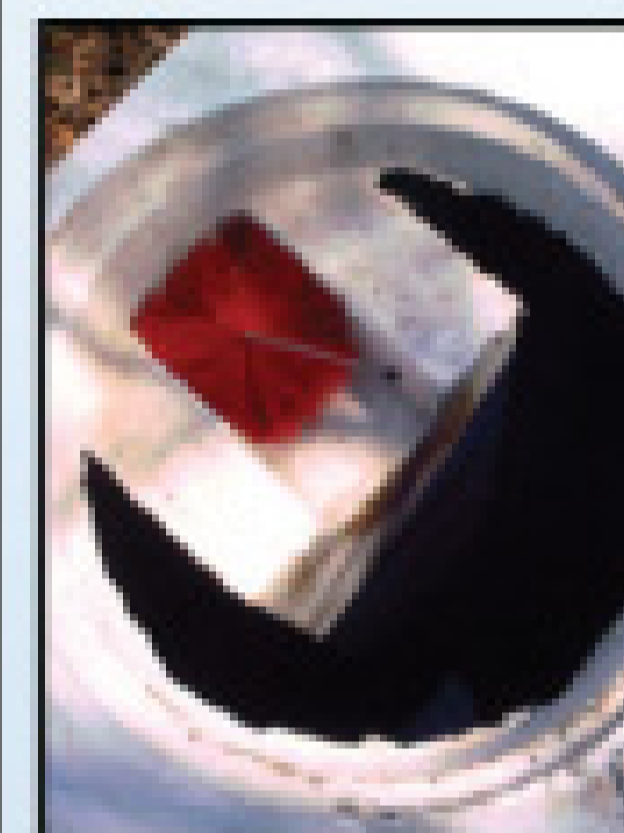


US Patent# 5,885,452
CAN Patent# 2,237,751

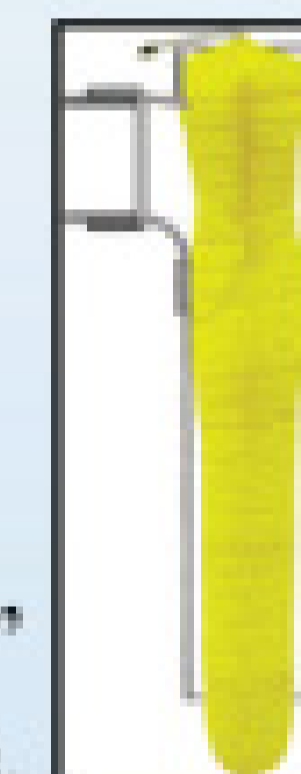


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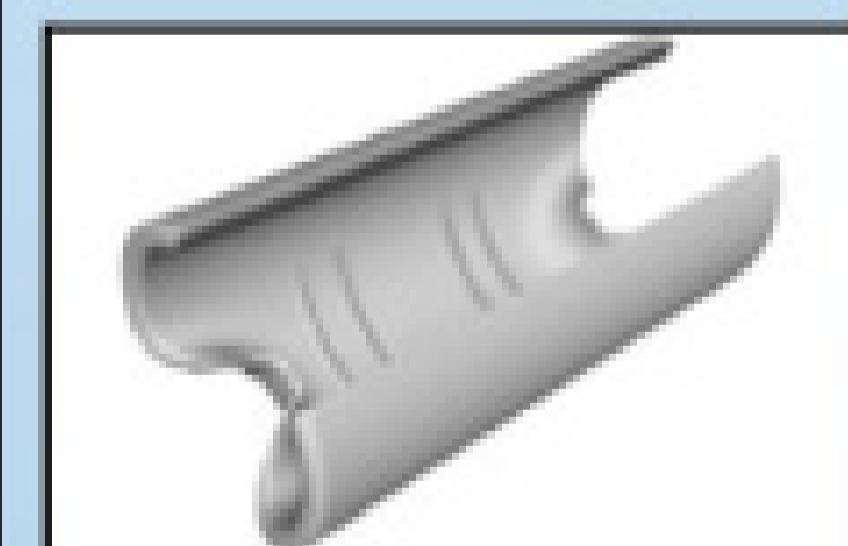
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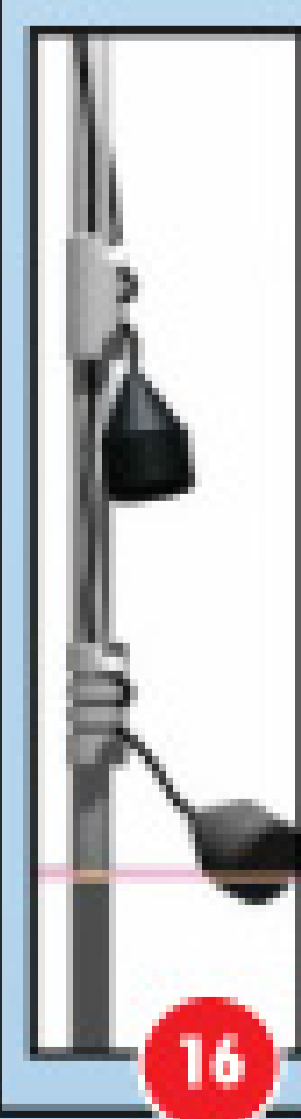
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Vern Jakoubek helps father and company co-owner Lloyd Jakoubek install a septic system. Lloyd is shown operating a 2002 John Deere 310SG backhoe. (Photography by William Lauer)

Simply Quality

Lloyd and Terri Jakoubek bring a professional and personal touch to designing and building onsite systems for upscale homeowners in Nebraska

By Gil Longwell

Raymond Contracting Inc., Raymond, Neb.

OWNERS: Terri and Lloyd Jakoubek

YEARS IN BUSINESS: 8

MARKET AREA: 60-mile radius

ANNUAL REVENUE: \$500,000

BUSINESS MIX:
80% installations,
20% inspection and repair

EMPLOYEES: 4

AFFILIATIONS: NOWRA,
NOWWA



Raymond Contracting installs mostly simple onsite systems — conventional systems and treatment lagoons. But that doesn't mean the company cuts corners on quality.

"We are in fierce competition with Johnny Lowdollar," says Lloyd Jakoubek, who with wife Terri owns the company, based in Raymond, Neb. "Our customers want and are willing to pay for the focused experience and skills we bring to the jobsite, and that is what sets us apart."

Jakoubek started in the onsite industry in 1976, Terri joined him in 1997, and they have been comfortable in the field ever since. Raymond Contracting is located in a developing area of Lancaster County, about 15 miles northwest of Lincoln.

The couple started the business

in 2000. "When we were looking at various business opportunities, we did a cost analysis on various pieces of equipment and found that a backhoe was the least expensive and had the highest rate of return," Jakoubek says. They immediately focused on onsite installation.

costs more than \$200,000 and some are in the \$1 million range. "People who put that much into a house don't want substandard systems or the problems they bring," Lloyd says. "They want to be educated and are a lot easier to work with."

Last year, based on the number

"While customers are screening us, we are screening them. We use a checklist to interview prospective customers."

Lloyd Jakoubek

They work in a 60-mile radius, and about 80 percent of their work is installation of new and replacement systems. As the job requires, Raymond Contracting can field one or more state-credentialed site evaluators, perc testers, system designers or system inspectors.

A typical customer's new home

of permitted installations, Raymond Contracting was the largest onsite installer in Lancaster County and the second largest in Nebraska.

Collaborating with customers

For a customer, selecting Raymond Contracting for a project is more than just hiring an installer.



Lloyd Jakoubek prepares laterals during a septic system installation.

In the initial contact, the Jakoubeks evaluate the customer and his or her understanding of the situation. "While customers are screening us, we are screening them," he says. "We use a checklist to interview prospective customers."

The checklist gathers information about the site and the existing or proposed home. During this conversation, the Jakoubeks learn a lot about the landowner's knowledge and understanding of onsite systems.

Sometimes, soil conditions will satisfy state permit requirements for a conventional system, but the Jakoubeks' experience with those soils tells them conventional is not the right choice. Recently, a landowner insisted on an in-ground system rather than the lagoon system Lloyd and Terri both proposed. Although both systems met the regulations, they turned down the project, rather than risk harm to the company's reputation.

The Jakoubeks like to be the first contractors on a site. Walking the site with the landowner lets them offer ideas on the site development plan. Lloyd points out the areas best suited for the onsite system, the house and other improvements. "Before we move any equipment to the site, we have been there as many as six times, consulting with the landowner, the homebuilder, the plumber and the general excavating contractor," he says.

Raymond Contracting spends a lot of time educating customers. "Our primary customer is the homeowner," Terri Jakoubek says. "Over the years, homeowners have learned to be better listeners. The



Lloyd Jakoubek assembles pipe during a system repair with son and assistant Vern Jakoubek.

primary onsite system site-evaluation tool is the perc test, and in some soils the soil profile is also a factor in site-suitability determinations."

The Jakoubeks counsel and advise their clients, helping them to understand the relationship between their lifestyle and the demands it will place on the system. This is in addition to the regulations that cover system sizing, which in their county is based on the number of bedrooms and the perc rate.

"Plan for expansion" is a standard message that Lloyd delivers while helping to select the system location. Terri perc tests an area large enough to accommodate a doubling of the minimum absorption area. In their designs, treatment tanks are often specified with at least 25 percent reserve capacity. "I am known as the Perc Test

Queen," Terri laughs.

She has developed a standard procedure for perc testing. "You can't just drill a hole and pour water in it," she says. "Poor techniques and procedures can jeopardize a site. Sloppy procedures yield unreliable results." Perc tests conducted at different depths give a good understanding of soil permeability. Often, Terri conducts the initial test at three depths to find the optimum conditions. After evaluating those results, she tests more holes at the preferred depth.

System alternatives

Soils in the area are such that the Jakoubeks see few advanced treatment systems, locally called "engineered systems." Raymond Contracting has installed just three of these systems. "Our soils are either

Building Relationships

Having a booth at home shows makes Raymond Contracting approachable in different ways. In this neutral environment, a future landowner with a dream or a landowner with a problem can get his or her onsite system questions answered. "We meet homeowners, buyers and builders at these shows," says co-owner Terri Jakoubek.

"An exhibit booth has an invisible sign that says, 'Ask me your septic system questions,' drawing people into face-to-face conversations where relationships can begin," she adds. "When a friend tells you about their positive experience, you are more inclined to pay attention."

Word-of-mouth is another kind of relationship building. Yellow Pages ads are important, too. Connecting with customers through ads in school newsletters, sports calendars and event program booklets sends the message that Raymond Contracting is part of the community.

deep and well-drained and support conventional in-ground systems, or they are heavy clay," Lloyd says. In the latter case, sewage lagoons are the system of choice.

"The county's minimum lot size of 3 acres generally enables us to find a suitable site for either of these systems," Lloyd notes. When local relief requires, conventional systems include a lift pump that moves the effluent upslope to the gravity distribution system. Lloyd and Terri use Quick 4 chambers from Infiltrator Systems Inc. Conventional system sites must have a perc rate of five to 60 minutes per inch. Engineered systems are required for perc rates faster than five minutes or slower than 60 minutes per inch.

In a typical year, 25 to 30 percent of Raymond Contracting's new systems are sewage lagoons. These are passive systems, and when

there is no need for an effluent lift pump, there are no mechanical components. There is no treatment tank, either. Everything that reaches the building sewer is delivered to the lagoon, which is designed and sized to allow passive natural oxygenation, evaporation and bio-microbial digestion complete the entire treatment process.

Lagoons are always rectangular; a lagoon for a three-bedroom home is at least 53 feet square (2,809 square feet). Each additional bedroom requires another 1,269 square feet. These systems have a nominal operating depth of 24 inches with a reserve freeboard of

ers develop an appreciation for that technology, and their aversion diminishes," Lloyd says.

Focused resources

For work in the field, Raymond Contracting has selected equipment well suited to the limited range of systems the company installs, and with an eye on the cost-benefit ratio. Four machines satisfy the needs of the four employees.

The roster includes a 2002 John Deere 3105G backhoe, a 1992 Ditch Witch 4500 trencher, a 1987 International S series tandem dump truck, and a 1985 GMC C2500 with a hydraulic auger. "Terri uses

Neuman are part of the team.

"Septic systems are what we are all about, and part of our message is one of environmental stewardship," says Terri. Raymond Contracting is a member of the Lincoln and National Home Builders Associations, NOWRA and its affiliate the Nebraska On-site Waste Water Association (NOWWA). These connections bring the company education and business ideas. A Better Business Bureau membership sends a message of reliability. The company exhibits at local home shows.

Lloyd usually takes the lead on the sales team, and he and Terri prefer face-to-face customer contacts. About 50 percent of their telephone contacts mature into contracts; that jumps to 80 percent when the contact starts with an in-person encounter. Lloyd observes that Terri's strengths include making septic systems understandable to women. In its education and sales outreach, the company uses the materials provided by the Cooperative Extension Service at Nebraska State University.

Inspection mandate

When not marketing or installing systems, Raymond Contracting benefits from a new county requirement that all onsite systems be inspected at real estate transfer. Lloyd



The Jakoubeks prepare a septic tank for installation.

is a county-approved system inspector.

Raymond Contracting does about two dozen inspections a year, and 40 percent identify problems that require repair or replacement. "Our job is to document what is in the ground," says Lloyd. "The county health department reviews our report and issues its conclusions."

During inspections, every tank is opened and the liquid level is checked. Pump-out is not required. The setbacks from features such as wells, buildings, property lines and streams are recorded. A system that discharges to the surface is considered unsatisfactory and requires repair.

Lloyd expects demand for inspection to grow as houses turn over more frequently. "That is good news during times like this, when new home construction is falling and there are fewer construction-driven new installations," he says.

Last year, about 20 percent of the firm's business was related to inspections and repairs. A high percentage of malfunctions can be tracked to running toilets. "At a house that had been vacant for several months, we found an ongoing surface malfunction," he says. "We discovered a leaking toilet was the cause."

In system repairs, replacements and new installations alike, the company's goal is to create systems that properly treat wastewater and protect groundwater and the environment. The Jakoubeks emphasize that they build relationships with customers. Terri observes, "We are in this for the long haul." ■

"You can't just drill a hole and pour water in it. Poor techniques and procedures can jeopardize a site. Sloppy procedures yield unreliable results."

Terri Jakoubek

an additional 24 inches.

Raymond Contracting refers all such work to a preferred provider. Lagoons need minimal pumping — solids are removed about every 30 years. "These systems are popular for their lack of maintenance and their simplicity of operation," Lloyd says. "They are also about half the cost of a conventional septic system."

When designing lagoons, Lloyd encourages owners to build reserve capacity. The downsides to a lagoon system are aesthetic. "When a lagoon is the only option, landown-

ers develop an appreciation for that technology, and their aversion diminishes," chuckles Lloyd. The company also owns a 2005 Ford E350 utility van and a 2007 Ford F350 pickup.

The division of labor is straightforward. Terri and Lloyd are state-certified site evaluators, system designers and installers, and Lloyd is the equipment operator. Terri is the office manager. In the field, their son Vern Jakoubek and Ted



Company co-owner Terri Jakoubek records water levels during a perc test. The device on the back of the truck is a hydraulic auger used for drilling the test holes.



MORE INFO:

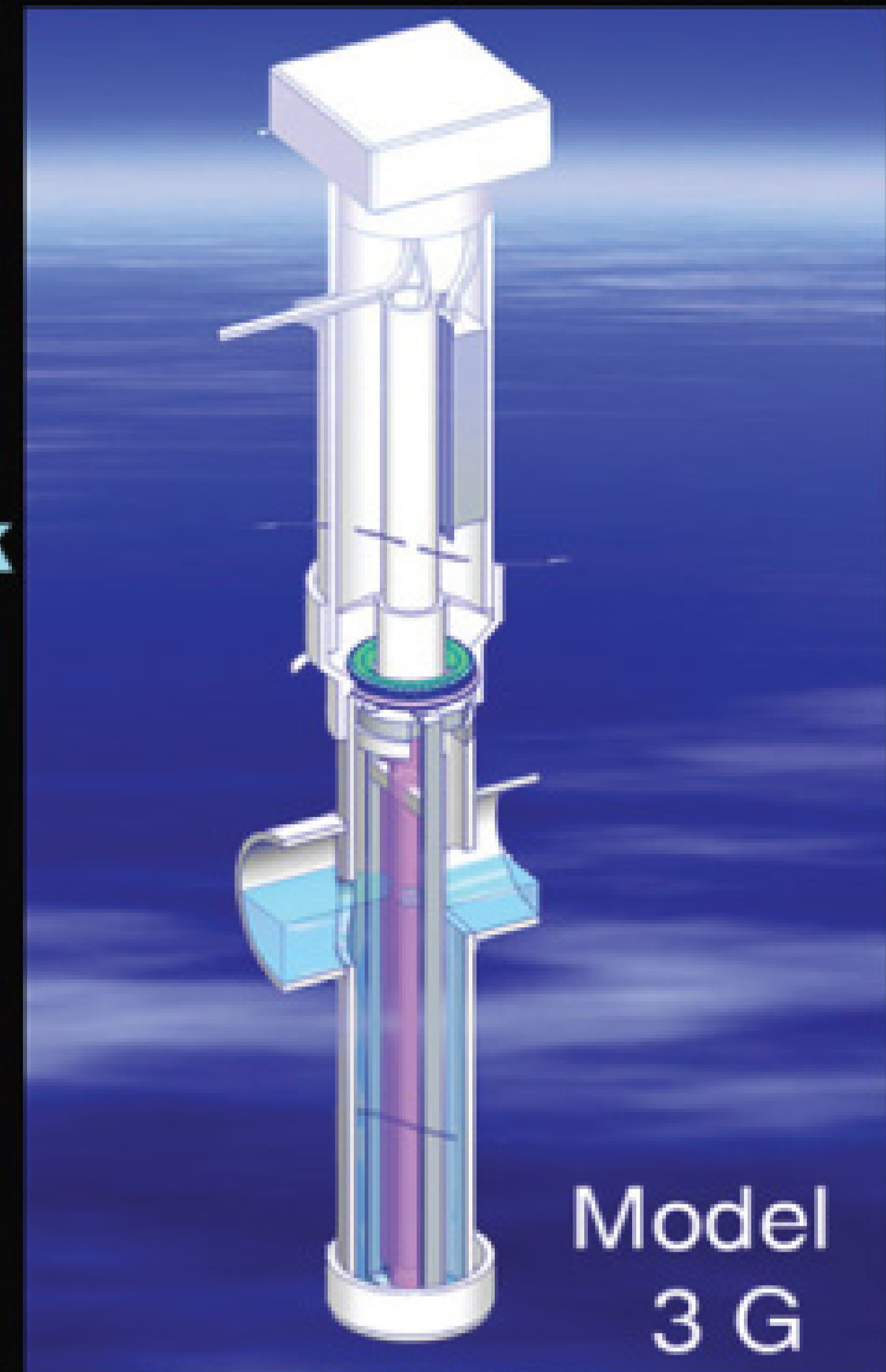
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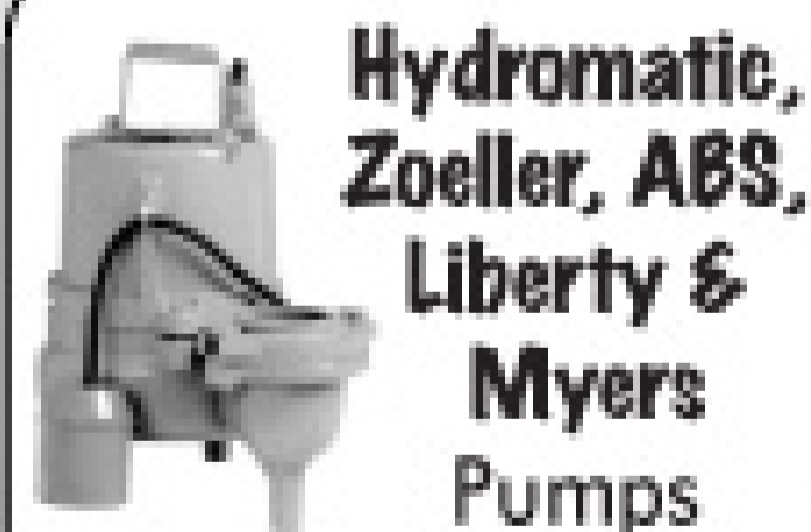
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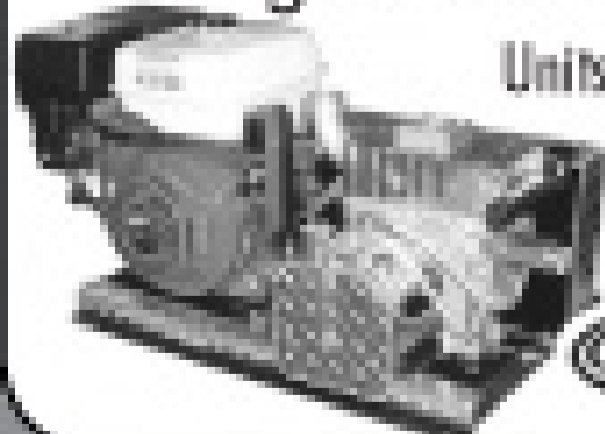
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Going Small?

Installers discuss downsizing equipment because of rising diesel costs and the use of rubber-tired equipment

Question:

I am doing my year-end review and looking at some of my expenses. The big jump in fuel makes me wonder if I might be better off selling my big equipment and downsizing everything. I do new systems (ATUs, sand mounds and conventional stone and pipe) and a lot of repairs. I do most of it with a full-size rubber-tired backhoe, which I pull with a tandem dump truck.

I spend a few thousand every year renting or hiring small equipment. It has always worked well for me, but I know that doing the same work with something I can pull behind a pickup truck wouldn't take a whole lot longer, and I would probably burn way less fuel and spend less on maintenance. So I'm wondering how many installers use big equipment, and how many use small equipment. Any thoughts?

Answers:

I install mounds and at-grades, and I use a rubber-tired backhoe

with a skid-steer. I use the backhoe for plowing and digging and put everything else on the skid-steer with over-the-tire tracks.

The skid-steer costs more per hour than the rubber-tired machine. It uses 2.4 to 3.5 gallons per hour if I use it hard. It takes too long digging tank holes with a small machine. It depends on what type of soil you're digging. I have used small excavators in hard clay and added days to the job.

I would not use rubber-tired equipment for any backfilling or movement of material on the septic area. The health department inspector talks about soil compaction with tires. When I used the skid-steer without tracks, they complained some, but they would let a guy use a 973 Cat crawler and compare the two.

I use a rubber-tired backhoe to install and repair, and a track skid-steer to backfill. I have yet to figure out how you dig a level trench (side to side) with a mini-excavator on a sloping site.

I think it's only a matter of time and no rubber-tired machines will be allowed to install septic systems. Ohio put this regulation on hold, but I think it will apply in another year or so. They don't think we are smart enough not to drive over the trenches and compact the soil.

I'm not sure what rules the previous poster is referring to, but the Ohio rules rescinded in June 2007 did not say anything about the use of rubber tires, nor have I heard any discussion about their use being banned in any of the rules discussions. (Posted by an Ohio registered sanitarian)

Regulators know that some equipment owners simply do not know better than to drive over trenches. This knowledge is in part why regulators regulate. Regulators and professional installers also know that regulations will not stop inappropriate activities.

Every day, a few new people get into the installation business. Many know how to operate a machine, but not how to protect a site or install a system in the most benign manner. Many people in this business do not voluntarily attend training.

Presumably, almost all in this business are aware of the regulations they are expected to follow, and a large number no doubt follow them without an appreciation of why they exist. Hopefully, they learn to do it correctly while they comply.

In my area of southern Ontario, the ground conditions change dramatically from heavy clay to sand. Over the past few years, we have just about eliminated

rubber-tired machines. On large systems with lots of room, we use our Cat 320 excavator. We level most of the imported fill with this. We have a 14-foot blade on a quick-attach coupler, so very little compaction is done.

Last year we purchased a new Cat 305 excavator for the small sites, but we needed something to carry material. We had to purchase a Cat 257 skid-steer on rubber tracks. We tried to rent when needed, but it really did not work out. You could never get a machine when you needed it.

This year we purchased a 7-foot, six-way blade for the skid-steer, so we are seeing if that works. In my opinion, the smaller machines are the way to go. But we have larger machines to fall back on.

I'm in Illinois. I agree installers need certification or training before they go nuts on a backhoe. I have had inspectors bring a new installer or inspector on my job to train on installation. It's a lot different from reading a book and hands-on training. It should be done like the plumber's license.

There are a lot of judgment calls made by an installer that fall back on experience. I'm no expert, and anyone can make a mistake, but I have a problem with seeing the same mistake made over and over. If I see or hear about something an inspector is not catching, I let him or her know where to look and what to look for.

There are a lot of people installing in my area who are not in the septic business and just got a license to save money on building a house or to give a package deal on excavating work on jobs. ■

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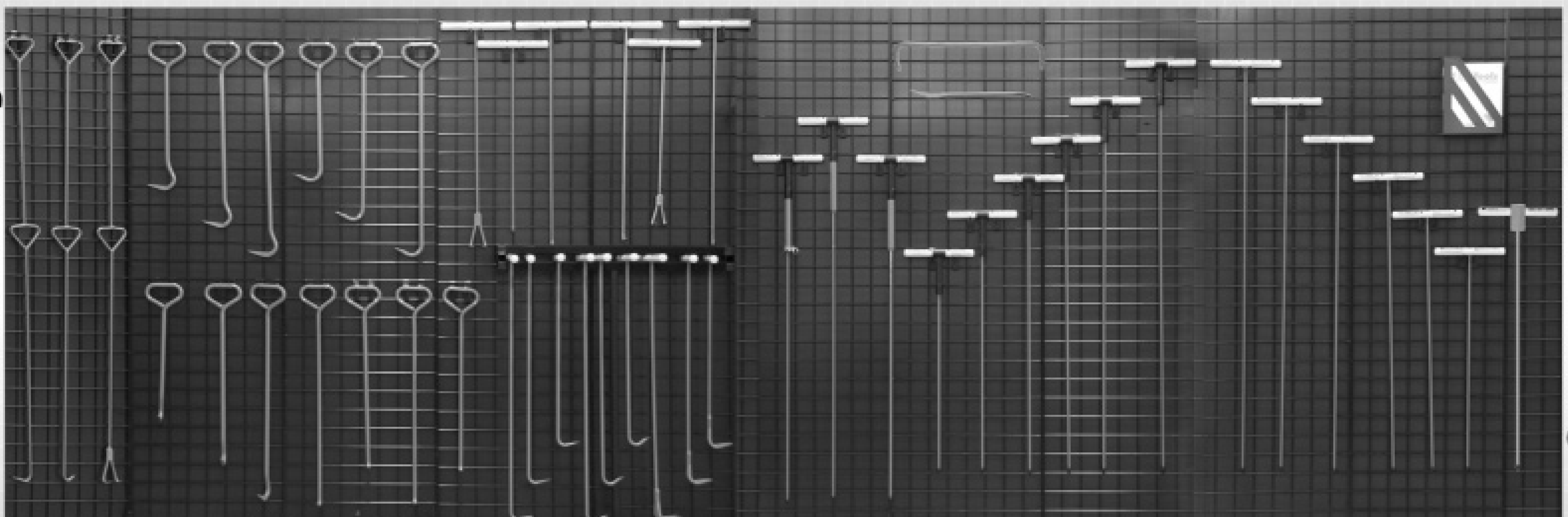


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Simple Solutions Selects Distributors

Simple Solutions LLC, makers of the Wolverine brand of activated carbon filters, has added new distributors Carleton Environmental Services, Richmond, Ontario; Missouri Water and Wastewater Products, Camdenton, Mo.; and YTG, Yemen Technical Group, Sana'a, Haddah, Yemen.

Pump Systems Releases Guidebook

Optimizing Pumping Systems: A Guide to Improved Efficiency, Reliability, and Profitability from Pump Systems Matter and the Hydraulic Institute is a 250-page reference based on the collaborative efforts of 22 industry experts. The book includes graphics, illustrations and reference tables covering a range of topics, including pump fundamentals, pump and system interaction, calculating cost of ownership, improving the performance of existing pump systems, optimizing new designs and pumping system economics. For more information, call 973/267-9700 or visit www.pumps.org.

Infiltrator Adds ENGEL Injection-Molding Machine

Infiltrator Systems Inc. has installed the first of two ENGEL duo 45050/4400 robotic injection-molding machines at its Winchester, Ky., manufacturing plant. The new machines will enable Infiltrator to greatly

increase its manufacturing capacity, replacing the production output of three older platen presses. The duo line includes 10 machine sizes, all with high-speed cylinders to help reduce cycle time. The company also operates several other ENGEL duo machines at its Kentucky and Utah facilities, including 720-ton, 1,250-ton and 1,900-ton units.

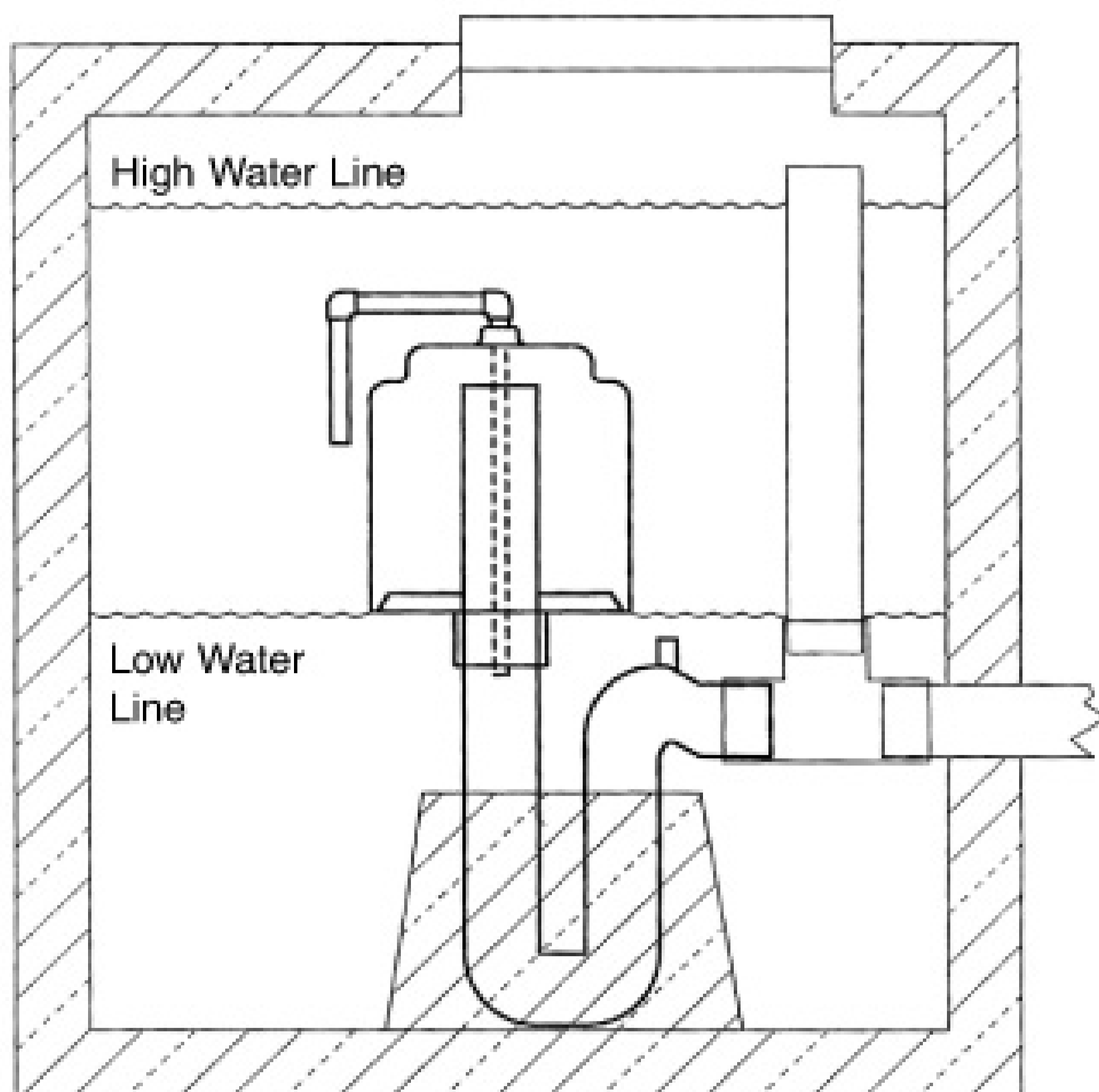
Lenzyme Installs Solar Heating Panels

Lenzyme has installed a solar water heating system at its remodeled manufacturing facility in Little Suamico, Wis. The multiple solar panels provide 100 percent of the company's hot water needs, as well as supplemental heat. The company's facilities also are highly insulated and designed to take advantage of natural daylight and keep energy demands to a minimum. The 16 solar panels measure 4 feet by 8 feet each. When fluid in the panels reaches 120 degrees F, a thermostatic switch activates a pump inside the building, circulating the fluid through insulated tubing to a heat exchanger and hot water tank. A diverter valve also redirects excess fluid under floors in the production and office area to produce radiant heat. ■



Jerard Nighorn, vice president of sales, stands next to the solar heat panels installed at the Lenzyme facility.

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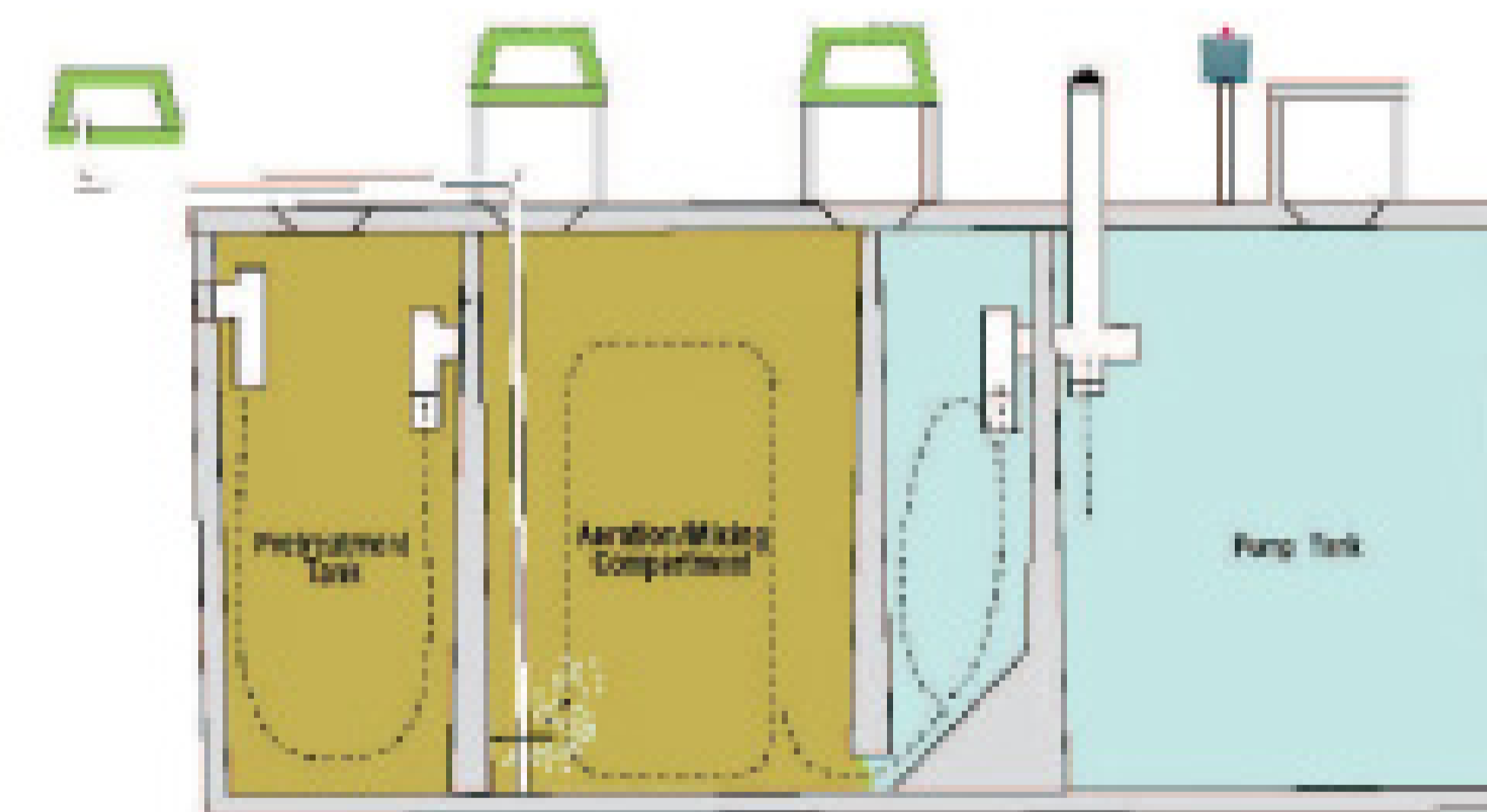
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14

Star of the West

An extended aeration, activated sludge process enables an installer to develop property in the environmentally sensitive Black Hills of South Dakota

By **Scottie Dayton**

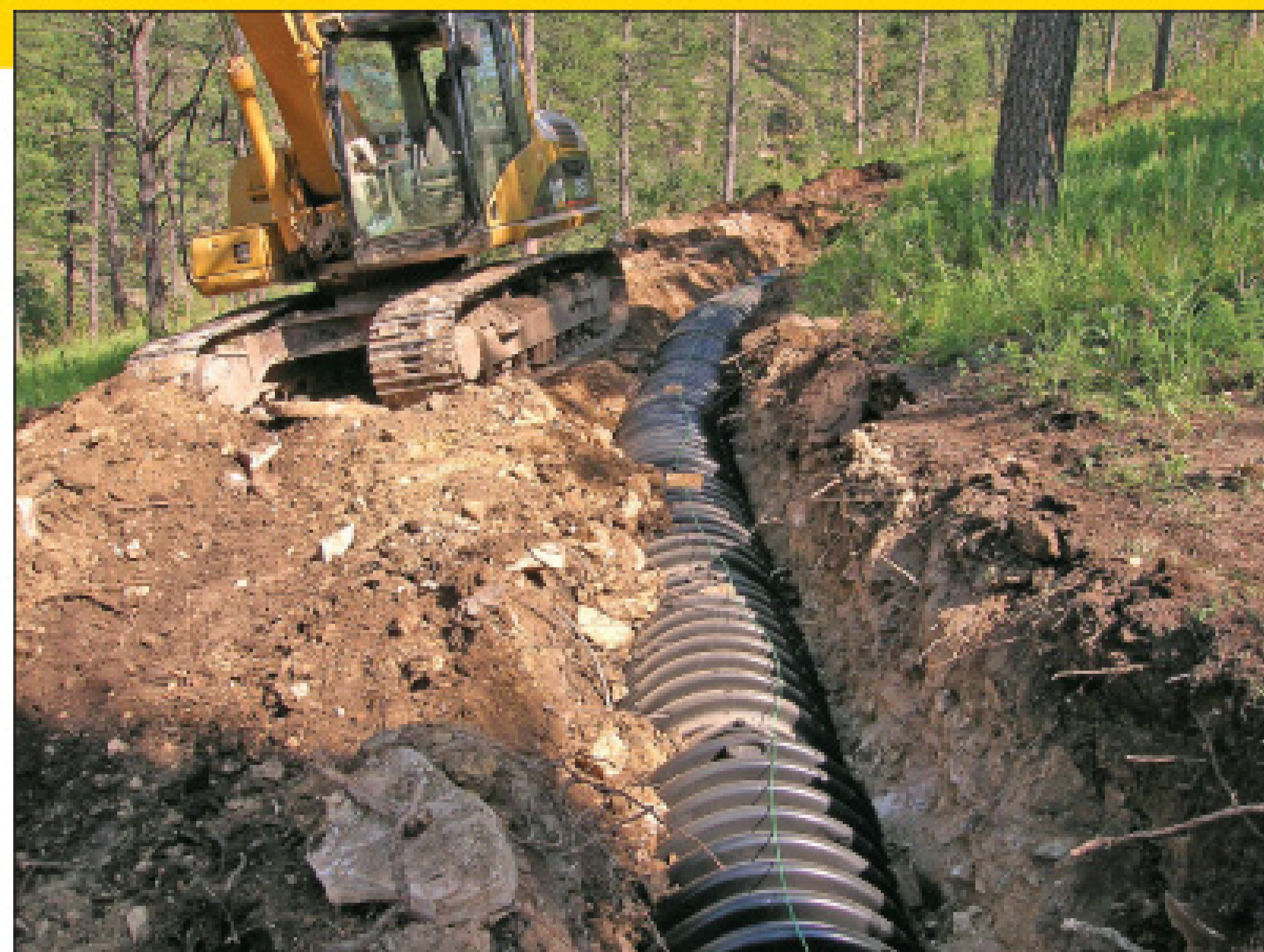
When 315 acres abutting the Black Hills National Forest became available, Jim and Dusty Schad of Schad Construction Inc. bought it. Father and son, noted for custom-built homes in Rapid City, S.D., envisioned a unique, upper-end development fitting into and preserving the surroundings. Although neither are developers, they picked the 1- to 3-acre building sites, then drew in the roads and lot lines.

But the state Department of Environment and Natural Resources denied permits for conventional onsite systems because those in the Black Hills were contaminating Rapid City's water supply. "We

thought the project would die," says Dusty Schad. "Bringing city sewer five miles to Canyon Springs Preserve wasn't an option."

After doing research, the Schads chose an extended aeration, activated sludge process unknown in their state. It took 18 months for state, county and local authorities to accept the system's NSF/ANSI Standard 40 Class 1 certified system design, and the fail-safe mechanisms the manufacturer used to keep homeowners from tampering with or failing to maintain the units.

All the streets and sewers are now in place. Once a lot is purchased, the home is custom-built and the onsite system installed by



Workers from Schad Construction Inc. in Rapid City, S.D., install the first leg of a 15- by 75-foot drainfield. (Photos courtesy of Schad Construction Inc.)

the Schads' new company, Crystal Mountain Systems Inc. Four systems are operational and 12 homes are under construction.

Site conditions

Soils are 6 inches of topsoil followed by 2.5 to 6.5 feet of sandy lean clay over silty sand/gravel with cobbles and boulders. Percolation rates average 23 minutes per inch. No limestone bedrock or water is present. The 2-acre lots have no neighbors in front or behind. Box Elder Creek, which runs through the property, has large sinkholes that flow into limestone caves that discharge into the Madison Aquifer, the prime source of water for Rapid City wells.

System components

Mitchell Kertzman, P.E., of Renner Associates LLC in Rapid

City, designed the system to handle 21,750 gpd from 87 homes. Its major components are:

- Eighty-seven 500-gallon, single-compartment fiberglass septic tanks from Ecological Tanks Inc., Downsville, La.
- Eighty-seven 1,000-gallon Model EZ 500 Aqua Safe aerobic treatment units (ATUs) from Ecological Tanks.
- As needed, 500-gallon fiberglass lift stations with 1/2-hp WS 50 or 1-hp WS 100 pumps from Monarch Industries, Winnipeg, Manitoba.
- Sixteen 1,000-gallon dosing tanks from Ecological Tanks.
- Thirty-two 4-inch dosing siphons

System Profile

Location:	Rapid City, S.D.
Facility served:	Canyon Springs Preserve
Designer:	Mitchell Kertzman, P.E., Renner Associates LLC, Rapid City
Installer:	Crystal Mountain Systems Inc., Rapid City
Site conditions:	6 inches of topsoil followed by 2.5 to 6.5 feet of sandy lean clay over silty sand/gravel with cobbles and boulders. Percolation rate averages 23 minutes per inch with no water table.
Type of system:	Aqua Safe ATU, Ecological Tanks Inc.; Bio-Diffusers leaching chambers, Advanced Drainage Systems Inc.
Hydraulic capacity:	21,750 gpd

The second leg of the drainfield is shown during installation.



from Fluid Dynamic Siphons Inc., Steamboat Springs, Colo.

- 6,150 feet of ARC36 Bio-Diffusers leaching chambers from Advanced Drainage Systems Inc., Hilliard, Ohio.

System operation

Raw sewage flows through a 4-inch PVC service line to a septic tank, then into the ATU. Wastewater enters an outer mixing compartment where air, introduced by a compressor through four drop lines around the perimeter, creates hydraulic displacement and a constant source of oxygen for aerobic bacterial activity and reproduction.

As organisms digest the nutrients, the liquor enters an inverted cone-shaped clarifier from the bottom. Solids settle in this quiet zone and re-enter the mixing compartment. Clear, odorless effluent flows upward either to gravity-feed through 4-inch Schedule 40 PVC laterals to the concrete manholes or to lift stations where pumps send the fluid to the manhole. The discharge from each house enters the manhole separately for sampling and to identify nonoperating units.

Depending on how many houses are on each manhole, 6- or 8-inch gravity sewers direct the liquid to the dosing tanks. Liquid entering a dosing tank fills it to the trip level of the twin siphons, which fire alternately due to different water column heights inside.

As the liquid in the tank reaches the high-water line, an air bubble is

"Instead of clustering the treatment plants together, we created large drainfields. Because Aqua Safe systems are new to the state, we didn't take the allowed 20 percent drainfield reduction, so they are probably oversized."

Dusty Schad

forced around the invert of the trap and discharged out the leg of the first siphon to operate. This action starts the siphon and empties the tank to the elevation of the discharge invert. The siphon that didn't operate loses nearly half the liquid in its trap. The air displacing the water causes this siphon to operate next. All siphons have solar-powered cycle counters readable from outside the tank.

Via serial concrete drop boxes, a 4-inch PVC gravity sewer disperses the flow from the dosing siphons to 18 drainfields with two zones. Each zone contains five to 10 infiltration laterals. "Instead of clustering the treatment plants together, we created large drainfields," says Dusty Schad. "They average 15 by 75 feet, with the longest at 126 feet. Because Aqua Safe systems are new to the state, we didn't take the allowed 20 percent drainfield reduction, so they are probably oversized." The system has no filters.

Installation

Freddy Frantom Jr. from Ecological Tanks helped with the approval process, representing Schad at state and county hearings. The

major concern of all authorities was that homeowners would not maintain the systems. Frantom designed an auto dialer to remove homeowners from the equation.

To simplify installation and ensure that all the tanks are level, Schad uses fiberglass to attach the septic tank to the aerobic module, creating a 16-foot-long component. Including the lift station adds 8 more feet. The lightweight assemblies have an eyebolt in each corner. "We use Ecological's choice of resin, fiberglass and dye to avoid possible chemical reactions between brands," Schad says. The assemblies are transported individually on a flatbed trailer.

Holes are dug at least 12 inches wider than the tanks. The elevation of the piping determines the depth. "We sometimes add extra Tuf-Tite risers to achieve the required 3 inches above ground," Schad says. Tanks rest on 6 inches of sand to prevent settling. Tanks are filled with water to the discharge pipe before backfilling with native topsoil to the bottom of the inlet and outlet piping.

For concealment and to avoid people landscaping over the air

compressor, Schad detaches it from the treatment tank and mounts it beside the home's air conditioner-heat exchanger. The 3/4-inch Schedule 80 PVC airline is buried 12 inches deep. The electrical control box for the compressor, visual and audible alarms, and auto dialer is in a weatherproof enclosure next to the heat exchanger.

Each drainfield is divided into two alternately dosed zones. Where infiltration beds are used, the center-fed distribution piping is installed in a continuous loop. Each zone has an average of three laterals, but some have five. A drop box fills the upslope leg first, then the subsequent ones in sequence. The drop box also can isolate one or more trenches while the remaining ones continue to operate. Backfill over the drainfields was seeded with a mixture of native grasses.

Schad Construction built a 20-foot-deep, 3-acre stormwater retention pond that holds 5.5 million gallons and is stocked with trout. "The Doty Volunteer Fire Department is building a new station next to our project, and we're installing the onsite system," Rusty Schad says. "The Black Hills has one major forest fire a year, and the pond has a tri-hydrant, enabling firefighters to pull water in emergencies."



A three-stage wastewater component from Schad Construction is installed at a new home in the Black Hills. To simplify installation and ensure that all the tanks are level, workers attached the septic tank, Aqua Safe aerobic module, and lift station together with fiberglass.

Maintenance

Following maintenance guidelines from Ecological Tank, Schad developed a two-year service contract that the three regulatory agencies had to approve. The contract must be signed at the time of sale. "Most buyers are receptive to it because they don't want the responsibility," he says. "Knowing this, we even offer a five-year contract."

Crystal Mountain Systems is the service provider, inspecting systems twice per year. Technicians adjust the electrical control, if applicable, and service the mechanical components. They check the effluent for color, turbidity, scum overflow and odor. When necessary, they call a pumping service to clean the septic tank and treatment plant. They check the air compressor for blockages and clean or replace the filters. An inspection takes about 20 minutes.

The system discharges to the drainfields at pollutant levels significantly lower than the discharge from the Rapid City Municipal

Wastewater Treatment Plant. The plant reported 10mg/l CBOD5 and 10 mg/l TSS during the second week of April 2006.

According to Baylor University in Waco, Texas, the 30-day average discharge from the ATUs was 2.4 mg/l CBOD5 and 2.1 mg/l TSS. The EPA maximum for discharge to Rapid Creek is 30 mg/l CBOD5 and 30 mg/l TSS. ■

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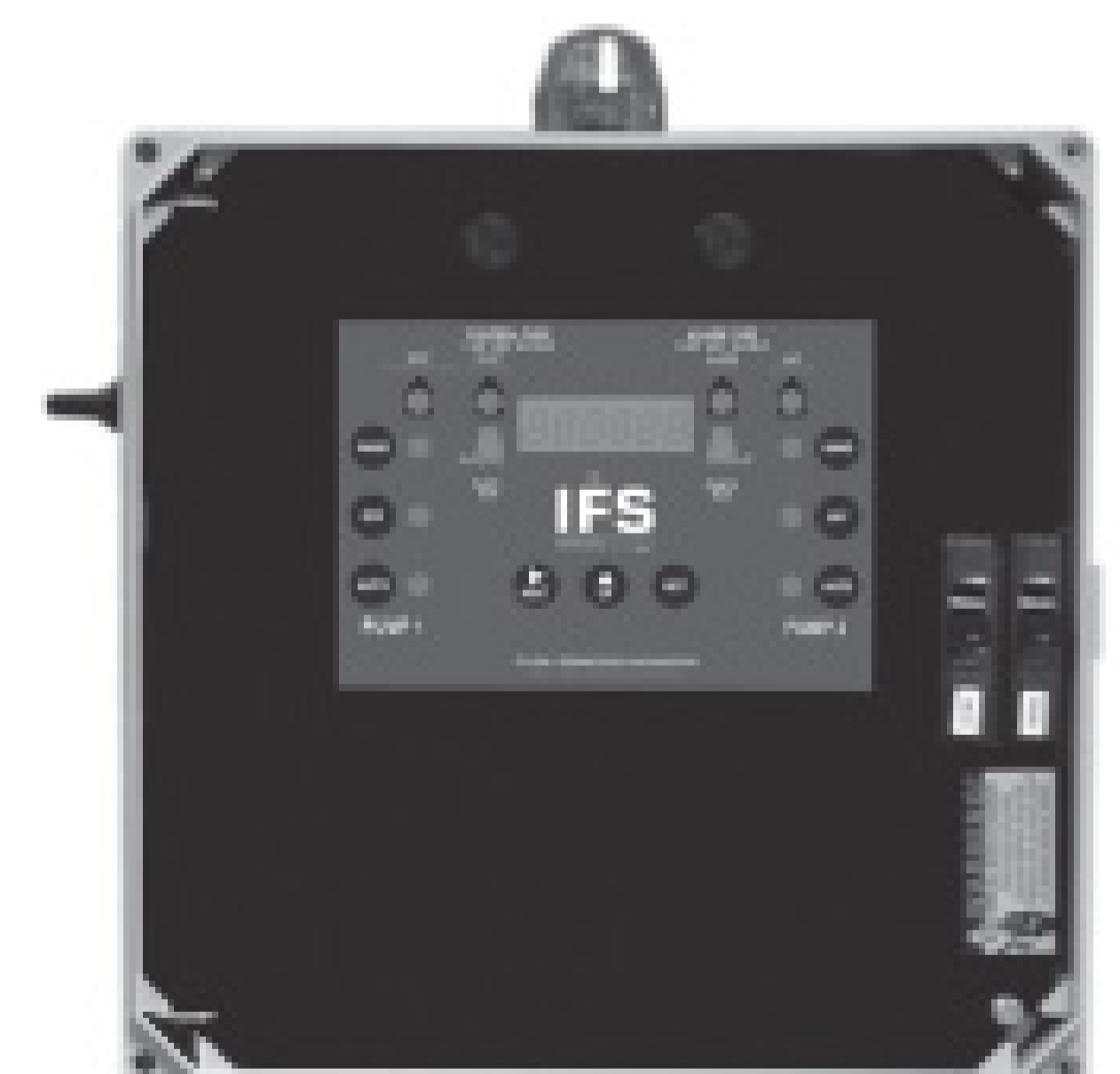
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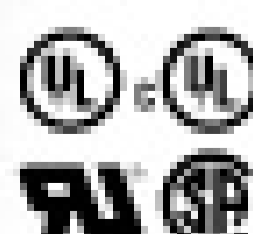
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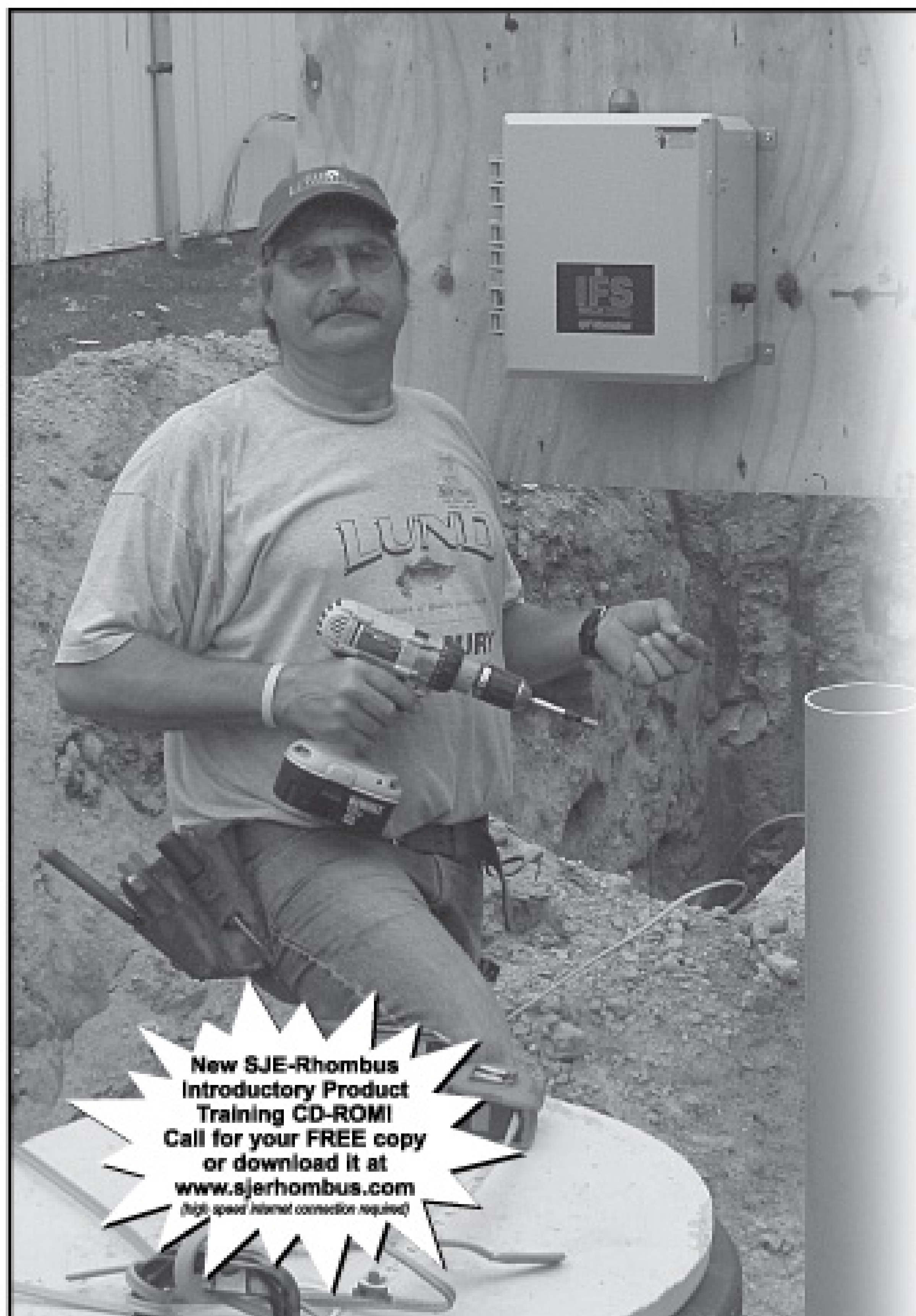


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October 2008



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Tri-County Introduces Soil Shaker Skid-Steer Attachment

The Soil Shaker 2000 skid-steer attachment from Tri-County Septic is designed to loosen sealed, compacted or nondraining soils in septic drainfields. The attachment enables the operator to penetrate soils using the probe hammer.

While in the ground, the attachment releases air, breaking up the compacted soil, restoring the entire drainfield without damage to the lawn. A demonstration DVD is available. 320/293-6644; www.soilshaker.com.

SJE-Rhombus Introduces D-Master Diaphragm Switch 41

The SJE D-Master diaphragm switch from SJE-Rhombus is designed for sump pump use in confined spaces. With no external moving parts, the switch features a 10-inch pumping range, 10-foot cord and 120-volt piggyback plug for sump pump connection. 888/342-5753; www.sjrhombus.com.

Bio-Microbics Designs Membrane Bioreactor

The BioBarrier Membrane Bioreactor from Bio-Microbics Inc. is designed to allow high-quality effluent to discharge into most environments, including surface irrigation and other re-use methods. The wastewater system's automated operation sequence requires no backwash, ships installation ready and fits into both new and existing tanks. 913/422-0707; www.biomicrobics.com.



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Raven Offers Wastewater Process Control Package 251

The Process Control Package from Raven Environmental Products Inc. is designed for activated sludge treatment plants to obtain operational information in wastewater treatment operations. The package enables operators to determine operational parameters, analyze sludge settling characteristics, sludge detention times, return sludge flow rates and waste sludge quantities. The package includes a laboratory bench-top centrifuge designed specifically for wastewater process control, one Coretaker core sampler, three Settleometers and a 14-page user's manual. 800/545-6953; www.ravenep.com.

Liberty Expands Line of Effluent Pumps 125



Liberty has expanded its line of effluent pumps to include larger 1-hp, 1.5-hp and 2-hp models. The pumps feature maximum head capacities of more than 130 feet and flows to 130 gpm. The dual-sized discharge has a 1 1/2-inch removable flange with a 2-inch threaded port for connection to either size pipe. The pump also has a standard 25-foot quick-disconnect power cord and dual shaft seals. 800/543-2550; www.libertypumps.com.

CLARIFICATION

An AccuPerc digital percometer from Carpenter Group USA measures 6 inches tall and 4 inches in diameter. An entry in the August Product News column included dimensions for a set of three units in a carry case. ■

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Report Identifies Successful RME Characteristics

The Water Environment Research Foundation (WERF) funded research that identified business characteristics common among 15 successful Responsible Management Entities (RME). The 72-page report, *Business Attributes of Successful Responsible Management Entities*, provides guidance to businesses and organizations interested in becoming RMEs.

Certification through recognized training courses topped the authors' list of commonalities. Successful RMEs are certified in operation, maintenance and inspection. They limit the systems they operate to three or fewer to simplify construction, operation and maintenance, minimizing inventories on spare parts and training requirements.

Successful RMEs have full managerial capabilities that include a paid manager, a collections person, and one or more people responsible for the RME's formation and early growth. The report says the founder is often passionate about decentralized systems as a way to address groundwater pollution.

Successful RMEs have a long-term financial plan, a strategy for growth, enough money to be self-sufficient, a sustainable monthly charge, and an independent financial advisor. Most RMEs grow their way to financial viability.

The sustainable monthly fee must cover all costs, yet one common mistake was equating cost with only operation and maintenance. Long-term management also includes sampling and testing, replacing failed mechanical equipment, and more.

The report confirms that RMEs can't operate unless the public accepts the need for long-term maintenance and is willing to pay for it. That requires continuous public relations, and the presence and enforcement of onsite regulations.

Researchers noted that the job of many local health department regulators has become too big. Successful RMEs operate as regulated public utilities, developing close

relationships with regulators, or operate a special district or zone.

The report concludes that the decentralized industry would benefit from focusing more on financial and managerial issues and less on debates about the performance of technologies. Success depends mostly on management, acceptance of the venture by the public, and sound financial planning. Visit www.ndwrcdp.org/publications/index.htm.

Behind the Times

An article in the summer newsletter of the Maryland Onsite Wastewater Professional Association (MOWPA) identifies the state's 25-year-old septic regulations as the largest impediment preventing use of advanced onsite technology.

The second greatest issue is individuals and businesses with inadequate training working in the industry. According to the article, any plumber, contractor or backhoe operator can obtain an installer permit without demonstrating competency or providing training documentation.

The association's efforts to change the septic code and pursue a state-mandated educational program are gaining support. MOWPA proposes three certification categories: Designer, Installer and Operator/Maintenance/Service Provider. Practitioners in each would require training in conventional gravity systems, advanced pretreatment systems, sand mounds and pressurized systems, and drip systems.

Talk Radio

Operation and maintenance programs and a state of Washington mandate to inspect gravity systems every three years and pump them annually prompted numerous homeowners to call the Washington On-Site Sewage Association (WOSSA). "They are looking for information on how this will affect them and asking for names of service providers," says WOSSA president Jeannie Yackley.

The volume of calls led the organization to develop a 60-minute talk show expected to reach 250,000

listeners in western Washington. "Septic Solutions" discusses the care, maintenance and installation of onsite systems, urban myths and legislative issues, and gives people who call straight answers. WOSSA assembled advertising and program partnerships to help underwrite the \$40,000 it costs to air the program for 26 weeks. Call Jeannie Yackley at 253/770-6594.

To combat fuel costs, WOSSA is bringing more fall and winter training classes to its members, instead of having them travel to the training center in Puyallup. Based on attendance of 20 to 30 per class and averaging distances traveled, the plan could save members about \$35,000 next year on fuel.

The summer WOSSA newsletter reported that several members had fuel stolen. One company had more than 200 gallons siphoned from a truck. When thieves found locking gas caps on vehicles at another company, they returned with a small tanker, cut the fuel lines on three trucks, and siphoned nearly 1,000 gallons. Insurance denied the claim and did not cover the \$5,000 loss.

Last Call

The North Carolina Septic Tank Association reminds installers and inspectors that their continuing education hours must be recorded by Nov. 15, 2008, to renew their certification. Call Monica Rhea at 704/739-5849 or visit www.ncsta.net.

CALENDAR OF EVENTS

Oct. 12-15

Virginia Onsite Wastewater Recycling Association Conference and Trade Show, Blacksburg. Call Trapper Davis at 804/966-9190 or visit www.vowra.org.

Oct. 14-15

Delaware Onsite Wastewater Recycling Association Conference and Exhibition, Dover Downs Hotel and Conference Center, Dover. Call Ken Walsh at 302/381-6516 or visit www.dowra.org.

Oct. 23-26

Ontario Association of Sewage Industry Services Conference and Exposition, Best Western Conference Centre, Orillia. Call Don Kelloway at 877/202-0082 or visit www.oasisontario.on.ca.

Nov. 12-13

North East Residuals & Biosolids Conference & Exhibit, Nashua, N.H. Call Ned Beecher at 603/323-7654 or visit www.newea.org.

Dec. 4-5

Kentucky Onsite Wastewater Association Conference, Sloan Convention Center, Bowling Green. Call 270/715-0043 or visit www.kentuckyonsite.org.

Dec. 8-9

NOWRA Installer Academy, Riviera Hotel, Las Vegas, Nev. Call 800/966-2942 or visit www.nowra.org.

Jan. 8-10

Michigan Onsite Wastewater Recycling Association Conference and Exhibit, Kellogg Hotel and Conference Center, East Lansing. Call Chanin Frank at 989/773-6985, ext. 258, or visit www.mowra.org.

Jan. 13-15

Iowa Onsite Waste Water Association Conference, Polk County Convention Center, Des Moines. Call 515/225-1051 or visit www.iowwwa.com.

Jan. 13-15

Ohio Onsite Wastewater Association Conference and Trade Show, Ramada Plaza Hotel and Conference Center, Columbus. Call 866/843-4429 or visit www.ohioonsite.org.

Jan. 19-21

Missouri Smallflows Organization Conference and Exhibition, Holiday Inn Select, Columbia. Call 417/739-4100 or visit www.mosmallflows.org.

Jan. 22-24

Alberta Onsite Wastewater Management Association Conference, Deerfoot Inn and Casino, Calgary. Call 780/489-7471 or visit www.aowma.com.

Jan. 23-24

Washington Onsite Sewage Association Conference, Vancouver. Call John Thomas at 253/297-2837 or visit www.wossa.org.

Jan. 26-28

North Carolina Septic Tank Association Conference and Exposition, Hickory Metro Convention Center, Hickory. Call Doug Lassiter at 336/345-8357 or visit www.ncsta.net.

Jan. 30-31

Wisconsin Liquid Waste Carriers Association and Wisconsin Onsite Water Recycling Association Joint Convention, Marriott West Hotel, Madison. Call 608/255-2770 or visit www.wowra.com.

Feb. 11-12

Nebraska On-site Waste Water Association Conference. Call Lee Orton at 402/476-0162 or visit www.nowwa.org.

Feb. 14-15

Utah On-Site Wastewater Association Conference, Expo Center, West Valley City. Call Carmell Burns at 435/797-3174 or visit <http://uwrl.usu.edu/partnerships/training/uowa.html>.

Feb. 25-28

Pumper & Cleaner Environmental Expo International, Kentucky Exposition Center, Louisville, Ky. Education Day Feb. 25; exhibits open Feb. 26-28. Call 800/257-7222 or visit www.pumpershow.com.

March 1-4

Ontario Onsite Wastewater Association Conference and Exhibition, Sheraton Conference Centre, Richmond Hill. Call Denis Orendt at 905/372-2722 or visit www.oowa.org.

March 18-19

Tennessee Onsite Wastewater Association Continuing Education Workshop and Annual Meeting, UAW Union Hall, Spring Hill. E-mail Scott Fellwock at scott.fellwock@nashville.gov or visit <http://onsite.tennessee.edu/TOWA.htm>.

TRAINING & EDUCATION

Flooded Onsite Systems

The University of Minnesota Water Resources Center published the fact sheet "What to do with your private onsite wastewater treatment system after a flood." Installers may share it with customers. It's a free download at <http://commerce.wi.gov/SBdocs/SBPowtsFlood.pdf>.

Septic Systems and Source Water Protection

The summer issue of *Pipeline*, from the National Environmental Services Center, tells homeowners

how to care for their onsite systems and protect their community's water quality. The eight-page document is a free download at www.nesc.wvu.edu/pipeline.cfm.

Soils Course

The Wisconsin Department of Commerce Safety and Buildings is offering a course on describing soil profiles and recording site data on Oct. 10 at Northeast Wisconsin Technical College in Marinette. Call Jean Joyce at 608/267-7113.

NAWT Training

The National Association of Wastewater Transporters has scheduled these sessions:

- Oct. 3-4 – Inspector Training and Certification, Austin, Texas. Call the Texas Association of Real Estate Inspectors at 512/370-1977.
- Oct. 14 – Inspector Recertification Training, Holiday Inn, Casa Grande, Ariz. Contact Kitt Farrell-Poe at 928/782-3836; kittfp@ag.arizona.edu.
- Oct. 23-24 – Inspector Training and Certification, Fresno, Calif. Call 707/579-4882 or visit www.cowa.org.

Alabama

Licensing classes are the joint effort of the Alabama Onsite Wastewater Association (AOWA) and University of West Alabama (UWA).

- Oct. 2-3 – Continuing Education, Gadsden
 - Oct. 16-17 – Pumpers, UWA's Livingston campus
 - Oct. 29-30 – Continuing Education, Mobile
- Call Allen Tarrt 205/652-3803 or visit www.aowatc.uwa.edu.

California

Certification courses are sponsored by the California Onsite Wastewater Association and NAWT.

- Oct. 8 – Soils, central Calif.
 - Oct. 23-24 – Inspector Training and Certification, Fresno
- Call Cliff Trammel at 707/579-4882 or visit www.cowa.org.

Iowa

The Iowa Onsite Wastewater Training Center at Ankeny has this course:

- Oct. 16 – Media Filters with Installation Demo

Call Annette Adams at 800/362-2127, ext. 6464, or e-mail Dennis Hayworth at dahayworth@dmacc.edu.

Michigan

The Michigan Onsite Wastewater Training and Education Center at MSU Tollgate Center in Novi is offering these courses:

- Oct. 8-9 – Existing Systems Evaluator Training
- Oct. 29-30 – Soils

Contact Barb DeLong at 517/355-4720 or visit www.egr.msu.edu/age, then Outreach.

Minnesota

The University of Minnesota Extension has this hands-on workshop:

- Oct. 21-24 – Service Provider Precertification, Mankato

Call Nick Haig at 800/322-8642 or 612/625-9797 or visit <http://septic.umn.edu>.

Missouri

The Missouri Smallflows Organization is offering these CEU courses:

- Oct. 7-8 – Troubleshooting and Hydraulics, West Plains
- Oct. 21-22 – Lagoons and Drainfields/Curtain Drains, Camdenton
- Oct. 28-29 – Lagoons and Drainfields/Curtain Drains, Moberly

Call Terri at 417/739-4100 or visit www.mosmallflows.org.

Nebraska

The Cooperative Extension at University of Nebraska is offering these certified courses for CEUs:

- Oct. 15 – Extension Pumps & Controls, Norfolk
- Oct. 16 – Extension Dosed Systems, Norfolk

Call the Nebraska On-site Waste Water Association at 402/476-0162 or the university at 402/472-9614.

North Carolina

North Carolina Soils and On-Site Wastewater Training Academy is offering these courses at Raleigh unless stated otherwise:

- Oct. 1 – Land Application
- Oct. 8 – On-Site Systems Layouts, Pittsboro
- Oct. 9 – Principles of Gravity System Design, Pittsboro
- Oct. 15 – Inspector Field Practicum, Jacksonville

- Oct. 15 – Soil Structure, Asheboro
 - Oct. 15 – Installing Pump Systems, Greensboro
 - Oct. 16 – Installing Advanced Systems, Greensboro
 - Oct. 16 – Inspector Field Practicum, Greenville
 - Oct. 16 – Matching the System to the Site, Asheboro
 - Oct. 17 – Soils of the Triassic Basin, Pittsboro
 - Oct. 22 – Applications for Drip Irrigation Technology, Mills River
 - Oct. 23 – Drip System O&M, Mills River
 - Oct. 24 – Soils of the Lower Mountains, Mills River
 - Oct. 29 – Soils of the Upper Mountains, Laurel Springs
 - Oct. 30 – Matching the System to the Site, Laurel Springs
- Call Joni Tanner at 919/513-1678 or visit www.soil.ncsu.edu/training.

Rhode Island

The University of Rhode Island's Onsite Wastewater Training Center offers these professional development workshops at its Kingston campus:

- Oct. 2 – Bottomless Sand Filter Design and Installation
 - Oct. 16 – Innovative and Alternative Systems Field Tour
- Call David Kalen at 401/874-5950 or Mark Stolt at 401/874-2915 or visit www.uri.edu/ce/wq.

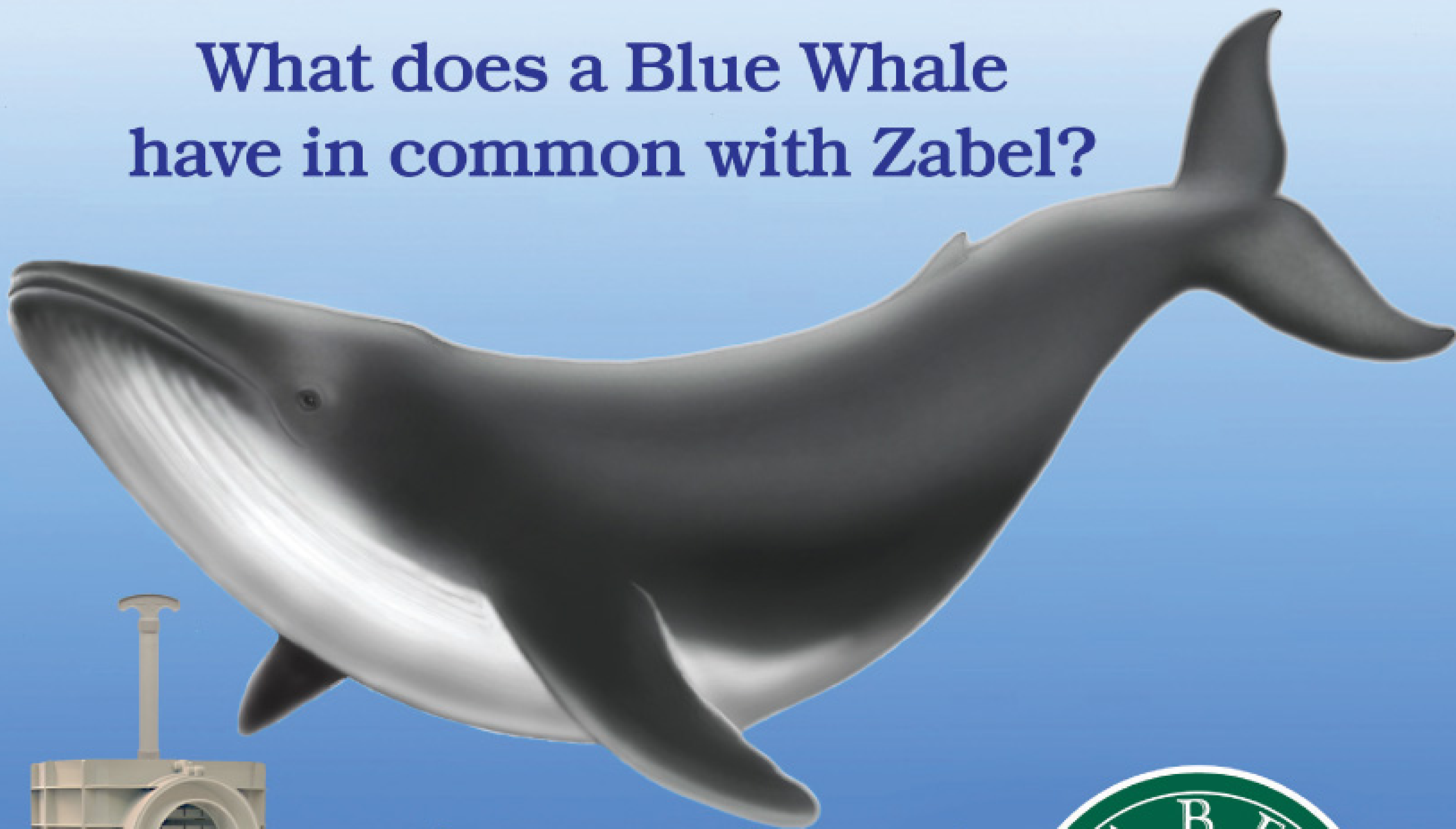
Virginia

The following courses by the Virginia Center for Onsite Wastewater Training (VCOWT) and Southside Virginia Community College are in Blacksburg unless stated otherwise:

- Oct. 12-15 – A to Z of Onsite Wastewater, Blacksburg (VOWRA)
- Oct. 12-15 – Soils, Blacksburg (VOWRA)
- Oct. 14-15 – Construction Inspection
- Oct. 23-24 – Understanding Water Movement in Soils
- Oct. 28-29 – Construction Inspection

For VCOWT classes, contact Debbie Campbell at 434/736-2011 or visit www.southside.edu/programs/wastetreat. For VOWRA courses, contact Trapper Davis at 804/966-9190 or visit www.vowra.org. ■

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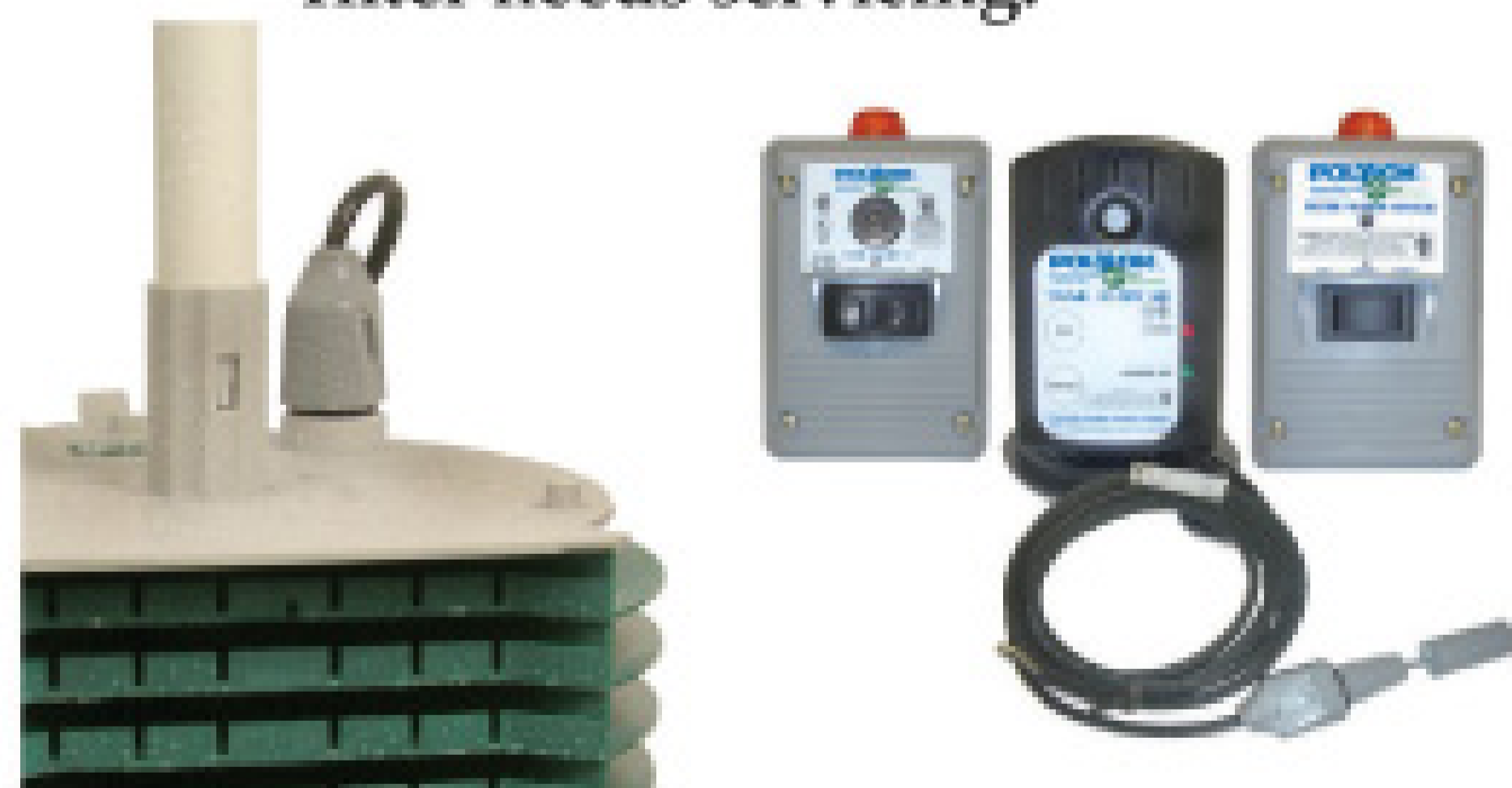
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