A DynaLift™ MBR in Delaware is the first tubular membrane wastewater treatment biological nutrient removal facility. It is the largest air-lift tubular membrane wastewater treatment process in the Western Hemisphere. The treated wastewater effluent from this facility offers a reliable source of superior quality water suitable for replacing potable water for lawn and landscape irrigation, aquifer recharge and other forms of beneficial reuse. This project serves as a model for retrofitting existing sites with cramped conditions.

The effluent produced by this facility is acceptable for any form of environmentally controlled dispersion either to surface water, to the land or to groundwater and will be replacing the potable water currently used to irrigate athletic fields at the middle school, little league ball fields and other locations in town.

The superior quality of the effluent produced by this technology provides social, economic and sustainable benefits as follows:

- Reuse reduces demands on valuable ground water supplies, used for drinking water and irrigation
- Reuse helps reduce pollutant loading to surface waters
- Reuse may postpone costly investment for development of new water sources and supplies
- Reuse allows multiple uses of land for agriculture and reuse of reclaimed water
- Reuse can save money and can provide aesthetic value

The public health, safety and welfare are protected in the reuse applications by the redundant control of infectious bacteria and viruses. The membrane pores cannot be penetrated by bacteria and the membranes provide 4-log virus removal. Disinfection, a second level of protection, is provided by ultraviolet units.

New tubular membrane arrangement minimizes power cost

The process combines mixed liquor activated sludge, operating at high concentrations, with ultrafilter membranes for solids separation. In the beginning, the process was limited to small wastewater flows where high quality effluent was required, due to the high capital and operating costs when compared to other processes. With the ever increasing demands for higher effluent quality, MBR’s are now very much in demand and are being applied in larger municipal projects.

The tubular membranes provide a more economical and durable product. Conventional use of cross-flow tubular membranes requires higher pumping power to create high turbulence inside the tubes in order to minimize fouling. Tubular membranes are more robust than hollow fiber and flat sheet membranes, and can be placed outside of a tank for easy maintenance. Their longer life and simplicity has made tubular membranes a desirable alternative.

Unique Membrane Arrangement

By placing the tubular modules vertically, and limiting the amount of permeate withdrawn from the membrane, it has been proven that membrane flux is stable and fouling is manageable using much less pumping power than in a conventional crossflow system. Air is injected at the bottom of the module, creating an airlift effect that increases the turbulence inside the tubes. A cyclical backwash of the membrane modules maintains consistent flux.
The flux is less than a standard crossflow membrane arrangement and the power required is only about 10%–15% of a crossflow system. This power requirement is less than most with immersed membrane systems. Low applied pressure and the extremely low trans-membrane pressure (TMP) minimizes the amount and the density of the solids boundary layer on the membrane surface. This produces very stable flux and low rates of fouling.

Flux stability is enhanced by a periodic backwash. Cleaning is achieved by either injecting cleaning solutions with the backwash water, or by circulating or soaking cleaning solutions through the membrane modules. This effectively keeps the membrane flux at high levels.

**System Operation:**

The system operates on a continuous basis by controlling the rate of permeate flow from the membrane modules. A recirculation pump feeds mixed liquor from the bioreactor to the bottom of each module where air is injected. This, in effect, acts as an airlift pump increasing the velocity that aids scouring inside the membranes. The scouring mixture discharges from the top of each module and is returned to the bioreactor (or the anoxic zone for de-nitrification). Back-flushing with permeate water is initiated on a timed cycle to each bank of modules. This removes any cake formed on the inside of the membrane tubes, thus maintaining flux rates.

**DynaLift™ System with Denitrification**

**Advantages:**

- **Robust tubular membranes** are more durable and require less frequent replacement. Membranes are double supported by a rigid backing that ensures no breakage or rupture
- **Effluent integrity is assured** since membrane rupture or breakage is not an issue
- **Low power requirements** comparable with immersed hollow fiber and flat sheet systems
- **Safer working environment** for the operator since maintenance cleaning does not require moving the membranes with hoists and trolleys
- **Minimizes operator exposure** to wastewater and potential health impacts
- **Lower installed capital cost** since no additional tanks, sludge, recycle or permeate pumps, hoists or trolleys are required
- **Lower lifetime operating cost** due to lower power costs, fewer membrane replacements and lower labor costs
- **Compact footprint** does not require additional tanks
- **Better control of fouling** since 100% of the membrane surface area is continuously exposed to the circulating fluid without dead spots
- **Forty-year proven reliability** of the tubular product
- **Resistant to chemical degradation** due to the use of high strength PVDF membrane chemistry
- **Efficient cleaning** in place without membrane removal being required