Learn How to Install MBR Systems and Enjoy a More Profitable Future

Due to their small footprints, versatility and friendliness to the environment, MBRs should be a growing part of your business

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Unless you're planning to retire in a short time, membrane bioreactors will almost certainly have a place in your business — probably a growing place.

Homeowners are pushing beyond the usual subdivisions, and businesses want to be in prime locations. Both situations mean building on land with difficult soils, near wetlands or near lakes, or all of the above. And then it's up to wastewater professionals to find a solution that satisfies clients and protects the environment. These circumstances are creating a larger space for membrane bioreactors.

"It has been an increasing fraction of our business since we've been doing it," says Mark Lancor, P.E., the principal engineer at DyMar in Southbury, Connecticut. The company has provided civil engineering, surveying and planning since 1987.

In Connecticut, the state says no one discharges to surface waters unless they are lucky enough to be on one of the few rivers grandfathered into current regulations. For the most part the state's soils are shallow, limited by bedrock, or have a high water table, Lancor says.

MBR installation has increased in the Midwest also. "We barely put in a regular septic systems now because I've set my crew up to do specialized work," says Ray Tebo, owner of New Excavating Technologies in St. Anne, Illinois.

He formed a subsidiary business just to do MBR work, and he set up a separate shop where his technicians can dry-fit parts and mock up systems to make sure each project will go in the ground quickly and smoothly. His work is primarily commercial, and the need for an MBR is often driven by site constraints, although he occasionally has a client who wants the most environmentally conscious solution.

A sewer plant in miniature

Although the term membrane bioreactor sounds technological, an MBR is just a

municipal wastewater treatment plant — with aerobic and anaerobic zones, filtration and disinfection — reduced to a compact footprint. It uses the same activated sludge process as a municipal plant, and its recycled water is of very good quality.

The basic layout of an MBR starts with a trash tank to catch large debris. On the outflow is a filter to hold back smaller solids that don't settle and may clog the reactor.

Next is the reactor tank. A constant flow of air from blowers keeps water moving inside so bacteria stay suspended with the organic material and keep eating, and of course all the oxygen supports bacteria, which in turn provide faster and more complete treatment of organics. Inside the reactor tank is also a membrane with very small pores — about one-thirtieth the diameter of a human hair — and a low-power pump that draws water slowly through the membrane. Large organic particles and most bacteria can't fit through the pores and remain circulating inside the tank. Water coming out of the reactor is clean enough for reuse in whatever ways local codes may allow, whether that is washing clothes, flushing toilets or irrigating a garden.

MBRs are very versatile. They work where there may not be wastewater flows for a time — at a vacation home, for example — and they can handle high-strength waste. They're good for denitrification, and they have a very small footprint.

About the only place they may not be useful is a residence where the waste flow and strength are very predictable and mild, Lancor says. But in Tebo's experience, MBRs can excel in this use also.

A different mindset

For Tebo, shifting to MBR installation required a change in equipment. He went small with excavators that can be hauled in the back of a truck and are used for soil testing and electrical trenches. MBRs require less digging, and what digging there is often happens in a tight space. He also bought more trucks to haul tools and parts, because MBR work is more mechanical and electronic than is the case with other wastewater systems.

His specialty also meant a change in employees. When he hires now, he doesn't look for a guy who only digs. He wants someone with the mindset of a mechanical or electrical contractor, because they'll be working with electronics and precision machinery. They also have to be careful workers: no hacking off pipes with a handsaw.

“Everything needs to be cut straight, and everything must be sealed properly. If you have one leak you are doomed, because at some time there will be 5 inches of rain, and if there’s any infiltration the system will be overwhelmed,” he says.

“You have to have a treatment plant operator’s mind, too, because you will need to adjust these systems during the first couple of years, and you must know what adjustments to make,” he says.

You need remote operation, and that means not skimping on the logic controls, Lancor says. Many problems can be solved remotely, so putting this capability in a system will save the client money, because a technician won’t spend hours driving to a plant to troubleshoot a minor issue.

Design for bigger

It’s also important not to skimp on tankage. Measured against the cost of a total system, the cost difference between a 10,000-gallon tank and a 12,000-gallon tank is nothing, Lancor says. But having more capacity up front in equalization tankage makes it easier for a system to absorb unanticipated flows. The same is true on the back end if water will be reused. Skimp on the tankage to store clean water, and any demand exceeding the storage capacity will have to be made up from another source at greater cost.

Because MBRs use a liquor that is continuously remixed instead of using a once-through process such as a trickling filter, they have more untapped capacity, Lancor says. One job he did was originally sized for 14,500 gpd, but the addition of some meters, sensors and a new logic control expanded the plant to 19,500 gpd. That leads to another piece of advice: Allow for expansion. Just as upsizing tanks is a relatively small cost, so is allowing room for another MBR cassette at some future time.

Making these specific decisions on components requires understanding the economics of a system over the course of its life, he says. The up-front cost of an MBR system will be greater than that of other systems because of the extra pumps, the MBR itself, perhaps extra pipes for water reuse, and maybe variable-speed blowers to supply sufficient air while cutting energy use. But if you look at the return over time, that capital investment is recovered, he says. The value of real estate may be greater, or the MBR capacity may allow a larger building without the need to invest in more wastewater treatment capacity.

“When you’re doing the right job for your client, you’re looking at the life cycle cost, and then you give the client a choice. But in general, the resiliency and return on an MBR is above most technologies out there,” Lancor says.

MBRs are not new, and although they're more complicated than a septic tank sitting in the ground, they're not that complicated. You may already have a handle on the technology because you're already wiring in advanced control panels and setting up aeration blowers. Take the next step to MBRs, and you may set yourself up for a more versatile and profitable future.

Ray Tebo, right, and Tayler Layne, of New Excavating Technology Inc., during the installation of MBR systems at Giant Goose Ranch in Illinois.