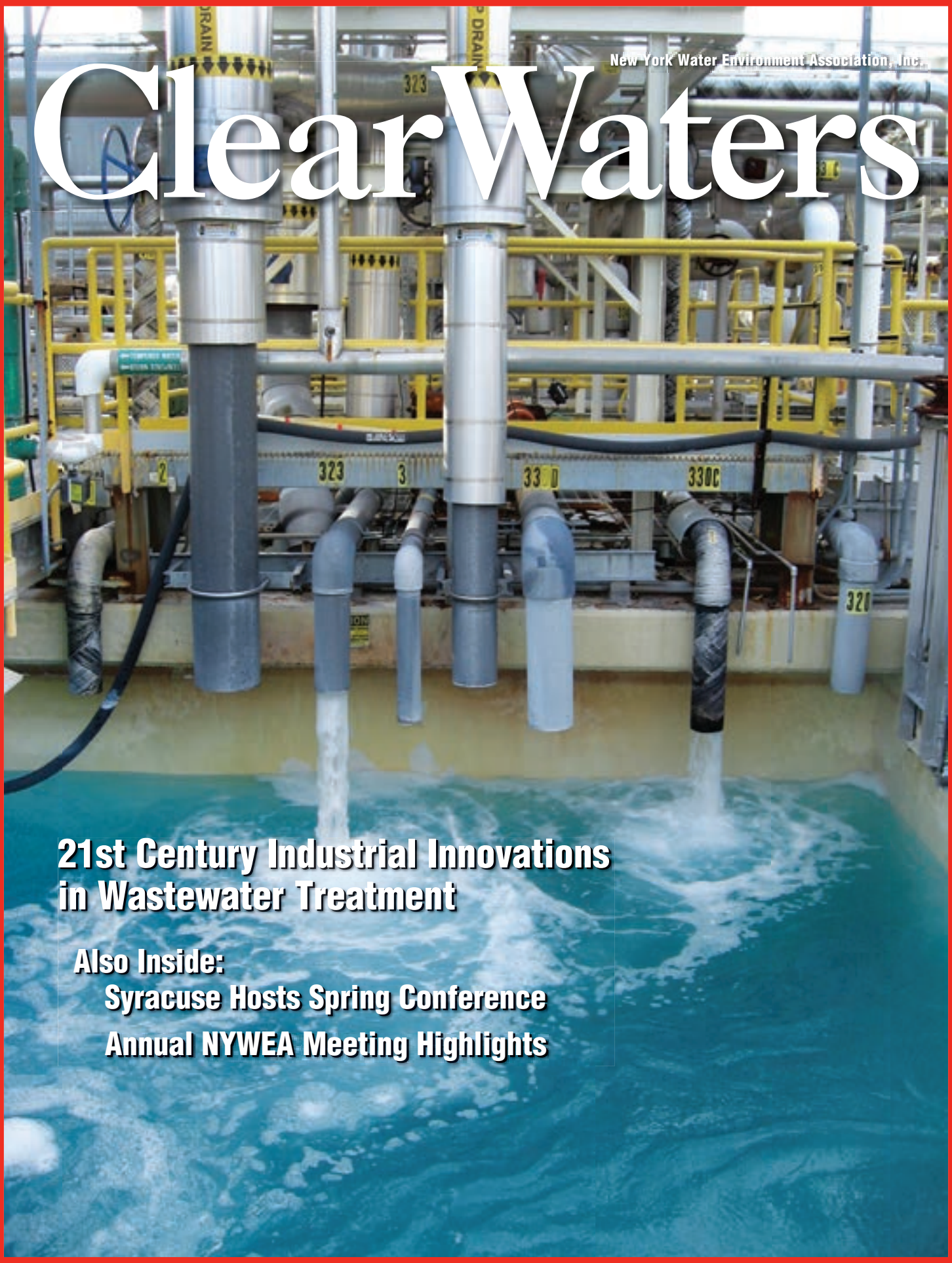
Spring 2013, Vol. 43, No. 1

New York Water Environment Association, Inc.

ClearWaters



21st Century Industrial Innovations in Wastewater Treatment

Also Inside:

Syracuse Hosts Spring Conference

Annual NYWEA Meeting Highlights

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Cover Image: All IBM-East Fishkill's waste streams combine here, at the onsite Industrial Waste Neutralization Treatment System, for final treatment before proceeding to its sanitary wastewater treatment plant and then discharge into Gildersleeve Brook. See one way in which the corporation helps to minimize chemicals used in the process on page 37.

Photo by Linda N. Daubert, PE/IBM-East Fishkill, NY

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♻ **Clear Waters** *is printed on recycled paper, using soy-based ink.*

President's Message | Spring 2013

Industrial Innovations in WW Treatment

While many of us focus mainly on municipal wastewater treatment, the need for treatment innovations for industrial waste streams is ever present. There are clear differences in many areas of municipal and industrial treatment needs, which this *Clear Waters* addresses. Jim Cunningham's article compares municipal to industrial wastewater treatment, while other articles provide case descriptions of treatment innovations created for industry which can be applicable to municipal wastewater treatment, such as membrane bioreactors and thickeners. Tightening regulations for municipal facilities commonly transfer up the line to industrial pre-treatment facilities. This creates a heightened demand for cost effective treatment improvements.

It is also certainly important to maintain effective communications and cooperation among municipal facilities and their tributary industrial pre-treatment customers. Good faith cooperation is the cornerstone of successful treatment programs and knowledge transfer.

Winter Meeting

The annual winter meeting in New York City was an overwhelming success. We saw record numbers of attendees, sponsors and vendors with a large presence from the NYC Department of Environmental Protection. The NYS Department of Environmental Conservation (also well represented) offered updates by water compliance bureau director, Joe DiMura, and commissioner, Joe Martens. Sandra Ralston, incoming Water Environment Federation president, attended the entire event and assisted outgoing NYWEA President Rich Lyons in giving out WEF awards. It was great having her with us!

I attended a motivating presentation at the Utility Executives Committee session by George Hawkins, general manager of DC Water. George is a great speaker because of the passion his message brings about the industry, its professionals and customers. He thrives on the "juice" of truly making a difference, reminding us that we are environmental stewards and what we do establishes quality of life – in fact, even saves lives. From proper wastewater treatment and management, to clean, safe drinking water, this cycle is a matter of life and death. His message made me even more proud to be associated with you and all the NYWEA environmental professionals and caretakers. What we do matters; WEF's "Water's Worth It!" campaign is perfectly timed.

Business and Strategic Plans

To operate as an efficient and effective organization, the NYWEA Board of Directors regularly updates its Strategic Plan and its Business Plan. The 2013–2016 Strategic Plan was completed in 2012, which identified four initiatives essential to the growth and well-being of NYWEA. These include: training and certification, public outreach, sustainability, and regulatory and legislative influence. The purpose of the business plan is to create a financial "roadmap" in funding the strategic plan, allowing the leadership to view the financial past and understand trends to make effective financial decisions. Areas of responsibility in this plan include: conference management, training and certification, regulatory and legislative influence, sustainability, public outreach, the scholarship program, and partnering and collaboration with other organizations. The business plan helps us allocate the necessary funds and resources to accomplish strategic initiatives for NYWEA's growth, relevance and impact in years and decades to come.

Here is a summary of NYWEA's 2013 initiatives:

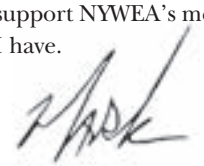
1. **Finalization of the 2013–2016 Business Plan**, with board presentation by April 24.
2. **Ensuring the Business and Strategic plans provide guidance and direction** for the organization; and, Summary Action lists will be provided to each committee in accordance with the Strategic Plan and as funded by the Business Plan.
3. **Enhancement of the Awards Program**, working with the Awards Committee to create an award that recognizes a public group or individual promoting water quality or environmental sustainability and it is eligible for members or non-members. In addition, the awards nomination process will be streamlined to make it easier.
4. **Creation of a Stormwater Committee** to assist members with stormwater regulations and compliance.
5. **Growth of Student and Young Professionals Membership**, working in conjunction with the Public Education Committee for outreach programs to educate college and high school students about environmental issues and the value of NYWEA membership.
6. **Promotion of Utility Membership**, by using reduced rate memberships and NYWEA publications. NYWEA has 30 utility members, with Onondaga County the most recent one.
7. **Sustaining the Scholarship Program**, to reach $50,000 in awards per year and preserve the fund's principal of $1 million. The business plan sets an affordable, consistent approach in raising funds on a yearly basis, and so that members can contribute affordably – making a real difference for the future of the profession.

In my travels around the country over the years to WEF MAX meetings at which WEF-affiliated state organizations gather, I am always impressed with how proactive NYWEA is. From our impressive scholarship program, succession planning white paper and successful training and operator certifications, to our Strategic Plan, Business Plan and other important initiatives, NYWEA stands tall, helping to lead the way.

Receiving Gavel for 2013

The last day of the annual meeting, President Rich Lyons passed on to me the NYWEA gavel. The title, Mr. President, truly fit Rich and I thank him for his professionalism, dedication and leadership. Rich, director of the Albany County Sewer District, accomplished much for NYWEA – truly making a difference for our membership and the environment.

I am excited and motivated heading into my year as NYWEA president when environmental issues, such as hydrofracking, stormwater and the Sewage Right to Know Act, are at peak interest and concern. I know that this will be a busy year, so I stand ready to support NYWEA's members, my co-workers and friends, with all that I have.



Mark Koester

85th Annual Meeting – A Great Success!

Many thanks to the exhibitors, sponsors, advertisers and members who attended the 85th Annual Meeting and made it a tremendous success. Once again, we had over 1,000 people in attendance, and 180 exhibitors showed their wares on two floors of the New York City Marriott Marquis. The Program Committee did an outstanding job coordinating 23 technical sessions that were well attended. Students from across the state presented their research during the University Forum Student Paper competition. These aspiring students were judged by members and presented $1,000 cash awards in four categories. The Utility Executives Forum on Tuesday (sponsored by the National Association of Clean Water Agencies) attracted over 50 wastewater utility executives; and the Young Professionals session and reception were again popular and fun places to be. The Awards Luncheon topped the meeting as a fitting tribute to those members deserving special recognitions. Be sure to see the photos featured on pages 6–9, and on NYWEA's Facebook page.

Next Year's 86th Annual Meeting Update – Coping with Super Bowl Sunday

It's challenging when events outside of our control affect our lives. A case in point for NYWEA is the 2014 Super Bowl. For those of you who have attended any of NYWEA's Annual Meetings in New York City, you understand the size and technical scope of each conference. This event also carries a significant financial aspect for the association. When we learned that the Super Bowl's Fan Fest location in 2014 was going to be changed to Times Square, we immediately commenced meetings with the hotel to review our options. If we stayed in the Sunday move-in format for exhibitors, and held the Opening Session on Monday, we wouldn't have enough rooms in our block to accommodate all of the members who want to stay at the hotel. In addition, the hotel can charge us a higher fee for rooms if we were to stay in our typical format that included Super Bowl Sunday. By advancing the meeting by one day, the room rate drops by $50/night from $279 to $229, and that savings to the members, coupled with room availability and great long term relationship with the Marriott Marquis, were the primary reasons the Board of Directors voted unanimously to push forward by one day the 86th Annual Meeting. This action takes away the conflict of the Fan Fest in Times Square for the move-in of the exhibitors. The meeting will have a slightly different feel to it, officially starting on Tuesday morning and ending on Thursday. On Monday, exhibitors will move in after 12:00 noon. In the coming months, the Conference Management Committee will be reviewing the details and communicating with you the logistics, including when the hotel opens the room block. We appreciate your support and understanding as we plan this unusual situation in 2014. We'll be back to business as usual with the 2015 meeting in the traditional Monday to Wednesday format. If you have questions, please do not hesitate to contact me.

Clear Waters Themes

This issue blends both the theme of industrial innovations and NYWEA's industrial colleagues with the Spring Technical Conference. Many thanks go to the authors who dedicated time to write articles. I continue to be impressed by the quality articles that are shared with our readers and which help us all to enhance job performance.

For over eight years now, we've held a Women's Networking Reception at the annual meeting, an informal gathering of women to meet and share experiences. At last year's reception a suggestion was made to devote an issue to women working in the environment, which is now planned for the Fall 2013 issue. Please let me know if you're interested in helping with that issue. On the horizon, we'll have editions dedicated to CMOM and asset management; volunteer leadership; and, oxidation and filter media. If you have an idea for *Clear Waters*, please do not hesitate to contact me.

Be sure to attend a meeting in your local NYWEA chapter this spring – it's a terrific way to connect with plenty of like-minded individuals!

Patricia Cerro-Reehil
pcr@nywea.org

Hot on the Web: Wastewater Manual!

The 2nd Edition of the *Wastewater Handbook for Elected Officials* is now available online at www.nywea.org! Over 180 pages of useful information!

Upcoming NYWEA Meetings & Chapter Training Sessions

Legislative Dialog
May 7, 2013
Room 711A–LOB
Albany, NY

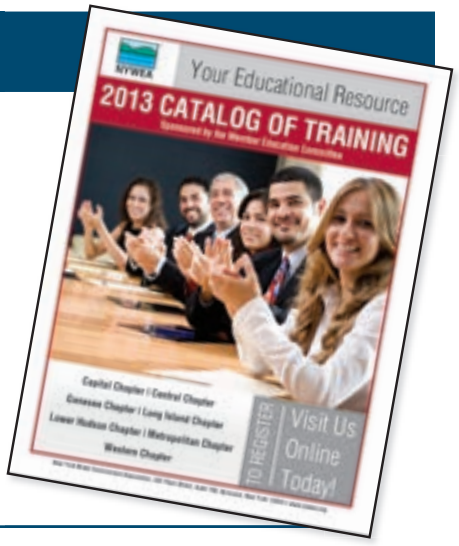
2013 Spring Technical Conference & Exhibition
June 3–5, 2013, Sheraton, Syracuse

Emergency Preparedness and Crisis Management
June 17, 2013, Hopewell Junction, NY
July 11, 2013, Williamsville, NY

Self-Priming Pump Stations and Pump Hydraulics
August 21, 2013
Rochester, NY

Filament Identification and Control
September 11, 2013
Watertown, NY

NYC Watershed/Tifft Science & Technical Symposium
September 18–19, 2013
West Point, NY



Marriott Marquis Hotel, New York City, NY

Highlights of 85th Annual Meeting

February 4–6, 2013

Above: NYWEA President Richard Lyons welcomes attendees to the 85th Annual Meeting.

Right: Sandra Ralston, WEF President–Elect

Left: Keynoter Claire Baldwin, of CDM Smith, discusses Succession Planning.

Right: Members ask questions during the Utility Executives Forum. (L-r): Mike Garland, Dave Comerford, Olewole McFoy and Joe Fiegl

Above: NYSDEC Commissioner Joe Martens addresses NYWEA members during the Awards Luncheon.

Above: Congressman Paul Tonko is presented the Nelson A. Rockefeller Award. (L-r): Tony Della Valle, NYWEA President Richard Lyons, Congressman Tonko, NYWEA Executive Director Patricia Cerro-Reehil and Steve Fangmann

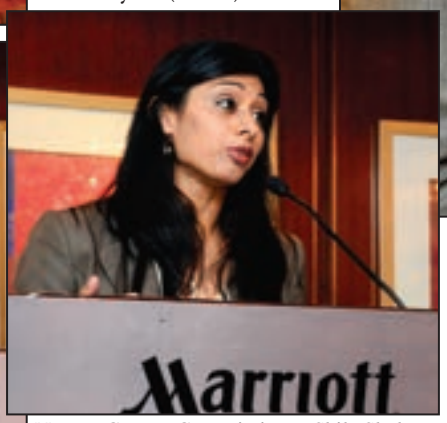
Below: Manhattan College students at the 85th Annual Meeting

Panel Discussion and Lessons Learned on Hurricane Sandy's Impact

Left: Robert Fischer of Bayshore Regional Sewerage Authority in NJ shares his experience during Superstorm Sandy.

Right: NYCDEP's Carter Strickland (far right) is presented a Silver Shovel by Operator in Chief William Grandner (left), NYWEA President Richard Lyons (center) looks on.

Commissioner Tom Lauro shares Westchester County's experience from Hurricane Sandy.



Nassau County Commissioner Shila Shah-Gavnoudias explains what happened in Nassau County from the storm.

Above: Matt Driscoll from NYSEFC speaks about funding opportunities for areas of the state affected by the hurricane.

Left: NYWEA's Dan Bentivogli encourages New York municipalities to join NYWARN (NY Water/Wastewater Agency Response Network) for emergencies.

Deputy Executive Matt Millea explains how Onondaga County helped during the cleanup aftermath of Hurricane Sandy.

Above: Gilbert Anderson, Suffolk County Commissioner, speaks about the hurricane's affect in his region.

Left: Attendees during the Opening Session

continued on page 8

continued from page 7

And, The Awards Go To …

Ralph and Alice Cramden appear at the President's Reception.

Above: Keneck Skibinski (right) is inducted into the NYWEA Hall of Fame.

Left: George Casey accepts the WEF Laboratory Analyst Excellence Award posthumously for his sister, Ann Casey.

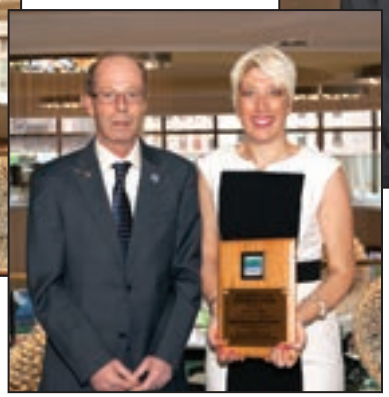
Above: Robert Astorino, Westchester County Executive, receives the Frank E. VanLare Award.

Representatives from the Village of Weedsport receive the Municipal Achievement Award.

Above: Dave Comerford accepts the WEF George W. Burke Award for Safety for Buffalo Sewer Authority's Bird Island WWTP.

Right: Boris Rukovets receives the WEF Arthur Sidney Bedell Award.

George Bevington receives the John Chester Brigham Award



Melissa Motyl from CH2M Hill receives the Kenneth Allen Memorial Award.

Left: President Lyons presents Rebecca Prendergast, Clarkson University, with Student Chapter Service Award.

Exhibit Chair, Joyette Tyler, presents Greg Jager of G.P. Jager with the Best Multi-Booth Exhibit Award.

Jean Malafronte (third from left) escorting the YPs to the next event

Mark Koester is installed as NYWEA's 2013 President.

Jim Roberts from NYCDEP speaks about CMOM.

(L-r): Mike Garland, Richard Lyons and NYSDEC Commissioner Joe Martens

George Hawkins proudly points out DC Water's logo as he addresses the Utility Executives Forum.

Left: NYCDEP's Chief Operating Officer, Kathryn Garcia, addresses members during the American Academy of Environmental Engineers (AAEES) breakfast.

Will Stradling (far right) presents Clarkson University with the 1st Place Student Chapter Recognition Grant.

Networking in the Exhibit Hall

Photos by Big Apple Photography, Ken Skibinski, Maureen Kozol and Patricia Cerro-Reehil

Water Views | Spring 2013

Building Infrastructure Resiliency for Storm Impacts

New York has been hit with extreme weather events, including storms Irene, Lee and Sandy. Many of New York's wastewater treatment facilities were severely damaged and temporarily shut down. This included the Bay Park Sewage Treatment Plant on Long Island and the Yonkers Joint Wastewater Treatment Plant, both of which were inundated with salt water. Similarly, the Binghamton-Johnson City area was hit with a record flood due to Lee, which caused extensive damage to its sewage treatment plant and collection system. It will take years to complete repairs.

Following the storms, it was clear that statewide action was needed. As Governor Andrew Cuomo said in his State of the State message: "There are some parcels that Mother Nature owns … She may only visit once every few years, but she owns the parcel and when she comes to visit, she *visits*."

Governor Cuomo appointed the expert NYS2100 Commission to make initial recommendations toward more resilient infrastructure. The Commission has released its preliminary report which includes concepts to address the risks to wastewater infrastructure posed by floods, coastal surges and power outages. Find the report at: http://www.governor.ny.gov/assets/documents/NYS2100.pdf.

In the State of the State address, as it related to NYSDEC and superstorm Sandy, Governor Cuomo emphasized:

- Lowering the emissions cap on the Regional Greenhouse Gas Initiative, with proceeds being used to re-power existing power plants and to strengthen natural and built infrastructure to better prepare for storm events like Hurricane Sandy.
- Building smarter with resiliency by exploring enhanced engineering criteria for new, expanded or rebuilt structures. This will include programs to enhance resiliency by such steps as elevating structures, using flood-proof engineering criteria or incentivizing the purchase of flood damaged residences in very hazardous areas.
- Strengthening coastal protections by filling in low spots where many dunes, which acted like protective levees for coastal communities, have washed away.
- Examining the full range of "hard" and "soft" infrastructure measures available to protect New York Harbor that could together operate to establish multiple barriers of protection.
- Improving wastewater treatment systems with direction to fix and build heightened resiliency in them. This means taking immediate steps to address sensitive infrastructure and implementing engineering asset management plans that provide a blueprint for resiliency. The Governor stated his interest in implementing disinfection systems, coupled with backup power, at "vulnerable" plants to prevent large pathogen discharges during outages.

Governor Cuomo has estimated that approximately $30 billion will be allocated to New York under the federal Sandy relief package. This means a lot of potential funding to get this work accomplished.

Recent storms have sent everyone a strong message. Part of that message is that wastewater treatment facility operators need to achieve resiliency for storm events and rising waters. The NYSDEC is committed to helping in this important effort.

– James Tierney, Assistant Commissioner for Water Resources
NYS Department of Environmental Conservation

Focus on Safety | Spring 2013

Not to Repeat History

Two of the greatest advances in public health have been the improvements to the drinking water supply and in wastewater treatment. Historically, drinking water was given priority over wastewater because a connection had been made between "dirty" water and disease. Beer, not water, was the common drinking beverage because people observed water could cause sickness while beer did not (except for possible intoxication). In beer making water is boiled, however, the scientific basis of sterilization was not yet understood. Therefore, the common solution to pollution, whether human or craft waste, remained dilution by the rivers. The prevailing wisdom was that rivers had a natural purifying ability and that the waste would eventually disappear.

Eventually, industrial development and society reached a level in which the simple removal of wastes into a common water body became untenable. With treated piped drinking water unfortunately also came increased wastewater volume. Water piped to the rising number of water closets overwhelmed the traditional privy pits or cesspools, precipitating disease outbreaks – something safe water systems were supposed to eliminate. The death rate, which had been on the decline due to clean drinking water, was increasing due to poor sanitation conditions. This helped spur construction of sewerage systems to remove the filth from the neighborhoods, but the problem was still piped straight into a waterway. The traditional approach of only treating the water supply and not the wastewater continued well into the 20th century.

The industrial expansion that began in the late 19th century brought its own challenges to drinking water safety. For ages, industries were sited on waterways to provide a direct conduit for their untreated process waste, and their continued development and use of complex chemicals created additional stressors to municipal water supplies. The cycle of increased mortality and morbidity from the previous century repeated itself. At the same time, interest in environmental conservation increased to tipping point levels. By the middle of the 20th century, the time was ripe for change.

Anti-pollution laws and improvements to treatment technologies have provided clean drinking water, easier treatment and protection of the environment. As someone with responsibilities in the industrial wastewater treatment sector, I can attest to the time and attention needed to comply with these regulatory requirements, the importance of remaining an environmental steward and in promoting strategic thinking so as not to repeat the past.

– Eileen M. Reynolds, Certified Safety Professional
Owner, Coracle Safety Management

Comparing Municipal to Industrial Wastewater Treatment

by Jim Cunningham

Most operators either manage a municipal wastewater facility or an industrial one, but not both at the same time. I own a water/wastewater management and consulting company that, for nearly four decades, has operated both industrial and municipal WWTFs simultaneously. My company's industrial treatment clients comprise those with direct discharges (regulated by State Pollutant Discharge Elimination System permits), as well as discharges into municipal systems (regulated by a municipality's Industrial Pretreatment permits). I also manage municipal wastewater treatment systems with and without significant industrial contributions and discharges.

Clearly, moving from one project to another has afforded me a wide ranging perspective. My experience sitting on both sides of the table – representing the regulated industry and the municipality/regulator – gives me the benefit of understanding the challenges that confront these contrasting partners in wastewater management.

Profitability Always Key

Successful industries have to be razor sharp at a wide range of business management activities to remain sustainable in a challenging, competitive global marketplace. Few industries stay in business very long if they are not profitable.

A wastewater treatment system can be a significant expense for an industry, so industrial owners typically desire to minimize this expense. Many industries producing wastewater have located near municipalities that can accommodate their wastewater needs. Studies by the US Environmental Protection Agency have shown this cost is significantly lower than having to construct and maintain their own wastewater facilities. The federal 1972 Construction Grants Program had incentives for municipalities to build in "excess capacity," which made it feasible for many municipalities to accept industrial wastewater for a fee. In many cases, this fee has offset the cost of treating a community's wastewater – creating a win-win for both entities. In most cases, regulators encourage industries to discharge to municipal systems if the municipal system has the capacity available. It is often more beneficial for an industry to provide the required pretreatment for its more complex wastewater constituents and then discharge to a publicly owned treatment works (POTW) than attempt to obtain a SPDES permit for direct discharge.

In the 40 years since the Construction Grants Program began, much of the POTW capacity has been used up. So, what is next for industries and municipalities?

Municipal waste-based surcharges to commercial and industrial facilities for biological oxygen demand (BOD) and total suspended solids (TSS) typically range from 12–28 cents per pound, depending on the municipal plant size, process and available capacity. As municipal treatment facilities age and reach their capacity, industrial waste-based surcharges are likely to increase which, from a cost perspective, may tip the scales for industries to consider the cost effectiveness of constructing their own wastewater facilities with a direct discharge. Without new federal funding to replace aging municipal facilities, it's likely that POTWs will no longer be able to accept non-municipal wastewaters – an arrangement which had supported much of the industrial development from the 1970s to today.

Photo by Jim Cunningham

This photo shows an expensive repair taking place on a leaky sewer line in a municipal system.

Contrasts and Similarities in Treatment Systems

Many industries are not located near a municipal system, so they construct and manage their own independent treatment systems. Managing an industrial wastewater facility is vastly different than managing a municipal system that collects the majority of its wastewater from residential users. There are as many different types of industrial wastewater facilities as there are different types of industries and products. Typically, there is only a handful of municipal technologies commonly employed for treating domestic wastewater. To list the different types of industries and their treatment methods here would be endless. So, for an apples-to-apples comparison, I will describe industrial systems that use similar treatment methods to most municipalities.

Most industrial systems that produce a biologically degradable wastewater with limited chemicals in their discharge utilize activated sludge systems similar to most municipal systems. Most industries have to augment their treatment processes with additional upstream and downstream treatment components, depending on the industrial wastewater makeup and discharge requirements. Unlike an old, leaky underground public sanitary sewer system, industrial

continued on page 14

continued from page 13

Photo by Jim Cunningham

A New York brewery where beer fermentation tanks generate yeast wastewater and tests occur for organic loading to the wastewater system.

wastewater is usually collected from the manufacturing site all within the manufacturer's buildings. Industry does not suffer from the uncontrolled hydraulic impacts from groundwater leaking into its pipes, or wet weather storm events. With my municipal operator hat on, I am on guard when a large rain event is about to happen. It is not a concern for an industrial facility. Piping on the inside of a building is also much easier to modify and repair, and the cost to do so is far less than finding leaks and repairing a sewer system under streets.

Industrial wastewater production can have significant flow peaks and organic loading spikes that match variable manufacturing production schedules. Industries typically use an equalization and/or neutralization holding tank to help adjust for pH, temperature, food augmentation, nutrient addition, mixing, pre-aeration, pre-oxidation and, sometimes, chemical precipitation. This is a big advantage that a municipal system typically does not have designed into its facility due to the very large flow a municipality processes daily. Although I have seen a few municipalities with flow equalization tanks to help shave peak wet weather events, they certainly are not the norm because of their expense.

I have found that a well-mixed flow equalization tank that holds approximately one day's industrial production can be extremely useful to the treatment plant operator. A single grab sample of the day's mixture from the equalization tank can be tested for target control parameters, allowing the operator to set feed rates to the next process treatment unit based on load, not just on flow. One can also capture a spill and contain it, or treat it, before allowing it to enter other process units. Numerous times, I've observed surface oils and been able to skim them off the top to prevent the oil from entering the biological process. Simple visual observations, such as color, foam, odor and floating objects, can provide a quick read of a potential problem. Most municipal operators do not have the luxury of this tankage, and the subsequent data for process control.

Waste Flows: The equalized and neutralized industrial wastewater is typically flow paced based on the concentration of the organic load retained in the tank. The goal is to provide the downstream biological process with a wastewater that is biodegradable, nontoxic, and has a consistent organic load to enhance biological assimilation without spike loading. Although the industrial wastewater flow volume is usually much less than what a municipal system experiences, the organic loading can be very concentrated. As an example, one industrial facility has an average flow of 100,000 GPD with an aeration basin equivalent to a 10 MGD municipal facility. It sometimes seems quite strange to see a two-inch influent pump feeding a massive multi-million gallon aeration tank with a 500 hp blower, followed by a 20-foot diameter, tiny final clarifier. As an industrial troubleshooter, I find it important not to make comparisons to municipal facilities from both a design point of view and process management perspective. I have observed municipal industrial pretreatment inspectors making some rather outlandish judgments based on their municipal treatment points of view.

Temperature Shifts: Wastewater temperature entering most municipal facilities is fairly constant with gradual, seasonal changes. Industrial wastewater temperatures can have drastic swings. These temperature swings can impact operations by causing changes in the bioreactors that microbiology cannot tolerate, impacting dissolved oxygen levels and soluble oils. These in turn can cause biological inhibition. The biology can invert within a clarifier as a result of a sudden temperature shift. Effluent temperature violations can also occur. A loss of temperature can also be experienced when an industry closes for Christmas vacation or takes a production line down for maintenance. Cold winter periods with a sudden loss of temperature in an industrial wastewater facility can have negative results on a biological process, especially if nitrification is required. At one industrial facility, 50,000 round plastic balls that float were added on the activated sludge tank's surface to help retain temperature *(see photo page 15)*. They work very well as a floating insulation blanket. Another industrial wastewater facility has a steam heating system diffused into the flow equalization tank that controls the equalization wastewater temperature before going to the biological process. In this, the temperature can be set and held constant, which is outstanding for growing microbiology, but not outstanding from an energy cost point of view!

Good and Bad Sludge: Sludge at an industrial facility can be an extremely variable product. A food processor, like a brewery, could compost its biosolids to produce a product that is easily marketable (i.e., agriculture and landscaping) with little downside. A municipality, however, could perform the same composting process but, with the potential pathogen risks, can create a negative public response. Another industry with heavy chemical usage may produce a sludge that might only be accepted at a hazardous waste landfill.

Industrial dischargers quite often impact the sludge disposal options municipalities may have. Strict pretreatment standards not only have to insure that industrial wastewater products do not make it into the receiving waters (pass through), but also that municipal sludge does not become concentrated with the ever-growing list of heavy metals and inorganic, synthetic, volatile and organic carbon compounds.

A mysterious sludge problem arose when a wastewater facility for a nuclear power generating site piping in only domestic sanitary wastewater had tested its aerobically digested dewatered sludge and found radiation that should not have been present. There was no piping connection into the secure side of the reactors. After a great deal of study, it was found that the dust on workers' shoes brought minute particles over from the secure side. The floor mop water collected it and the wastewater facility concentrated it in the

digesters. Just adding sticky pads on the floor to each of the portals helped fix this problem.

Product Related Impacts: While municipal operations tend to be fairly constant over a period of time – except for the occasional large wet weather events creating huge flow peaks – industrial wastewater facilities are impacted by manufacturing cycles and the addition or loss of products. At one industrial facility, for instance, the production and resulting treatment plant was primarily focused around a high volume process for dying cloth. The treatment plant received a substantial flow and organic loading seven days a week. Offshore, competitive price pressures suddenly forced the manufacturer to shut down the cloth dying production line. You might think that the wastewater plant operator would be elated, not having to manage such a high volume and high strength wastewater – but it was just the opposite. The wastewater facility was now so large that the biological process did not work in the same single large aeration basin. The heat from the former process kept the wastewater plant warm which enhanced the biological process. The sudden loss of the dye process wastewater created an entirely new chemical matrix and the loss of heat – both had negative impacts on the biological process almost overnight. For the short term, the wastewater was heated and dog food was added to keep the process alive until structural changes could be made to the existing process. This took about a year to finish and tons of dog food. (No, the biology did not start to bark!) The plant's new configurations worked well until one day a new product line was added by the industry, which meant a total reconfiguration of the plant's wastewater treatment again. Never a boring moment for the industrial operator!

Municipalities without significant industrial input do not have to think about reconfiguring their plants; although, recently, I have witnessed a few municipal plants that have each lost a large industry, causing them similar situations with too much plant capacity and a huge loss of revenue.

Regulatory Standards: I have observed that regulatory inspectors tend to hold industrial wastewater facilities with direct discharges to a higher standard than municipal facilities. This is likely because industries tend to deal with more toxic chemicals. Industrial SPDES permits require a greater level of monitoring with a larger list of compounds that are strictly regulated. Analytical testing costs are often much higher at an industrial direct discharger. The potential environmental risk that an industrial direct discharger poses as a result of manufacturing (with chemicals, production variability and spills that may take only minutes to arrive at the treatment plant) is justification for regulators to ensure proper systems are employed to manage releases effectively. I believe the public mistrusts manufacturers due to past events like Love Canal and numerous other chemical discharges into the environment. Recently, New York State has made great efforts, at great expense, to remove the accumulated toxic sediments on the bottom of its lakes and rivers. On the other hand, I have worked for industries that have safeguards and treatment systems that outspend and outperform municipal treatment facilities many times over.

Management Methods and Job Dynamics

I had signed an agreement with an industrial client and operated the facility for about one month. One day I was headed to its aeration basin to grab a sample and I was met with 10 feet of foam on the basin. The foam was red and blowing into the parking lot. I have seen that much foam on initial startups of new municipal wastewater plants, but not a red foam which was stripping the paint off the cars in the parking lot! I immediately called my contact

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Photo by Jim Cunningham

Plastic balls placed on top of an activated sludge bioreactor tank at a pharmaceuticals wastewater treatment plant form a floating insulation blanket helping to retain temperatures.

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inside the manufacturing plant who claimed that he did not know of anything in production that was red that was spilled. (Sound familiar?) After a week, the process was back growing successfully, when it happened again. This time my inside contact was on vacation. I was transferred to his assistant who had recently had her car repainted and was under the impression I was responsible for the recent foaming event. The initial conversation was somewhat edgy, when I asked, again: "What product do you have that is red and recently discharged to the treatment facility?" To my surprise, she replied that several products are red. "Let's go walk around and see if there has been a spill," I advised.

Team Coordination: That day started a long relationship linking the wastewater plant managers with the production managers. Daily meetings to review production schedules and specific products, allowed the treatment operators to become proactive instead of reactive, resulting in full permit compliance (and no more cars had to be re-painted!). In my opinion, to improve industrial treatment plant management, it is important to become an integral part of a team formed between manufacturing and wastewater treatment management.

It can be difficult for a municipality to create a team relationship like this with large industrial dischargers; however, such a team can materialize with a great deal of effort to establish and maintain it. Industry may look at a municipality as another regulator that wants to increase its expenses. It's essential that the municipality understands the industry's production process and products, making an effort to promote a team approach. This often results in the industry understanding the municipal operator's issues and the impacts of spills and production changes on the municipal facility. For example, I encourage and set up meetings and tours at the wastewater plants I manage with local industries. This coordinated extra effort makes a big difference, and has been successful at solving problems that keep occurring without the added face-to-face time. Industrial managers usually call me when they have a spill because they know it helps us to take a proactive measure at the municipal plant they use. If one makes the effort to work with an industry but still receives the same type of response I received from the person who said his facility had "no such red product," the only option may be to kick-start enforcement capabilities. While this is not the preferred method of gaining compliance, it may get the industry's attention and, if handled properly, begin a positive working relationship.

Working Conditions: Employee working conditions at industrial versus municipal facilities can be quite different. Industrial chemicals create a higher level of concern for the industrial plant operator, as illustrated by the red dye that stripped paint off cars. Respiratory exposure can be a higher concern at an industrial facility as well. Spills and the mixing of chemicals together can create off gasses for which the industrial plant operator must keep a constant watch. Municipal operators have the potential for a higher level of bacterial exposures and deadly sewer generated gases that may not be as prevalent at an industrial facility.

Another observation is that industrial plant operators are typically paid at higher rates than municipal plant operators; yet, industrial pay benefits are not as good as municipal pay benefits. Also, industrial job security is not as stable in the long term. What perplexes me is that industrial operators, who often deal with much more complex and wide-ranging chemical treatment processes, are not mandated to be certified as industrial wastewater operators unless they treat domestic wastewater at direct discharge industrial facilities. Many extremely complex industrial pretreatment plants which discharge into municipal systems are not required to have operator certification either. In my opinion, this is an oversight by regulators. Ironically, I have been hired by a number of the larger industrial manufacturers to provide operator training at their plant sites. Most of the larger industries will spend much more money on training than municipalities do.

My experiences at both industrial and municipal treatment facilities are that the operators always want to produce the best effluent that they can; however, poor plant design, lack of training, inadequate equipment, lack of tools, or lack of sufficient funding can make these jobs more difficult for some than for others.

Procurement Policies: One aspect of managing an industrial facility versus a municipal facility is the procurement policies for purchasing new equipment and supplies. Municipalities are required to obtain a number of bids or quotes to purchase equipment. Writing bid specifications, sometimes involving engineers and attorneys, with advertising, reviewing and awarding to the low bidder can be costly and time consuming. In contrast, most industries look for the best equipment that will be reliable and will last to insure their production is not impacted. Quite often, it is not the low bid item that an industry will purchase. Such bidding may result in lower short-term costs, but when reviewed over a long period, the higher quality equipment that most industry purchases tends to be more cost effective and avoids lost down time. It also takes less time and money to procure – so they receive what equipment is needed, when needed. State municipal law sets requirements that must be followed, and I always comply with the low bid requirements for municipal facilities but, like the old saying goes, "You get what you pay for."

Future Outlook

I am hopeful that American industry will start to outperform competitors globally, and there will be a resurgence of industry in New York State. This state has enormous water resources that industry will need as global climate change occurs and other areas suffer from dwindling water supplies. At the same time, because clean and abundant water is so important for the production of goods and services, we need to stay vigilant in mandating that the best technologies be used for pollution free discharges from both industrial and municipal treatment facilities. A good industry in a community is a blessing that can provide many good paying jobs for generations; but at the same time, handling their wastewaters can be a real burden to the municipal operator without sufficient capacity or good coordination with the manufacturer. Without adequate water and wastewater infrastructure and capacity, there will be limited industrial growth.

It is certainly worth the effort to properly fund and maintain wastewater treatment infrastructure, and to pass along operator know how. Whether you are an industrial or municipal facility manager/operator, the economic future depends on clean water for growth and a healthy environment. Although industrial and municipal manager jobs may differ, the individuals in them hold the same goals in mind – producing clean water for future generations to use and enjoy.

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Genesee Valley Chapter Industrial Issues Committee – Mission of Service and Relevance

by Gretchen Wainwright, Libby Ford, Harry Reiter, Marshall Shannon and Jason Zwetsch

The Clean Water Act, Resource Conservation and Recovery Act, Toxic Substance Control Act, Occupational Safety and Health Act – these and other regulations, along with a company's own safety plans and policies, seem endless. The point person in a company responsible for ensuring regulatory compliance can also be faced with varying interpretations of the rules given by the regulators themselves. Understanding and mapping out the path to compliance, therefore, can be a real challenge.

For over 30 years, members of the Genesee Valley Chapter of the New York Water Environment Association (NYWEA) have turned to their Industrial Issues Committee (IIC) to help solve some of these dilemmas. The IIC helps members stay up to date with pending legislation, be aware of the environmental programs of fellow businesses and industries, network with regulatory staff, and develop relationships with and learn from consulting firms – all helping individuals and their programs to succeed.

What has allowed the IIC to thrive for over three decades?

Early History of IIC

The Genesee Valley Chapter's IIC has been in existence since the late 1970s. The early history of the committee is best remembered by Libby Ford of Nixon Peabody LLP. Ford met Emil Zenie, Monroe County's first Supervisor of Industrial Waste, in New York City in 1978 at a US Environmental Protection Agency (USEPA) educational session on Industrial Pretreatment regulations. Learning that Ford also hailed from Rochester and was a member of the New York Water Pollution Control Association (NYWEA's precursor), Zenie invited her to join the local NYWPCA Industrial Wastewater Committee (IWC), as the IIC was known then.

From the start, the committee's emphasis was on providing low cost, high quality educational seminars for local industries generating wastewater. At the time, two of the most active members in the IWC were regulators Zenie and Dennis Sugumele, a water engineer with the NYS Department of Environmental Conservation (NYSDEC) Region 8. Sugumele and Zenie initiated the IWC's long history of collaboration between the two agencies – NYSDEC and NYWPCA – that shared regulatory interests for local industrial wastewater dischargers. Both gentlemen firmly believed that because the State Pollution Discharge Elimination System (SPDES) program and the Industrial Pretreatment Program were fairly new, local industry needed to have access to training specific to the emerging regulatory requirements. As a result, a series of semi-annual seminars were launched.

Training and Meeting Initiatives: The committee invited as many local industries as possible to these training seminars. Rather than limiting the training to just current NYWPCA members, they obtained lists of SPDES permit holders and indirect dischargers from NYSDEC and Monroe County, respectively. Through these seminars, early committee members began to recruit membership from both industry and local consulting firms and to expand the focus from hosting not only seminars but also regular meetings focused on information sharing. From the start and continuing today, IIC members were encouraged to join NYWPCA (or later, NYWEA), but it was not a condition of the committee's membership.

The group quickly found that, in addition to planning seminars, there was great benefit in sharing experiences. This exchange became important enough to IIC members that they established bimonthly meetings formatted on what is termed the "roundtable," where everyone attending is given an opportunity to talk about recent successes, challenges and lessons learned. Over the years, stories have been shared on such topics as: what USEPA and NYSDEC are looking for during inspections; new spill prevention and response requirements; the state and federal hazardous waste regulations; European import requirements for products containing potentially hazardous materials; and, the hiring and training of new environmental, health and safety employees.

IIC Today

Today, the location for the IIC's bimonthly meetings rotates to various members who have the facilities and resources necessary to accommodate a group of usually 20 to 25 people. The agenda for each morning meeting is structured to begin with a substantive roundtable discussion, followed by regulatory updates, subcommittee reports and routine committee business. The group atmosphere is purposely informal, and the positions of chair and vice chair are filled by volunteers for a period of one calendar year with the vice chair assuming the chair position as it is vacated. Subcommittees are formed as needed to address issues or activities in which the committee has an interest.

Photos by Paul Micciche, AECC

Scenes from the popular Air and Waste Management Association (AWMA) joint seminar with the Genesee Valley NYWEA Chapter held last February

Photos provided by Harry Reiter, Monroe County DES

At an IIC-sponsored field sampling event, one author seen here, Harry Reiter (red jacket, top left and middle photos), takes measurements for the width and velocity of an area creek before collecting and identifying macroinvertebrates, such as water penny, stone flies and black flies, with other chapter members (Cynette Cavaliere, Ann Kupferschmid), their children and other volunteers.

The November meeting serves to close out the calendar year, and committee positions, meeting dates and locations are set for the upcoming year. This information is distributed to an extensive list of contacts, allowing interested individuals to set aside time on their calendars well ahead of the meetings.

The committee's finances are managed by the NYWEA Genesee Valley Chapter treasurer. The IIC also relies on the chapter for its web presence, maintenance of the mailing list, and distribution of news and event announcements.

Special Programs: From its inception, the IIC has undertaken numerous initiatives to benefit its members, the surrounding community, and environmental professionals. Each fall, the IIC hosts a technical seminar specific to the interests of industrial environmental health and safety (EH&S) managers. In February, the IIC partners with the local Air and Waste Management Association chapter to host an annual environmental conference in Rochester. This event attracts over 250 environmental professionals and 35 vendors from throughout New York State, and has become one of the premier environmental conferences in the region.

A portion of the proceeds from these events is directed into community grants and academic scholarships. The community grants are made available to local not-for-profits to support activities that promote environmental awareness and good works. Funds are also donated to a local college to support scholarships for students pursuing a degree in environmental sustainability and management. Committee members also donate time to a variety of community efforts, involving everything from trail maintenance to watershed monitoring. All of these activities are designed to enhance networking among members, promote environmental awareness, and give something tangible back to the community.

IIC Recognitions: Since 2002, the Industrial Issues Committee has annually recognized industries geographically located within the Genesee Valley Chapter's purview for outstanding environmental performance related to their wastewater discharges. Early each year, the Environmental Performance Gold and Silver Awards are presented to industries that are in 100 percent or 99 percent compliance, respectively, with all discharge limits required in their Publicly Owned Treatment Works and/or SPDES Permits for the previous calendar year. As many of these permits contain multiple outfalls, include discharges of both wastewater and stormwater, and each outfall can have dozens of limits, achieving 99 percent compliance is no small task. A few local industries have achieved the Gold Award for several consecutive years, and this award not only serves to highlight their incredible efforts, but also encourages them to continue their stellar performances.

Successful Membership: An organization like the IIC could not continue to exist, let alone prosper after 30 years, unless it was doing something right. So what are its secrets and how can other NYWEA chapters emulate its success?

It may be a bit of a cliché, but one of the most important ingredients for success throughout the IIC's history has been its people. The IIC has consistently had a core group of individuals who have committed both the time and effort necessary to make it successful. As responsibilities and careers change, so have the central figures. Since everyone who participates in the IIC understands the pressures that environmental professionals face, variable levels of participation are considered normal, and justification for changing roles in the IIC is never necessary.

"Just come when you can and do what you can, when you can," best describes the IIC's philosophy.

The IIC is comprised primarily of industrial EH&S professionals, with members working for all types of organizations, including regulatory agencies, industry, municipalities, consultants, laboratories and academia. The diversity of information and resources

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brought to bear by IIC members means there is something for everyone, and rarely does one leave a meeting without having learned something of value or, more importantly, having provided something of value to another member. In addition to the diversity of participation and information sharing, another key element for success is the non-threatening atmosphere during meetings and among committee members. The IIC meetings bring together professionals who can often be on opposite sides of the table – i.e., regulators and the regulated, potential business competitors, and industry and NGOs (non-governmental organizations). However, all IIC members are on equal ground during meetings. Individual egos and potential conflicts are "left at the door" and replaced with a spirit of collaboration in support of IIC's mission and for each other. No topic is truly out of bounds, though members often have to remind themselves that the focus of the meetings is wastewater.

Obtaining assistance or getting answers to questions is also not limited to scheduled meetings and events. The relationships formed are such that members are willing to help at any time. If asked, many IIC members would undoubtedly refer to other members as friends, not simply colleagues.

Even with the collaborative and diverse atmosphere of meetings, the IIC would not continue to thrive if the members and participants did not find value from it. Participation in IIC's seminars, Water Watch (field sampling) events, award and scholarship programs, and bimonthly meetings enhances the visibility of participating companies and helps them to connect with their communities. Many companies today have quality, safety or environmental management systems in place that require continuous improvement. The IIC provides an opportunity not only to learn from experienced professionals about what improvements are the most valuable to make, but how to implement them as well. It is probably safe to say that people participate because they want to learn and they want to help others.

Future Challenges of IIC

When the IIC started in the late 70s, social networking platforms like Facebook, Twitter, LinkedIn and Skype did not exist. In fact, desktop computers were only beginning to become available, and the capabilities of today's smart phones were unimaginable. If you wanted to participate in a learning-based discussion, you met in person. In today's fast-paced world of electronic communications and short sound bites, networking is a skill that is rapidly being lost. Many young professionals equate networking with the number of "connections" one has.

Over the course of the past 30 years, the association's name – formerly NYWPCA, now NYWEA – and the committee's name – once the IWC, now IIC – have both changed to reflect changes in technology and member needs. Since most industries and municipalities now have well developed treatment and compliance programs, the IIC recognizes that it will also need to continue to change if it is to provide future value to members. As Charles F. Kettering, an American inventor, engineer and businessman, once observed: "The world hates change, yet it is the only thing that has brought progress."

While the core of the IIC is strong and its seminars are well attended, recent bimonthly meetings have failed to attract new attendees. New members are needed so that the committee does not become stagnant or eventually break down.

As done in the past, the IIC is continually looking into changes that will keep the value added experiences going for years to come. Suggested changes have included the frequency of meetings, establishing meeting-specific topics of discussion, and scheduling presentations on subjects of interest. The committee may also once again change its name to keep up with its ever-evolving mission. The term "issues" in the name may imply the committee only exists to solve immediate problems, and if one doesn't have an issue that needs to be fixed, one does not need to attend. Regardless of the name, the current focus on industrial wastewater technical and regulatory topics, and regular face-to-face meetings and events will remain.

Most importantly, members are making changes to increase the involvement of young professionals and college students in the IIC. As wastewater professionals, we are all aware that veteran, experienced wastewater employees are retiring at rates faster than they can be replaced. In a NYWEA November 2012 Succession Planning white paper, it states: "Their loss has created voids in leadership, skills and technical experience." The white paper also reported that, "Recruitment is a very broad issue covering many different levels. One level of recruitment is knowing simply *where* to look for candidates."

The IIC is in a key position to point students in the direction of careers in the wastewater treatment field. The first step in getting students involved is getting them interested, and showing them the jobs will help do that. Industry and groups like the IIC can certainly assist. Many college programs offer students the opportunity or require them to work co-op jobs prior to graduation. For example, the Rochester Institute of Technology requires the equivalent of two semesters plus one summer's worth of paid co-op experience as a graduation requirement for students majoring in Civil Engineering Technology and Environmental Sustainability, Health and Safety. Fortunately, the Monroe County Department of Environmental Services has been providing co-op positions for students in many different job functions for a number of years.

However, these few positions are not enough. Moving forward, the IIC can play a more active role in encouraging industries and municipalities to provide co-op positions that are related to wastewater management and treatment.

The Genesee Valley Industrial Issues Committee was born of a need to promote cooperation and understanding within the environmental community. By encouraging an open discussion of the issues faced by local industries, the committee promotes environmental compliance and, frankly, bottom line profitability. Antagonistic or adversarial relationships only foster mistrust and leave each EH&S professional adrift in a sea of environmental regulations. For over 30 years, this group has worked to make the region a better place to live and work and it looks forward to many more years of the same.

If interested in forming an industrial committee through a NYWEA chapter, please feel free to contact any of the authors listed below, or join them at a chapter event. Meeting information can be found at www.nywea.org, under "About NYWEA" (then select: Chapters-Genesee-Industrial Issues). Committee members look forward to meeting more of you soon!

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Membrane Bioreactors and Thickeners – Comparisons to Conventional Plants and Benefits

by Thomas Carmody

Membrane bioreactors (MBRs) and membrane thickeners (MBTs) are gaining widespread acceptance as a result of a number of benefits realized over their 20-year history in wastewater plant applications. Of the over 3,500 flat plate MBRs and MBTs sold in the world, 160 have been purchased in the US with 20 in New York State. This is due in large part to the continuing evolution and understanding of membrane technology by the engineering and end user communities.

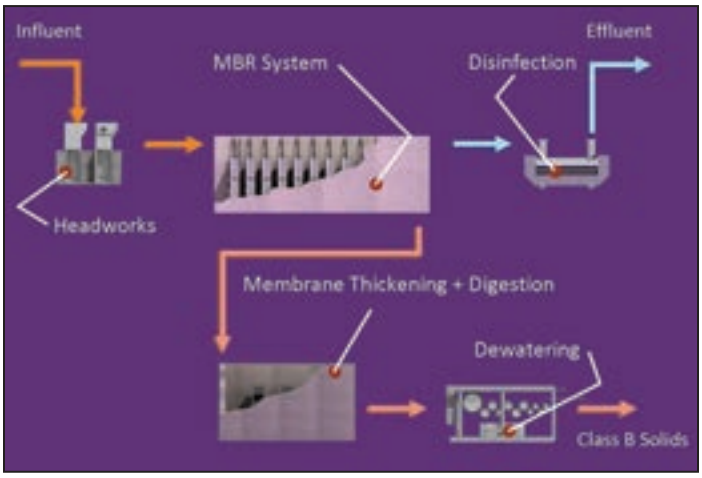
MBR Systems

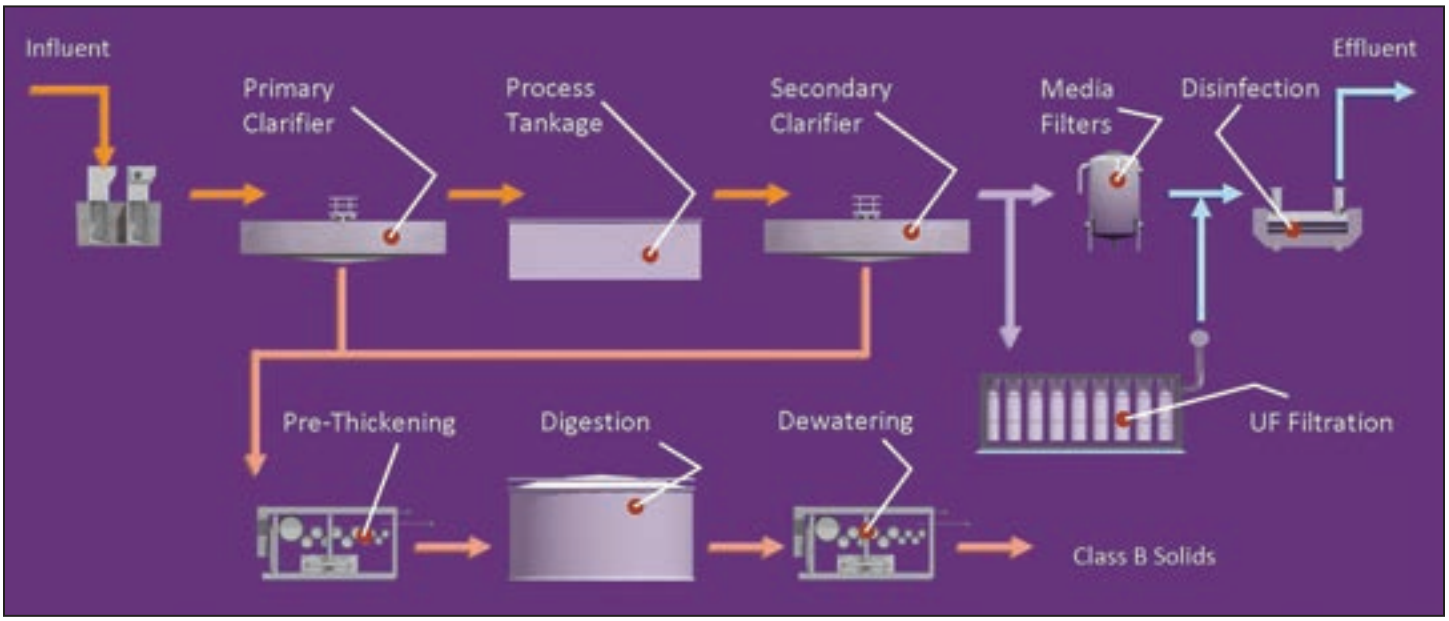
Membranes of various configurations have become accepted as part of the array of options for process technology utilized by process engineers in municipal and industrial applications. One option that has become increasingly common in New York State and around the world is the use of a membrane that is integrated with the biological process, called a membrane bioreactor, or MBR.

The MBR process utilizes the same basic biological process as a conventional aeration system which is shown in ***Figure 1***. However, with the MBR, the membrane is inserted into the aeration basin and, in doing so, eliminates the need for the secondary clarifier and tertiary filter, as shown in ***Figure 2***.

By elimination of the secondary and tertiary filter, significant complexity in the process operations is eliminated, and footprint and construction costs are minimized. With conventional aeration plants, the traditional upper limit on mixed liquor in the aeration tank is limited by the ability to separate and settle solids in the clarifier. With the MBR there is no settling process associated with the secondary clarifier, no worries about sludge characteristics and the ability to settle. Consequently, the aeration process can be operated at much higher solids levels in the mixed liquor. Therefore, depending upon the type of membrane, the mixed liquor in the aeration tank can be increased from the level in a traditional process of 3,000 mg/L to as high as 15,000 mg/L in an MBR, thus reducing the foot-print of the aeration basin proportionally to the increase in mixed liquor. Without the primary clarifier, and the need for secondary or tertiary filters, the plant foot print requirements are further reduced.

As a result, MBR processes have small footprints and high mixed liquor, which are two of the primary features that define the wastewater treatment process. The small footprint allows the MBR to be designed into places that other processes will not fit so that the process designer can "hide the plant in plain sight." The compact footprint advantage has also been used in retrofit scenarios. Membranes are inserted into existing aeration tanks or clarifiers to bring mixed liquor concentration up and allow two to 2.5 times the processing output from existing tanks while improving the discharge limit – adding total nitrogen (TN) or total phosphorus (TP) limits, for example. This added feature of increased mixed liquor level has proven to provide the benefit of a more robust process for highly variable feeds and flows or high strength wastewater, such as industrial wastewater.





Courtesy of Ovivo USA, LLC

Above, Figure 1. A conventional aeration system simplified flow diagram. Above right, Figure 2: A membrane bioreactor (MBR) and membrane thickener (MBT) simplified flow diagram

Membrane Thickeners (MBT)

One unique feature of the flat plate membrane is that it can handle high mixed liquors from 35,000 to 50,000 mg/L MLSS (mixed liquor suspended solids). As a result, the flat plate systems have also evolved into an application called a membrane thickener (MBT) to concentrate waste activated sludge (WAS) from MBR discharge or conventional activated sludge (CAS) plants. The same membrane is utilized to concentrate WAS from the MBR discharge concentration of 1.0 percent to a final concentration of 3.5 percent. In the case of a CAS plant, the MBT would take the WAS at a lower concentration 0.03 percent solids (3,000 ppm) and concentrate the WAS up to 3.5 percent without the use of polymer. Some plants who pursue sludge reduction to reduce hauling, concentrate their sludge as high as 5 percent total solids (TS). This process can be integrated with aerobic digestion to produce Class B sludge and can be done for small plants prior to hauling or for large plants prior to dewatering with considerable benefit.

Two examples of small MBR footprints are shown in ***Figures 3*** and ***4***.

MBR Components and Integration

There are several critical components to the MBR and MBT systems. The most critical component of the system is the membrane itself. ***Figure 5A*** shows a single unit filter and ***Figure 5B***, a submerged membrane unit (SMU) by the manufacturer, Ovivo. These possess flat plate membranes that have 0.2 micron nominal pore size. The SMU membranes are actually submerged into the aeration tank.

There are other configurations, including hollow fiber and tubular. Some membranes have tighter pores, known as ultrafiltration. Some membranes are mounted externally – meaning they are not submerged in the aeration basin.

Another critical component of the MBR system is the fine screen. Screening requirements for different membrane configurations will vary and range from 1mm to 3 mm depending on the membrane configuration and the manufacturer. A dual continuous screen (duty and standby) without bypass is required to prevent large solid particles from getting into the membrane, as shown in ***Figure 6***. This is a critical cost factor and one that needs to be carefully considered when designing an integrated facility.

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Image by Ovivo USA, LLC

Figure 3. This 90,000 GPD MBR plant fits into a 48-by-36-foot building. This building includes the fine screens, process tanks, control room generator set and all equipment, enclosing the entire plant.

Image by Ovivo USA, LLC

Figure 4. This shows a plant designed for biological nutrient removal limits and cold weather operation (influent temperature is 8 degrees Celsius). Its hydraulic capacity is 265,000 GPD and the effluent from the plant is recycled. This design has process tanks outside and equipment inside with a footprint of 59-by-54 feet for the process tanks.

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Beyond the screens and the membranes, each supplier will have a unique configuration of tanks that will integrate with the membranes. Since membranes come in several different shapes, the resulting processes (tank sizes, etc.) will be different. Therefore, the overall process must be evaluated as a whole at the start of the engineering design. It is often best to pre-select the vendor based upon a pre-selection criteria that includes installed cost, operating cost, experience, operational considerations and other strategic considerations that the end user would like to weigh into the selection. Once the pre-selection has been made, the engineer can do a more complete job of engineering the project around the selected vendor. The MBR vendor selected must be held accountable to the preselected capital cost figures. Pre-selection can be done formally on larger projects or informally on smaller projects.

The MBR installations in New York have a wide range of flow from 10,000 to over 1 MGD. They have a broad array of applications, with installations in the New York City watershed, municipalities and developers, along with several others. There are also nearly as many industrial applications, including dairy processors, pharmaceutical, toothpaste, nutrients and brewery wastewater. The higher strength wastes from these applications have loadings ranging from 600 COD (chemical oxygen demand) to 15,000 COD.

With new larger flow, lower profile membranes, large flow plants are now in design outside of New York State with systems for up to 39 MGD (with peak flows up to 85 MGD), and others installed and operational up to 24 MGD. Many plants are operational in the 2.0 to 20 MGD range, with more in design with the larger flow, lower profile membranes now available.

Typically, MBRs are selected because of these important factors:

- **Proven Technology:** The early MBRs which had so much promise also had an Achilles heel – the risk of the membrane life. Today's flat sheet membranes have a proven life in excess of 10 years. So when doing life cycle costs, engineers and end users should be assured that the risk associated with the membrane is limited. A critical factor in the selection of a vendor is being aware that there are many new entrants jumping into the market and not all membranes have the same track record, so do your research. Check multiple references from *older* plants and visit plants to ensure that membrane life is not an issue. Don't be afraid to factor in different membrane histories with different membrane suppliers, reflecting their market performances. A new supplier may have a lower capital cost but holds a higher risk due to unknown membrane life. Do not assume at this stage of market development, that all membranes are the same or can promise the same membrane life.
- **Cost Competitiveness and Meeting Future Limits:** Many of the alternative evaluations will conclude that the membrane cost (total installed and/or present worth) will be similar to conventional cost. If that is the case, many engineers and end users opt for the technology of the future, the membrane, as it offers a barrier in the effluent that provides more certainty against discharges and future regulatory changes. This is due to the fact that the final separation is performed by a fine pore filter and not by a gravity clarifier or sand filter which rely heavily on operator attention to achieve effluent quality. In addition, if carefully considered, end users will realize the MBR will be less operator intensive in an era when operations staff is hard to maintain at full level from budget cuts or attrition. Although labor may not be considered a significant cost driver due to existing staff, many times this is a long term strategic objective of the end user to purchase the least labor intensive treatment system. With automation and remote access to SCADA built in, the MBR fits this strategic objective for the long term.
- **Operator Friendly:** Many people think membrane systems are going to be more complicated or difficult to operate as they are different than conventional plants. Many users consider the opposite to be true. Operators who run flat plate MBR systems generally are very happy they don't have to worry about settling, filamentous bacteria, polymer dosage in clarifiers to enhance settling, etc. In general, they will need to keep up with instrument and computer maintenance, but that is the case with all new plants. Membrane cleaning is required, but only once every three to six months. Ease of operation is a benefit of the MBR that can be revealed to end users through site visits. Talking to existing operators is the best way to get operators to overcome the fear of a new system and understand how simple MBR plants are to run and maintain.

Figure 5A. (right) Flat plate membranes: the single filter unit of a submerged membrane unit (SMU) contains up to 200 flat plate membranes.

Images by Ovivo USA, LLC

Figure 5B (left) is a close up showing the top of the SMU where several plates are mounted in parallel with hoses to withdraw clean filtered water out into a manifold that would connect to a permeate pump.

Figure 6. Dual fine screen system shown installed in concrete channel.

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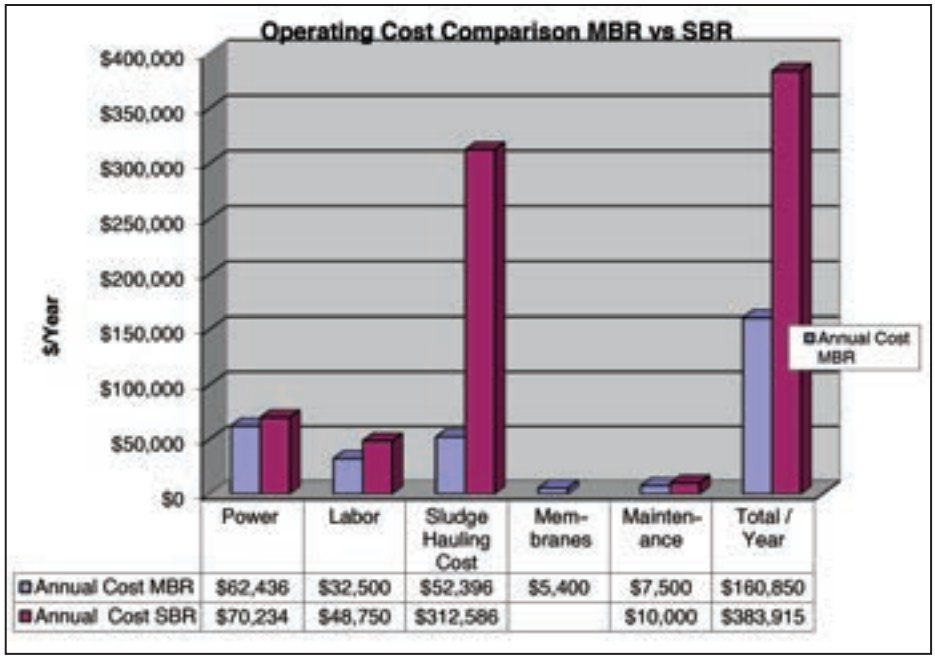
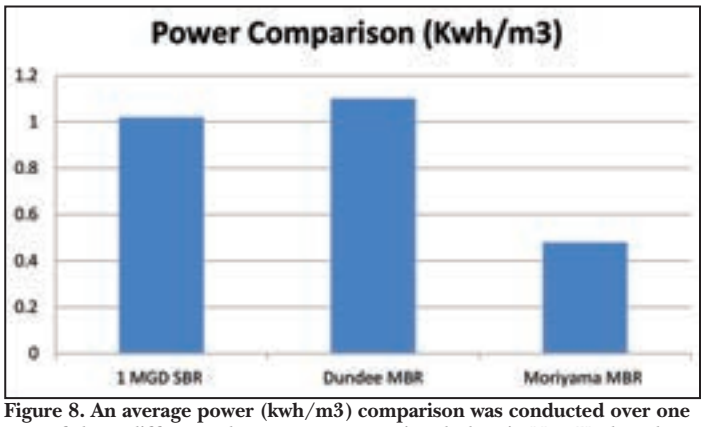
- **Small Footprint:** The MBR can be put into spaces that other processes will not fit and/or the MBR can achieve higher flows in a retrofit application by inserting membranes into existing tanks or clarifiers to increase flow or create more space in tanks to repurpose them to achieve lower TN or TP limits. This can create compelling economics for the MBR against building new tanks and an entire new process train. In industrial applications especially, where industry values its real estate, footprint size is often the benefit that moves industrial clients to MBRs.
- **Meets Tight Limits for TN (<3) and TP (<0.1):** Most of the MBR plants that are installed do not have low limits, so it is not always due to low limits that an MBR is selected. However, as limits are expected to get stricter, selection may favor the MBR due to its ability to meet low limits. The TP limits in particular favor the MBR since it eliminates the need for tertiary filtration and minimizes the need for alum due to the small pore size of the membrane. As the TN limits decrease, the increased concrete required for other processes increases the differential on installation costs which also drives the MBR benefit.
- **Minimizes Waste Sludge Volume:** The MBR has a long SRT and generates WAS at 1-1.5 percent so, inherently, it generates less volume of sludge than any other conventional activated sludge process. When integrated with a membrane thickener (MBT) to produce 3.5 percent solids, the savings on sludge costs are even higher. Moreover, the addition of the MBT to an MBR does not require much incremental capital cost. Additionally, the operational cost of the MBT is low, as no additional operator attention or polymer dosage is required. Sludge processing cost is a large portion of most operating budgets that is often overlooked during the alternatives evaluation. The operating cost analysis, along with several case studies (described later), illustrates the dramatic savings in sludge that can be derived by utilizing the MBT in conjunction with the MBR.

A typical operating cost comparison for a sequencing batch reactor (SBR) versus an MBR for a plant of about 250,000 GPD is shown in ***Figure 7***. As with any analysis, the figures are not exact prior to building a plant, but they are given here to be illustrative. The following points can be inferred from the analysis:



Courtesy of TC Tech, LLC

Figure 7. Cost analysis conducted by TC Tech, LLC of a conventional sequencing batch reactor versus a membrane bioreactor plant handling 250,000 GPD



Courtesy of TC Tech, LLC

Figure 8. An average power (kwh/m3) comparison was conducted over one year of three different plants – one conventional plant in New York and two MBR plants in Dundee, Michigan and Moriyama, Japan.

Power used in both MBR and conventional activated sludge processes is similar: As expected, the power required for the MBR and the SBR is similar. While early MBR plants were power intensive, more recent plants with flat plate membranes that are designed for power optimization are similar in power usage to conventional plants. There are many ways that modern MBRs have been optimized for energy. The primary reason is the scour air, utilized to keep the membrane clean, is also used in the biological aeration process; and, the rest of the process is similar to conventional processes except it is run at higher MLSS. In addition, flow pacing, ultrafine bubble diffusers and several other energy saving techniques derived from experience in existing plants are employed to minimize energy use.

To illustrate that MBR plant power requirements are similar to conventional systems in the real world, TC Tech recently compared actual data from an SBR plant in New York with similar flows (about 1.0 MGD) at two MBR plants. The average power use over one year is shown in ***Figure 8***.

When looking back at the data to see why the plant in Japan was lower in power, the average loading for that plant was found to be lower than both the other plants. In addition, the metric chosen (kwh/m3) did not account for loading. However, the point here is not to prove the MBR is lower, only to show that MBR can be comparable to conventional processes. This data, along with many other current data reference points confirms MBR, if designed properly, can be similar in power consumption to conventional processes. Power consumption is a regular part of the alternatives analysis. Each time an alternative analysis is done, it accounts for the specifics of the project, (i.e., flows, loads, etc.). TC Tech and Ovivo have found that on a regular basis MBR plants can be similar in power consumption to that of conventional activated sludge as shown in its analysis.

Membrane cost is not big factor: When membranes last 10 years and only have to be replaced once in a 20-year life cycle cost, the average cost per year of the membrane is small. This becomes very apparent when putting the cost of the membrane per year on a chart along with power, sludge and labor ***(Figure 7)***. Membranes are the smallest line item when properly considered.

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Sludge savings from the MBR/MBT combination are dramatic: A comparison showed how the MBR/MBT combination can save hauling cost on a mid-size plant when compared with an SBR. The SBR option, which often produces a fluffy 0.5 percent sludge, would likely need to add a dewatering option, which would increase capital and/or operational complexity. The MBT will give reliable, 3.5 percent sludge every day with the associated operating cost economics anticipated.

Labor costs: While labor savings are rarely allowed in alternative evaluations, many end users are finding high quality operators are difficult to keep and train. Less labor intensive treatment alternatives are often part of the strategic objectives of a project and often can swing the project in the direction of MBR if economics are close. Industrial plants in particular put a large emphasis on minimizing labor costs, and the MBR has proven to be a favorite processing selection for industrial pre-treatment and final discharge clients.

MBT Applications and Benefits

Since MBTs are less familiar to most readers than MBRs, it may be worthwhile to spend a few moments to review the basics and the economics of a few applications. The basic flow diagram for an MBT is shown in ***Figure 9***.

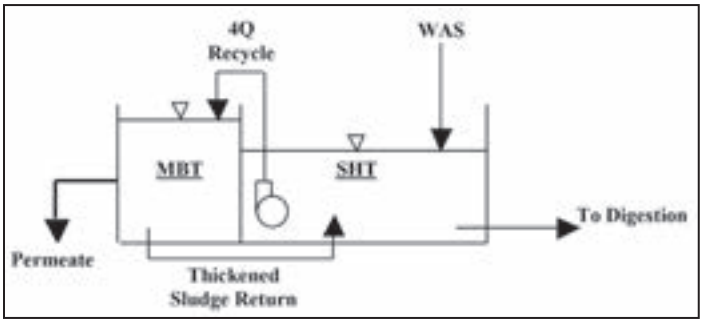
The waste activated sludge (WAS) is delivered to the system from the liquid side of the plant on a periodic basis. The WAS is circulated through the membrane tank where the membrane removes clear effluent and the WAS is thickened. The WAS recycles continuously, being aerated by specially designed diffusers to assure full mixing at high mixed liquor. The system operates continuously removing clarified liquid and receiving WAS. Thickened WAS is removed periodically at the desired thickness.

The advantages of this process over traditional thickening processes include:

- No polymer addition required
- Limited operator attention
- Continuous process
- No building required
- Digestion and thickening are accomplished in one step
- Sludge hauling is minimized

This technique can be applied to smaller plants that are hauling and to larger plants that are dewatering with excellent economics in both cases.

An example of a smaller plant is a 300,000 GPD conventional plant located in New York that was hauling liquid sludge and was having odor problems. The plant installed an MBT to thicken its sludge prior to hauling. As a result, there was an annual reduction of 59,149 gallons in hauling the first year, which translated into $4,954.00 per month, or $59,499 saved for the year. The payback on the project was 2.57 years.



Courtesy of TC Tech, LLC

Figure 9. The membrane thickener system continuously removes clarified liquid and receiving waste activated sludge (WAS). Thickened WAS is removed periodically at the desired thickness.

Another plant that installed an MBT while upgrading the liquid side of the plant from 1.2 MGD up to 1.8 MGD with an MBR, utilized the MBT as a pre-thickener to the belt filter press. While the plant was increasing flow by 50 percent, it was able to achieve 41 percent reduction in cubic yards hauled from the belt filter press and 41 percent reduction in polymer use due to the installation of the MBT as a pre-thickener to the belt filter press.

These key factors often go into the acceptance of the MBR technology on a successful project. The industry is gaining momentum with more systems installed and more people with knowledge of these successes. Evaluating MBRs as a process alternative for upgrades in New York is becoming more of a standard option and will continue to grow as these systems become better known to the water quality management community.

Membrane technology is no longer new, but a proven technology, as flat plate systems are now approaching 20 years in service and can be demonstrated to have lasted that long in plants using them. They are highly reliable, easy to operate, offer low operating cost and are very effective in treating for low discharge standards, even with high loadings. The MBR system requires some time to carefully investigate with the plant design and installed costs. It requires an upfront alternatives evaluation, including pre-selection with careful consideration of different features of different systems. In considering the options, an MBR can be a great alternative with significant benefits.

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Method of Dealing with Hexane Extractable Material in Mass Finishing Wastewater

by Tom Scott, Cindy Gundersen and Mike Chiaramonte

How does one reduce hexane extractable material (constituents of oil and grease) concentration in mass finishing wastewater? A case in point is an upstate New York manufacturer that had to answer this question due to excess oil and grease in its treated wastewater discharge. The experience it had defining and then solving the problem by using ultrafiltration is described here.

About Welch Allyn

Welch Allyn is a leading global medical device company known for its range of digital and connected diagnostic solutions for healthcare that reduce risk and enhance work flow. Founded in 1915 and headquartered in Skaneateles Falls, NY, Welch Allyn is a family-owned business that employs nearly 2,700 employees in 26 nations. The company manufactures basic diagnostic instruments, continuous patient monitors, automated vital signs devices and diagnostic cardiology equipment. Most recently, its continuing advancements have provided clients with faster, more accurate and efficient patient information access.

Photo by Tom Scott/Welch Allyn

Sign directing visitors into Welch Allyn's impressive State Street facility in Skaneateles Falls, NY

Photo by Tom Scott/Welch Allyn

Skaneateles Creek, a class C(T) water body, viewed downstream from Welch Allyn's outfall

The company's State Street facility in Skaneateles Falls opened in 1980 with corporate offices, product development, product service, machining, mass finishing, plating, product assembly and shipping.

Wastewater Treatment: Manufacturing wastewater treatment is comprised of two systems – one for manufacturing generated wastewater and the other for sanitary wastewater for the entire campus. Both systems produce a treated admixture that is directly discharged to Skaneateles Creek through a single outfall. Skaneateles Creek supports a viable trout population and is designated a class C(T) water body. Industrial wastewater from mass finishing is directed through three consecutive static tanks to remove settable solids. These nonhazardous solids are periodically filter pressed and disposed in a Part 360 permitted (NYSDEC solid waste management) landfill.

Flow from the final settling tank weir is mixed with plating rinses and further treated by metal hydroxide precipitation to remove dissolved metal constituents. Sanitary wastewater is treated by the extended aeration method, followed by continuous backwash sand filtration for residual suspended solids and year round disinfection.

During 2010, it became difficult for Welch Allyn to meet the State Pollutant Discharge Elimination System (SPDES) permit (NY 010 6674), with the surface water discharge limit of 15 mg/L for oil and grease. A subtle change occurred to the emulsified oil level contained in the influent wastewater. Initial actions were directed at determining what caused this difficulty by investigating avenues through which oil and grease could enter the wastewater treatment systems.

Finding the Problem

Through several months, the USEPA Method 1664A was used to measure hexane extractable material at several points in manufacturing operations and wastewater treatment units. Analysis of plating rinses, mechanical room discharges, and sanitary only effluent had average measurements of 15 mg/L or less. The source with the largest input was from mass finishing with an average measurement of 99 mg/L, and a range from 8 to 187 mg/L. With this data, oil and grease reduction efforts focused on the smaller mass media daily flow of 4,000 gallons, versus the total daily design flow of 60,000 gallons.

Mass finishing can de-burr, burnish, and clean large quantities of metal parts in preparation for further finishing processes. Vibratory machines containing media of various sizes, shapes and hardness, with a nonchelating surfactant, are used to prepare brass and stainless steel parts. Once clean, the brass parts are plated and stainless steel parts chemically polished. The suspended media solids, surfactant and residual machining oil-laden stream flows into the previously mentioned settable solids tanks.

Machining Oil Culprit: The culprit was determined to be a process change made in metal part fabrication by converting from synthetic coolants to vegetable-based oils for machining brass, aluminum and

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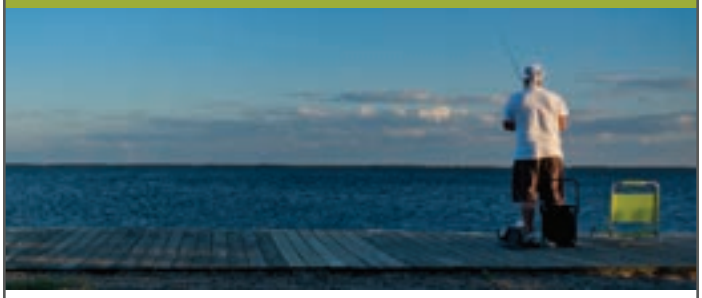

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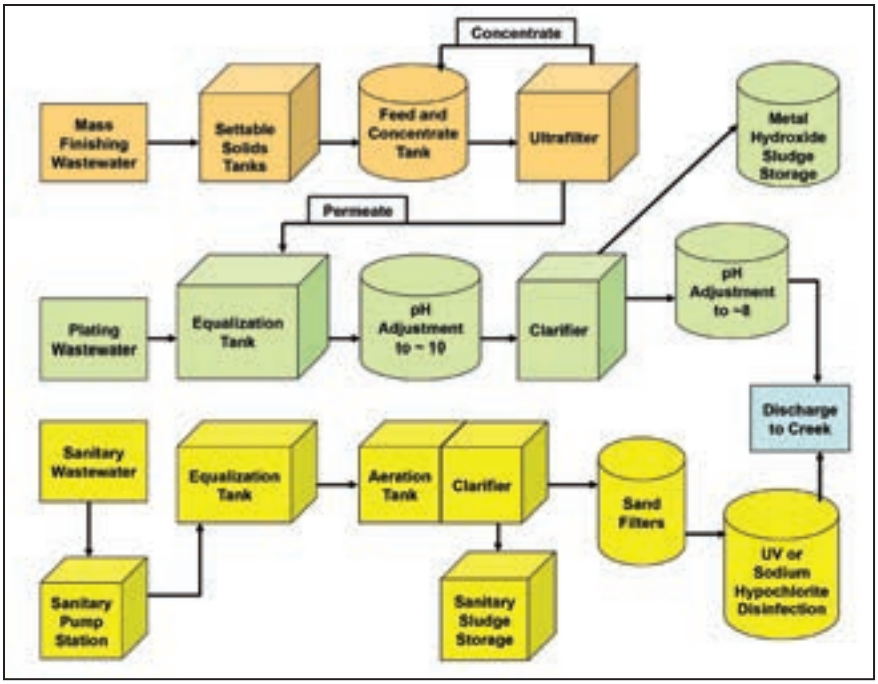

This diagram illustrates Welch Allyn's wastewater treatment systems.

stainless steel. This had a positive effect on machine operation and tool life, but impacted the ability to sufficiently clean metal parts after the machining process. Subsequently, any residual vegetable-based oil was emulsified in mass finishing.

With this information, the manufacturing team completed several improvements to work flow procedures and aqueous wash equipment to minimize residual oil on machined parts entering mass finishing. In concert with the team's efforts, several remedies were investigated for reducing the oil and grease concentration in the mass finishing wastewater. This included emulsion breaking actions via acidification, activated carbon filtration and ultrafiltration. What appeared to work best at the conclusion of these experiments was ultrafiltration.

Ultrafiltration Process

Ultrafiltration is a pressure driven method that can separate emulsified mixtures into a highly concentrated stream that is continuously pumped through a membrane. The emulsified solution flows parallel to the membrane surface and particles larger than the membrane pore size become concentrated (concentrate). Tangential flow "pushes" particles less than the membrane pore size into a low concentration stream (permeate). This clear permeate may be discharged, undergo further treatment or be reused.

After vendor demonstrations, pilot unit tests and a current user site visit, an ultrafiltration unit (skid-mounted Koch Membrane System Konsolidator 96) was installed during 2011. It is configured with 64 FEG Plus tubular membranes in order to process up to 6,000 gallons per day. This membrane, which has a one-inch diameter mounted in a 10-foot long plastic pipe, was designed to operate without plugging when subjected to a substantial suspended solids concentration. The ultrafilter and ancillary equipment occupy 320 square feet.

The process starts with an air diaphragm pump drawing mass finishing wastewater from the final solids settling tank and sending it to a 3,000 gallon, conical bottom tank. This tank sits next to the ultrafilter and continuously feeds the ultrafilter pump a mix of new and concentrated wastewater. Over time, this increasingly concentrated feed becomes inefficient for continued treatment. At this point, it is concentrated as much as possible and transferred to a concentrate holding tank. This mixture of oil and suspended solids is moved to a vactainer truck every six to 10 weeks for off-site disposal by a waste oil recovery company. The cycle begins anew by refilling the feed tank with new solution.

This setup currently produces a clear permeate with an average concentration of 30 mg/L hexane extractable material. Currently, permeate flow is directed to metal hydroxide precipitation for removal of dissolved metals and to attain a consistent hexane extractable material measurement of 15 mg/L or less. It may be possible to reuse this mix of clear permeate and residual surfactant, however, in this situation it was found not to be economical to return it for reuse in mass finishing.

Daily monitoring of pressure and flow is required to assess membrane fouling and feed/concentrate treatability. Once a week, the membranes are chemically cleaned with a surfactant solution, and mechanically cleaned with sponge balls, to remove solid material from the membrane surface.

For mass finishing wastewater, ultrafiltration has reduced the concentration of hexane extractable materials by 70 percent, which has enabled Welch Allyn to meet the 15 mg/L oil and grease total effluent discharge limit.

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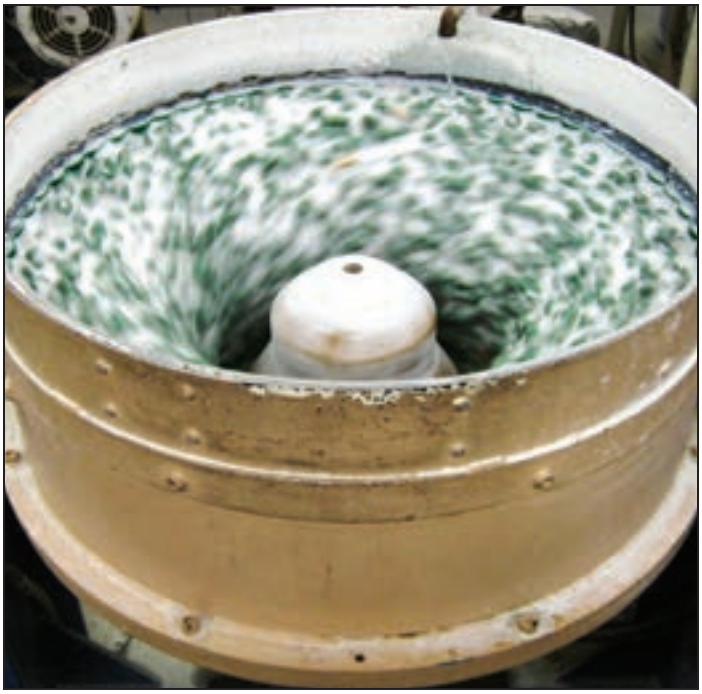

Photo by Tom Scott/Welch Allyn

A mass finishing media tub in action with brass parts, media and surfactant

Photo by Tom Scott/Welch Allyn

A row of CNC machines at the Welch Allyn facility used to fabricate brass parts (seen in foreground) for medical products. A change to vegetable-based oil used in the machining process unexpectedly led to higher hexane extractable residuals found in its wastewater.

Photo by Tom Scott/Welch Allyn

The ultrafilter unit's tubular membranes can process up to 6,000 gallons per day. On the right is the conical tank that feeds the ultrafiltration unit new and concentrated wastewater.

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Hydrogen Peroxide Wastewater Treatment Using a Catalytic Enzyme

by Linda N. Daubert

Photo courtesy of IBM, East Fishkill, NY

Aerial of IBM East Fishkill, NY site includes eight different treatment plants. The big tanks at bottom are the last point of treatment before discharge to the stream, Gildersleeve Brook.

The International Business Machines Corporation's (IBM) East Fishkill, NY facility is a world-class leader in semiconductor chip and packaging development and manufacturing. The continual innovations in technology at the facility require equally rapid and innovative environmental solutions. The facility's environmental group, which consists of a multidisciplinary staff of environmental and chemical engineers, scientists and treatment facilities operators, supports multiple 24/7 manufacturing processes while providing comprehensive solutions to meet the corporation's longstanding policies to protect the environment and conserve energy and natural resources.

Photo courtesy of IBM, East Fishkill, NY

IBM's outfall to Gildersleeve Brook

The environmental group is tasked with minimizing the impacts of chemicals that are discharged or exhausted into the environment. In December 2012, the group was awarded an Environmental Excellence Award from the New York State Department of Environmental Conservation (NYSDEC), for a project that focused on the reduction of total dissolved solids in the facility's final effluent, which is discharged to a small stream. The project involved the replacement of chemicals used in the Ammonia Wastewater Treatment Facility with a catalyst. The environmental group conducted research, designed and performed extensive bench experimentation, implemented pilot scale testing, provided concept designs, started up the new process, and has subsequently operated the system.

Initiative for TDS Reduction

IBM East Fishkill (EFK) initiated a project in 2003 to improve waste treatment processes and reduce the exponential rise of treatment chemicals associated with a rapid increase in semiconductor production and chemical usage. Concurrently, from 2003 to 2007, an investigation began into alternative technologies to remove sources of total dissolved solids (TDS) from manufacturing wastewaters and wastewater treatment processes, including the treatment of hydrogen peroxide. The largest quantity of hydrogen peroxide in site wastewater is present in the ammonia/hydrogen peroxide wastewater from semiconductor manufacturing. The former and existing wastewater treatment scheme includes the hydrogen peroxide removal process followed by an ammonia separation step, in which the wastewater is distilled for ammonium hydroxide removal. In 2007, EFK began an initiative with the NYSDEC to significantly reduce TDS in the site's final effluent discharge to a small receiving stream.

The peroxide removal process used at EFK through the end of 2009 was the industry standard: sodium bisulfite reduction, followed by sodium hydroxide neutralization. Both of these chemicals contributed high levels of TDS to the final effluent discharge. In early 2009, a catalytic enzyme process was qualified to replace the existing sodium bisulfite process to remove peroxide from the ammonia wastewater. This new process uses a small quantity of enzyme to catalyze the decomposition of peroxide waste into water and oxygen, without contributing TDS to the site's final effluent discharge and at a fraction of the cost. The process design incorporated existing building equipment as much as possible, and was

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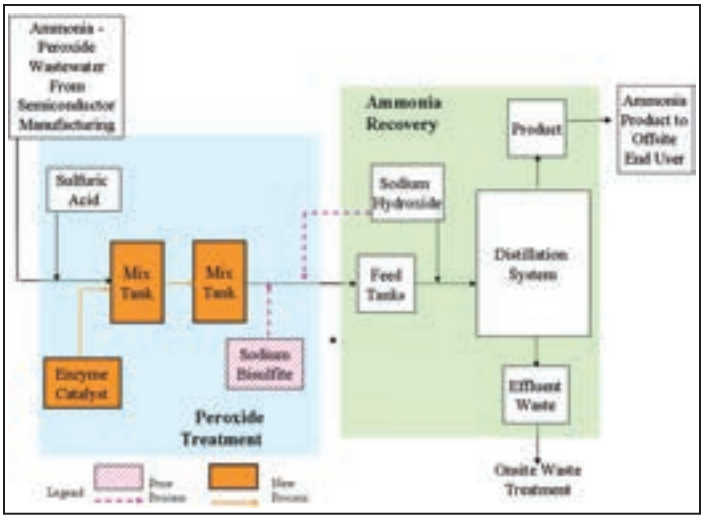

Courtesy of IBM, East Fishkill, NY

Diagram shows IBM East Fishkill's ammonia peroxide wastewater treatment system – showing both the prior process, and the new enzyme catalyst process that is patent pending.

seamlessly integrated into the existing treatment system. The design and construction of the full-scale peroxide treatment system was started and completed in 2009, with startup continuing through March 2010. This new treatment process eliminates use of sodium bisulfite (510,000 gallons/year at 38 percent by weight) and the subsequent sodium hydroxide (135,000 gallons/year at 50 percent by weight) for acid neutralization, and reduced chemical costs by $675,000 per year. The catalytic reduction of the hydrogen peroxide process has been continuously online since the beginning of 2010 and is currently patent pending.

Project Development

Hydrogen peroxide is conventionally treated in wastewater by neutralizing it with a reducing agent. Until 2009, IBM EFK used sodium bisulfite ($NaHSO_3$) to reduce hydrogen peroxide into water, producing sodium, Na^+, and sulfate, SO_4^{2-}, ions.

$$NaHSO_3 + H_2O_2 \rightarrow Na^+ + H^+ + SO_4^{2-} + H_2O$$

The resulting acidity created by this reaction had to be further neutralized with sodium hydroxide (NaOH).

$$H^+ + NaOH \rightarrow Na^+ + H_2O$$

The consequences of this treatment included high concentrations of both sodium and sulfate salts in the wastewater, the byproducts of the reactions to remove hydrogen peroxide. Alone, these benign salts pass through wastewater treatment systems into the receiving water body with no consequence, except as contributors to the final effluent's TDS concentrations. However, an increase in reproductive toxicity at the final effluent, noted in 2007, led EFK to hypothesize that higher levels of TDS could impact the relative health of the receiving water fauna, especially the vulnerable water flea.

Hydrogen peroxide, which is used widely in semiconductor manufacturing, is a large component of several wastewater streams at EFK. The subsequent treatment of the peroxide waste generated a large portion of the TDS in the combined effluent. By targeting the highest contributor of TDS in this process, IBM sought to reduce the component of TDS added as treatment chemicals.

The most elementary hydrogen peroxide reaction is its decomposition. It is thermodynamically favorable for hydrogen peroxide to decompose into water and oxygen, although the rate at which this happens is dependant on many factors, including concentration, temperature, pH, etc. Many substances, like metals, or enzymes, can catalyze its decomposition, releasing oxygen and generating only water as an aqueous byproduct.

$$2H_2O_2 \rightarrow O_2 + 2H_2O$$

The chosen replacement technology for the existing bisulfite treatment method needed to meet stringent requirements and be compatible with subsequent wastewater treatment processes. Not only did it need to be effective for the specific ammonia/hydrogen peroxide wastewater that is generated by semiconductor manufacturing, but it needed to provide a significant net reduction of TDS (which eliminated all conventional treatment options) without addition of other undesirable ions, such as metals. There were several other constraints because the subsequent ammonia wastewater distillation process step, which generates an ammonium hydroxide product for commercial sale, was critical to the overall operation of the site wastewater treatment systems and waste minimization activities. The new process needed to operate at a low pH to prevent loss of ammonia gas, and could not introduce chemicals or change wastewater characteristics that would foul the ammonia distillation column or contaminate the ammonium hydroxide product.

Other treatment alternatives do exist, but pose certain disadvantages in practice. Ultraviolet (UV) treatment will break down peroxide, but uses high amounts of energy. Various unsustainable metals, including platinum, palladium, copper and aluminum, can catalyze the reaction of hydrogen peroxide into water and oxygen, but then the metal must be regenerated or disposed. Activated carbon must also be regenerated or disposed, and is sourced from unsustainable materials (e.g., coal). All of these options solved the immediate TDS concern but at the expense of other environmental factors.

Following several years of investigation and laboratory testing, a commercial, aqueous fungal enzyme was chosen as the most favorable solution. The enzyme, an *Aspergillus niger* catalase (commonly known as black mold) derived from microbial fermentation, is a renewable source. Furthermore, production of this enzyme requires significantly less resources than its alternatives. Specific fungus strains are contained in steel fermenters and grown on agricultural products to produce industrial enzymes, requiring very little energy per mass of output, and leaving behind a completely biodegradable waste.

The selected technology was subjected to an extensive evaluation process before full-scale implementation. Rigorous peroxide removal optimization, pH, biodegradation, offgasing, and fouling tests were conducted by the environmental team before the new treatment scheme was established.

Implementation

The new process was incorporated seamlessly into existing buildings and systems. Two unused tanks in the path of the wastewater transfer pipeline were repurposed as catalytic reaction tanks, with minimal piping, instrumentation or other mechanical upgrades necessary, reducing the amount of new construction required and restoring obsolete equipment to productive use. Existing variable frequency drives were employed for energy savings, and exhaust systems were installed to address operational and safety concerns

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Photo courtesy of IBM, East Fishkill, NY

The catalase enzyme is fed to the system through this tank at a rate of less than 0.02 gallons per hour.

Photo courtesy of IBM, East Fishkill, NY

Two new fans carry oxygen away from the reaction tanks to avoid accumulation of oxygen within the treatment system.

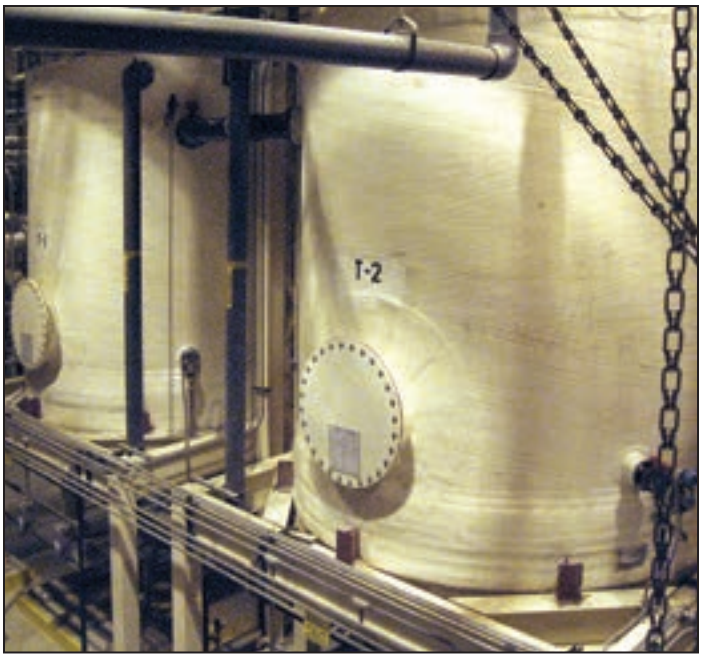

Photo courtesy of IBM, East Fishkill, NY

Two unused wastewater tanks were repurposed for new life as catalytic reaction tanks in peroxide treatment.

associated with deentrainment and accumulation of oxygen within the treatment system. The previous treatment scheme was left untouched as an active backup system.

Measurable Environmental Benefits

This replacement treatment technology challenged and surmounted all major disadvantages of the previous method. By eliminating 645,000 gallons of chemical usage, the project reduced truck deliveries to site by three to four per week, tanker offloading labor, potential hazards to employees, and greenhouse gases associated with truck emissions. The catalytic peroxide removal process does not produce a wastewater discharge concern at the expense of other media, because the only byproducts are water and oxygen. The process does not cause any increase in sludge generation, there are no additional air emissions, and the enzyme is biodegradable once exhausted. The reduction in EFK's chemical usage has resulted in a subsequent reduction in TDS in EFK's direct discharge to receiving waters. The company's environmental group hypothesizes that the lower TDS should benefit aquatic biota through improved receiving water quality at the point of discharge (Gildersleeve Brook) and downstream in New York State waterways.

Conversion of EFK's treatment system to the catalytic technology was the first of a kind in the semiconductor industry, and is currently awaiting patent. The new technology has been continuously online since December 2009.

Linda N. Daubert, PE, is Environmental Engineer for IBM in East Fishkill, NY, and may be reached at lndauber@us.ibm.com.

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Greening of an Industrial City:
Onondaga County's "Save the Rain" Syracuse Tour

Onondaga County Executive Joanie Mahoney

The City of Syracuse is busy sprouting more and more green as a result of the award winning "Save the Rain" initiative spearheaded by Onondaga County. In 2009, Onondaga County Executive Joanie Mahoney championed an effort to find a "Better Way Forward" to address water quality issues in the City of Syracuse, and developed the nationally recognized Save the Rain program. The initiative is a comprehensive stormwater management program using gray and innovative green infrastructure technologies to abate combined sewer overflows that help to protect the health and ecosystems of Onondaga Lake. To date, Onondaga County has constructed or financed more than 100 green infrastructure projects in the City of Syracuse, including green roofs, rain gardens, bioswales, tree plantings, rain barrels, cisterns and porous pavement. Onondaga County is a US Environmental Protection Agency designated national green infrastructure demonstration community and was recently awarded the US Water Prize by the US Water Alliance *(see awards sidebar)*. Visit www.SaveTheRain.us for more information on the program and to view project details, plans and technical specifications for all of the Save the Rain projects.

Those attending the NYWEA Spring Conference in Syracuse on June 3–5 *(see page 54)* can see firsthand various Save the Rain projects downtown on the Green Infrastructure Tour to be conducted Monday afternoon of the conference, sponsored by the Environmental Science Committee. The tour follows a morning keynote address by Onondaga County Executive Mahoney, leader of this green initiative.

The following are the projects to be visited during the Syracuse Green Infrastructure Tour. (Specific details will be posted on the NYWEA website, www.nywea.org.)

Green Roof at Oncenter's Nicholas J. Pirro Convention Center: A 66,000-square-foot green roof system was installed on the rooftop of the Nicholas J. Pirro Convention Center in Summer 2011. The roof includes a waterproof membrane liner covered with a layer of lightweight growing medium and planted with a mix of sedums (low-growing succulent vegetation). The new rooftop landscape is a self-sustaining system, requiring little maintenance once established, and relies upon natural processes to retain and evapotranspirate stormwater runoff. This is one of the largest green roofs in the Northeast region and it captures over one million gallons of stormwater each year.

Green Street on Harrison Street: The stormwater retrofit project along the 300 block of Harrison Street (next to the Oncenter) features the installation of a new sidewalk planter that uses bioretention to capture surface runoff from the adjacent roadway. Runoff enters the planter via four new curb stormwater inlets, irrigating the new native shade trees, ornamental shrubs and colorful perennials, and then infiltrates through an aggregate trench into the ground below. This "green street" captures approximately 180,000 gallons of stormwater runoff annually.

Rain Gardens at Oncenter Municipal Parking Garage: Rain gardens were constructed on the existing landscape in front of the Oncenter Municipal Parking Garage to capture and infiltrate the stormwater runoff from the roof leaders and pipe/downspout infrastructure of the parking garage facility. Disconnecting the existing infrastructure from the conventional sewer system resulted in an annual runoff reduction of approximately 1.3 million gallons of stormwater each year.

Oncenter Parking Lot: This stormwater retrofit project at the Oncenter Parking Lot included repaving the existing parking lot with porous asphalt along three sides. The remainder of the lot is paved with traditional asphalt and graded to drain into the porous sections. In addition to the pavement resurfacing, the project

Green roof at Oncenter's Nicholas J. Pirro Convention Center

Oncenter parking lot

features the design and construction of an infiltration trench along three sides of the parking lot to manage runoff from the entire lot as well as from adjacent streets. The project also features a new tree infiltration trench and a new section of sidewalk. The green infrastructure in this parking lot will reduce stormwater runoff by almost 1.3 million gallons annually.

Townsend Street Parking Lot: Completed in 2010, the stormwater retrofit project at the County Parking Lot at S. Townsend Street involved repaving the lot with new asphalt pavement, restriping lanes and installing two eight-foot-wide tree infiltration trenches. The two tree trenches feature the use of structural soil to provide adequate rooting volume for the trees and additional native vegetation. Runoff from the repaved lot enters the tree trenches, providing irrigation for the trees and vegetation before eventually infiltrating into the ground below the trench. The infiltration trench design features overflow control measures to prevent localized flooding and oversaturation of the structural soils. This project captures approximately 975,000 gallons of stormwater per year from the lot and adjacent pavement areas.

War Memorial Arena Stormwater Re-use Cistern System: The innovative water re-use system is located in the basement of the arena and includes approximately 15,000 gallons of below-ground rainwater storage and associated filtration, disinfection and water reuse technology. The project captures rain water and snow melt runoff from the War Memorial Arena roof, reusing the stormwater primarily for ice production and ice maintenance for events at the

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Rain gardens at Oncenter Municipal Parking Garage

Green Street on Harrison Street

War Memorial Arena stormwater re-use cistern system

Townsend Street parking lot

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arena, including sporting events and family entertainment. This stormwater cistern system reduces stormwater runoff by 400,000 gallons each year.

Water Street Green Gateway: The Water Street Green Gateway Project is a comprehensive "green street" application located on the 300 block of Water Street and is the first of the Save the Rain gateway projects intended to demonstrate a variety of green infrastructure applications at key entry points into the City of Syracuse. Several green infrastructure elements were installed to capture stormwater and enhance the urban landscape, including streetscaping with enhanced tree plantings in the right-of-way; installation of porous pavers in parking lanes; use of infiltration trenches and stormwater planters; and, additional landscaping features throughout the footprint of the block. This green gateway project captures approximately 924,000 gallons of stormwater runoff each year.

Information for this article was provided by Madison Quinn, Public Information Specialist for Onondaga County's Save the Rain Program, the US Water Alliance and NYWEA. All photos provided courtesy of Onondaga County Save the Rain program.

Water Street green gateway

Onondaga County Wins 2013 US Water Prize

In Washington, DC on February 26, along the Reflecting Pool between the Washington Monument and the Lincoln Memorial, the US Water Alliance announced the 2013 winners of the coveted US Water Prize. One of the select three nationwide was Onondaga County, New York for its program to "Save the Rain" and embrace green infrastructure solutions to wet weather problems.

"Our 2013 US Water Prize winners are leading the way, from East to West and all points in between, on the value of water and the power of innovating and integrating for one water sustainability," said Alliance President Ben Grumbles. "Our champions are showing how to save the rain, clean the stream, and grow with care, up and down the supply chain throughout the water cycle."

The three winners are honored on Earth Day, April 22, 2013 in Grosvenor Auditorium at the National Geographic headquarters in Washington D.C. "Our three winners reflect America's spirit of diversity, creativity, and collaboration," explains Dick Champion, chair of the US Water Alliance. "These are the best in public, private, and nongovernmental sectors. It's fitting that we honor them at *National Geographic,* itself known for public education of natural resources. We intend to elevate, celebrate and educate the public about these good stewards for the blue planet's most precious resource." More than 300 water leaders from the federal, state and municipal level will participate in the distinguished ceremony.

The nominations were reviewed by an independent panel of judges including some of the most respected names in the water and environmental sector: Rich Anderson, Senior Advisor for the US Conference of Mayors' Water Council; Veronica Blette, Chief of the WaterSense Branch, EPA Office of Wastewater Management; Monica Ellis, CEO of the Global Environment & Technology Foundation; Jody Freeman, Archibald Cox Professor of Law at Harvard Law School and founding director of its Environmental Law and Policy Program; and Jim Ziglar, Senior Counsel at Van Ness Feldman Law Firm and former Assistant Secretary of Interior and Commissioner of the IRS.

The US Water Prize, first launched in 2011, is organized and administered by the US Water Alliance. Through the prize, the national non-profit underscores the value of water and the need for one water integration, innovation, and collaboration among environmental, business, utility and community leaders.

DESCRIPTION OF AWARD:

Onondaga County, New York

Onondaga County received the US Water Prize for its Save the Rain program, a combined sewer overflow (CSO) abatement/water quality program focused on balancing the use of conventional wastewater/stormwater treatment technologies, with advanced, innovative green infrastructure best management practices. Rather than advance a costly project ($100 million estimated), County Executive Joanie Mahoney joined with USEPA and New York State to petition the federal courts to change course and establish a new, more affordable and sustainable CSO abatement program. As a result, the Save the Rain program was born in November of 2009. Federal Justice Frederick Scullin approved a CSO abatement program that allowed the County to change course and advance a program that balanced the use of wet weather storage as well as a requirement to use green infrastructure. It was the first settlement of its kind in the nation to endorse and require green infrastructure as a stormwater management solution.

– • –

NYWEA Awards Onondaga County for Sustainability Efforts

In 2011, NYWEA recognized Onondaga County for being a statewide leader in sustainability on several fronts, presenting it the NYWEA Sustainability Award for:

- An aggressive green infrastructure program to reduce combined sewer overflows in the City of Syracuse and to reduce infiltration/inflow in separate sanitary sewers in communities' tributary to the county's wastewater treatment system.
- Involvement of communities and community groups in developing and implementing infrastructure improvements for abatement of combined sewer overflows.
- Support of "Smart Growth" policies and practices to reduce urban sprawl and encourage re-development of existing urban centers.
- Consolidation of government services where appropriate and when supported by the public for water, wastewater, snow plowing and administrative services to provide more sustainable and cost effective County, City, Town and Village government systems in Onondaga County.

Congratulations, Onondaga County!

We hope NYWEA members will join us in Syracuse to see many of these projects first hand!

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Untapped Potential: Overcoming Barriers to Biogas Projects

by Linda Girardi

Wastewater treatment facilities (WWTFs) are one of the biggest energy users in a community. Paradoxically, they also offer significant potential for generating energy that can be used onsite or distributed back to the electric grid.

Subjecting sludge to anaerobic bacteria in a closed vessel (digester) produces biogas that has been successfully used to provide both heat and electricity. Yet, the US Environmental Protection Agency (USEPA) reports that fewer than 20 percent of the larger WWTFs with anaerobic digestion operations produce combined heat and power (CHP).[1]

So why aren't more WWTFs using anaerobic digestion and CHP to generate renewable energy from biogas? A key factor is *economics,* according to a recent study by the Water Environment Research Foundation (WERF) and New York State Energy Research and Development Authority (NYSERDA) in conjunction with Brown and Caldwell, Black & Veatch, Hemenway Inc., and the Northeast Biosolids and Residuals Association (NEBRA).[2]

The report, ***Barriers to Biogas Use for Renewable Energy***, uncovered two primary economic barriers to CHP projects:

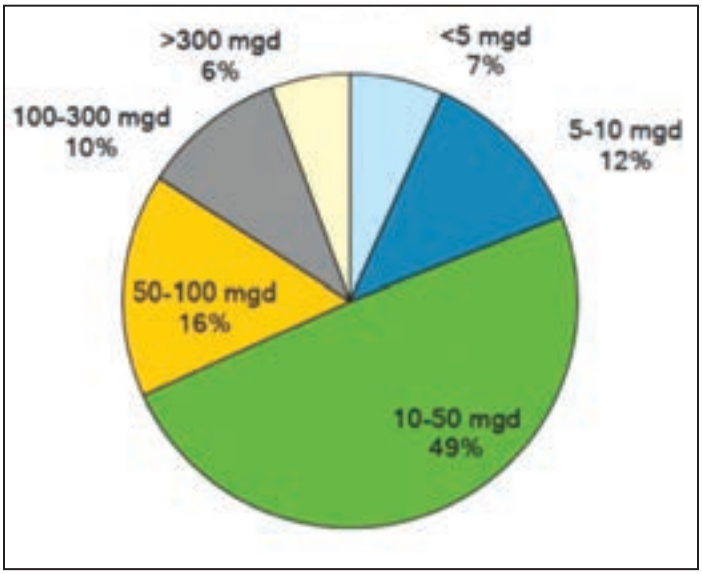
- The availability of capital resources
- The perception that the economics do not justify the investment

The study involved both an online survey and focus groups. The survey gathered information on perceived barriers to biogas projects from more than 200 respondents. The respondents represented a cross-section of utility personnel, including management, engineering and operations personnel at plants ***(Figure 1)*** ranging in capacity from less than 5 million to more than 500 MGD (millions of gallons per day). The focus groups provided an opportunity for researchers to validate the survey's findings with utility representatives and to delve more deeply into the barriers deemed most significant from the survey. Focus groups were held in New York City and three other locations across the United States (Sacramento, Miami and Chicago).

Importance of the Bottom Line

Limited Capital Budgets: The study found that the economics of proposed CHP projects present the greatest barrier to biogas use. It is all about the bottom line. Utilities have many demands for limited capital budgets and CHP projects can take a backseat to higher priority needs, such as meeting regulatory and permit requirements or repairing aging infrastructure. Some WWTFs have found it difficult to even find funding to study or evaluate CHP projects, much less to design and construct them.

Acceptable Payback: Showing that CHP projects have an acceptable payback period is also a challenge. In some cases, the threshold for payback can require three to five years, which can be difficult for CHP to meet. For other utilities, a reasonable payback may be 10, 20, or as much as 30 years or the "bond period" for the expended capital. The choice of a reasonable payback period is not purely about economics, but about the perspectives of the decision makers. A number of uncertainties and risks can also undermine payback. These include calculating the costs associated with operations and maintenance, working with third parties (outside agents), and predicting future electricity prices.



Courtesy of NYSERDA

Figure 1. Plant Size of Surveyed Utilities

Overcoming the Barriers

Although there can be significant economic barriers to starting up CHP projects, interest and investment in biogas use by WWTFs over the past five years have grown. There also is greater public interest in cost efficiency, renewable energy and sustainability – all of which support biogas use projects at WWTFs. The study probed for ways to reduce or reframe the economic obstacles that can stand in the way of a CHP project. Recommendations for breaking down these barriers include:

- **Adding alternative feedstocks, such as fats, oil and grease (FOG) and high-strength wastes (HSW)**. Adding alternative feedstocks can result in two financial benefits: a tipping fee for the "waste," and an increase in biogas production that results in greater reductions in purchased energy costs. For small WWTFs, the additional power that can be generated from FOG or HSW can significantly improve project economics and, in many cases, be the tipping point for moving ahead with a CHP project. Furthermore, additional revenue generated by receiving FOG and HSW improves the utility's operating savings considerably.
- **Improving the economics of CHP projects by considering alternative sources of funding**. Pursuing and securing alternative sources of funding, such as grants, low-interest loans, or capital purchase agreements with third parties, is another strategy to implement biogas projects at some WWTFs. Grants and incentives cannot only improve project economics, but they also can create a sense of urgency and importance around a project. Depending on the size

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of the award, payback for projects can be significantly improved. Grants from organizations such as NYSERDA, as well as federal and state governments, are available to utilities for CHP projects.

- **Reframing the economics of CHP projects by using better financial comparison metrics**. Most utilities use simple payback as their metric for project financial feasibility. However, other well accepted financial evaluation metrics, such as return on investment (ROI) and net present value (NPV), may produce a more accurate portrayal of a project's benefits. It's also important to highlight cash flow potential, especially over the long term, and to include the service life of the equipment in the economic analysis. By focusing on economic criteria other than simple payback, the argument for CHP can often be more compelling.

Finding the Fit

Combined heat and power is a strong technical fit for many WWTFs. Moreover, it can be a compelling investment at WWTFs, depending on local electricity prices. While many WWTFs have already adopted CHP, other facilities have not taken steps to move a project forward, or have not been successful in getting a project off the ground. Decision makers sometimes take a narrow approach to evaluating CHP projects, which are often viewed as discretionary in nature. Finding the necessary capital and ensuring the payback is worth the investment are two key economic barriers that must be overcome if CHP projects are to expand.

Linda Girardi is Vice President at Eastern Research Group, Inc. (ERG) and a marketing and outreach consultant for NYSERDA. For more information, contact Kathleen O'Connor, NYSERDA Senior Project Manager at kmo@nyserda.ny.gov ; or Lauren Fillmore, Senior Program Director for WERF at llfillmore@werf.org.

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NYWEA Spring Technical Conference and Exhibition

Hosted by Central Chapter, June 3–5, 2013

Syracuse: The Greening of an Industrial City

by David Barnes

The Central Chapter of the New York Water Environment Association began its planning last year in anticipation of the 2013 Spring Technical Conference and Exhibition to take place in Syracuse, NY on June 3–5, 2013. Our meeting's comfortable and convenient base of operations will be the Sheraton Syracuse University. Participants won't have to travel far to find a hands-on museum, a historical landmark, a major sports facility, and so much more.

A City Transformed: Gray to Green

Syracuse has an impressive manufacturing history. In the early 1900s, Syracuse had 87 large industries and, by 1939, there were 275 different products being manufactured here. The wide array of goods manufactured were: typewriters, candles, pottery, gears, electrical and air conditioning equipment, traffic signals, plated silverware, window fixtures for trains, cast stone building blocks, clothes-pressing machines, doorknobs, the Franklin automobile, baking powder, batteries, bicycle accessories, billiard tables, cash registers, chemicals (Solvay Process Company later merged with Allied Chemical), furniture, ice, salt and sewer pipes, to name a few.

This industrial history is undergoing a striking transformation today through the development of major "green" infrastructure initiatives. Rick Fedrizzi, President and CEO of the US Green Building Council, said: "Syracuse is home to an extremely valuable commodity: innovative, dedicated people. Local leaders – students to CEOs – have turned Syracuse into an incubator for green business and development, setting a standard for the rest of the country. Just tour Syracuse University, visit the Center of Excellence or walk through downtown to see it in action."

This Spring Conference will be an outstanding opportunity to network with and learn from other operators, design professionals, regulatory agency personnel, researchers, equipment suppliers and service providers in this fertile environment. An exciting three-day program is planned, beginning with numerous technical presentations that will qualify for operators' renewal and professional engineer certification credits. In addition, the social activities scheduled will provide many networking opportunities.

Exchange information, make new contacts and rub elbows with many colleagues and friends!

Registration information and program details will be emailed to members shortly, or you can always register online at www.nywea.org. Bring a friend and help us make this conference another great success!

Important Meeting Highlights

Green Infrastructure Initiatives: Current projects being planned to manage rainfall in several large communities will be discussed in several technical sessions, including local wet weather management plans.

Local Project Displays: Special displays will be featured at the conference by Central New York wastewater

Photos of Syracuse Skyline, Inner Harbor, Armory Square and Onondaga Park skaters by ©Wainwright Photography
On next page, top half photos courtesy of Destiny USA

utilities and communities. This will also be an opportunity for local universities to get involved and showcase the research they have been doing to assist with communities addressing and investigating water quality concerns.

Other Events: The conference will also offer an Exhibit Hall, special events and the annual Operations Challenge competition.

Check the NYWEA website for up-to-date program information and registration (www.nywea.org).

Other features Syracuse has to offer:

Destiny USA is a new, 2.4 million square foot destination that includes Carousel Center – a super-regional shopping center already attracting 20 million visitors a year.

The brand new expansion mixes all types of retail including luxury outlet tenants, restaurants and entertainment. A stunning three-story glass atrium provides perfect weather year round. In addition to unique shopping, also featured are:

Pole Position Raceway: Take an up close and personal look at what Destiny USA has to offer while taking a wild electric go kart ride.

The WonderWorks Experience: Experience WonderWorks is an amusement park for the mind with more than 100 hands-on exhibits. Feel hurricane force winds in the hurricane shack, touch electricity, and traverse over Destiny USA's Canyon Area at more than 70 feet high, the largest indoor suspended ropes course in the world!

Swing into OptiGolf: Golf more than 80 courses across the globe on high definition screens, while enjoying food and drinks at your fingertips.

David Barnes, PE, is the NYWEA Spring Conference Management Chair. He is a Senior Project Manager with CDM Smith in Buffalo, NY.

Exhibitor Opportunities

The Spring Technical Conference and Exhibition is supported by a strong technical program and offers opportunities for networking and making important contacts for you and your company. Owners, operators and engineers will be attending this important event.

A full Exhibitor Package and more information will be available on the NYWEA website: www.nywea.org.

Right, ©2011, Roger DeMuth, www.mrpanoramaman.com
Below, background, courtesy of the Erie Canal Museum

Grey to Green Initiatives

SUNDAY, JUNE 2

Evening President's Reception

MONDAY, JUNE 3

Opening Session with breakfast:
- Onondaga County's Grey to Green Initiatives, County Executive Joanie Mahoney
- Onondaga Lake Clean Up
- Environmental Facilities Corporation

Morning & Afternoon Technical Sessions

Off-site Environmental Green Walking Tour

MONDAY Afternoon – NYWEA Members Give Back

Build-A-Bike for Charity

NYWEA members interested in building a bike onsite will sign up in advance for this event. Bikes constructed will be donated to deserving youngsters in Syracuse. Look for more information on the NYWEA website (nywea.org).

Special Treat Monday Evening:

Reception and Dinner at the Erie Canal Museum

The Official Museum of the Erie Canal, located in Syracuse, is the only remaining weighlock building in America. The Erie Canal was the impetus for Syracuse's population growth from 600 people in 1820 to 22,127 people in 1850. Today, the canal's legacy remains a large part of the Syracuse downtown architecture and is seen at the Erie Canal Museum. NYWEA members are in for a treat Monday night when the reception and dinner takes place at the Erie Canal Museum *(above photo)*.

TUESDAY, JUNE 4

All Day Exhibition

Operations Challenge Competition – All Day

Morning & Afternoon Technical Sessions

Lunch in Exhibit Hall

Offsite Tour

Reception in Exhibit Area

Evening Dinner at SUNY–ESF Gateway Center

WEDNESDAY, JUNE 5

Morning Technical Sessions

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Waste Not, Want Not: Village of Marcellus Generates Biosolids Compost

by Ryan Riefler

It's a dirty problem, but every community has to deal with it at some point. Is it crime, or street maintenance? While those are certainly valid civic concerns, there's another issue that's making towns and cities across America scratch their collective heads – what to do with the biosolids left behind after wastewater treatment?

Photo by Ryan Riefler

The Village of Marcellus treatment plant and compost facility entrance sign which was landscaped with its own compost.

Photo by Ryan Riefler

Seventh grade volunteers from the Marcellus Driver Middle School filled village flower boxes with the WWTP's compost, a green process of recycling its biosolids.

Before you turn up your nose at this subject (pun intended), keep in mind that biosolids disposal is a problem that has both environmental and economic implications, regardless of city size or location. The country's changing regulatory climate, increased public scrutiny and decreasing number of disposal options have made biosolids management a very complex issue.

After the Marcellus Water Pollution Treatment Plant treats wastewater from the village and the town's two sewer districts it services, it is left with sludge that in the past had to be put in a dumpster and taken to a landfill. This cost the village approximately $35,000 to $45,000 each year, which is a significant expense for a community of its size. To make matters worse, those costs were rising due to higher fuel prices, and there was talk about closing down the landfill where the sludge was disposed. Plant personnel would have to transport the sludge to a landfill that was farther away and increase the transportation costs even more. All in all, it was anticipated that disposal fees were going up to about $50,000 annually.

Plant Supervisor, Greg Crysler, and I worked together to come up with an alternative disposal method that wouldn't just save the Village of Marcellus money over time – it would also be a proactive response to an environmental issue that's expected to become even more heavily regulated in the years ahead. The answer was creating the village's own composting facility.

Moving Forward

To set the wheels of the project in motion, we visited communities that had already built their own composting facilities for the same purpose, did some research and then presented ideas to the village board. The board agreed with the design and implementation plan that was proposed. The next step was to obtain funding.

The project would cost approximately $750,000 from start to finish. Fortunately, the State of New York's Department of Environmental Conservation gave our project "green" status, meaning the state will pay the village back 50 percent of the total cost, or about $325,000. When one considers that the village will be saving approximately $50,000 per year in disposal costs, it should pay off the remainder, or $325,000 of the total $750,000 investment, in about seven to eight years.

Once the project was approved, the village constructed two new pole barns to house wood chips, finished compost and a large screener. Also renovated was an existing covered drying bed at the wastewater facility, converting it to a composting structure that began operations in March 2012. What was once an area where sludge was dried and then scooped up and taken to the landfill, is now an enclosed 56-by-60-foot structure. Inside, workers take

Photo by Ryan Riefler

Loading sludge into the compost facility.

biosolid waste product and stabilize it by composting it with wood chips. The eventual result is Class A compost product that's free of charge to local residents already paying sewer fees.

Composting Process

The Village of Marcellus is permitted for aerated static piles and windrow methods. Aerated static piles is the method used, and the windrow pile method is a backup plan in case of mechanical failure.

Composting is a biological process of organic solids decomposition. Under a controlled environment including air, temperature, mix ratio and time, the sludge is reduced to its stabilized form. When finished, Class A compost is easily made and this can be used as a soil amendment, typically used in lawns, tree plantings and flower gardens.

Composting begins when the liquid sludge from the digester is dewatered through a belt press. This sludge is about 16-18 percent solids. Then the sludge is mixed at a pre-calculated mix ratio with woodchips that are between 50-80 percent solids. Once the proper mix is completed, the starting compost mixture should be between 38 to 42 percent. This mix is then dumped on top of a four-inch ABS plastic field drainage pipe. The perforation in the pipe allows the air to be evenly distributed throughout the entire length of the pile. After the pile is built, it is covered with woodchips at a thickness of six inches to one foot. This insulates the pile and insures even heating throughout the pile without stopping airflow.

The compost will now stay in aerated static pile for 21 days. A temperature probe is inserted into the pile, which is hooked to an air blower. The temperature will be recorded daily for 21 days. When the temperature of the pile reaches 57° Celsius, the blower comes on and cools the pile down to 55°C. This procedure continues over the 21 days with the pile temperature slowly cooling down and, eventually, the blower will not turn on at all toward the end of this period. In this time, the temperature must have three consecutive days of over 55°C and 11 days with an average of 45°C. This assures the process to further reduce pathogens.

Photos by Ryan Riefler

Piling the compost mix over the air line – called the static pile – for temperature, biological processing for 21 days; and the pile is shown when at temperature between 55–57 degrees Celsius.

After 21 days, the pile is broken down and moved into a curing pile. This is similar to the compost pile, except without the aerated pipe and without the insulation blanket. Curing the compost pile means letting the bacteria continue stabilizing the waste. At this stage, most of the breakdown has taken place. The curing pile will be turned or broken down every five to seven days to allow oxygen to get to the remaining bacteria. Curing takes 30 days with no exceptions. When the curing pile is cool enough and dry enough to screen or sift, it is finished. Compost is screened or sifted for two reasons: the first being to meet Class A compost standards; and, secondly, to recycle the woodchips to use them again. Approximately 75 percent of the woodchips are removed in this screening process and then reused in the next compost pile.

The finished compost will be granular and brown in color. Some small particles of woodchips will be visible and it will have an earthy smell. This compost will be sampled and analyzed according to permit, and then be ready for public give-away.

Equipment and Safety Concerns

The renovated composting structure did cause some challenges for the village's wastewater employees. The relatively small structure is split into two smaller sections, and the roof is supported by a truss system that's two-feet on center and only nine to 10 feet off the ground. Because the employees are constantly inside the structure making and transporting piles of compost, the village needed a machine that could help with the task within a confined space and with a low clearance. Some heavy equipment dealers in the area were contacted and various skid steer loaders from a number of manufacturers were tested out. Eventually, our crew selected a machine (JCB 260) that had a tight turning radius and the ability to dump material onto existing piles even under our low roof.

Visibility in the cab was a very important concern to the wastewater team. The compost piles have an internal temperature of 150 degrees Fahrenheit, generating a great deal of steam in cooler weather. Dust is also a problem when screening out the wood chips from the compost mix, making a pressurized cab a must. The skid steer chosen also has a unique, single-arm "powerboom" design, which allows wastewater employees to raise the boom up between the building's low, narrow truss system - something that could not be done with a traditional two-armed skid steer.

Safety is always a consideration on any worksite, and that's certainly true for a municipality that has to deal with workman's compensation and other potentially expensive liability issues. When visiting other compost facilities before launching our own, we saw that safety was a huge concern at all the plants visited. Let's face it, the sludge being transported is a very slippery substance, and that makes our work more dangerous. We had talked to an operator who used a skid steer with the standard design that requires him to climb over the bucket to get inside the cab. He had slipped and fell between the machine and the bucket, severely skinning his shin. It's even worse in the winter when the moist sludge is freezing onto the

continued on page 60

continued from page 59

exterior of the machine. With our skid steer, we can open the side-entry door and climb directly in or out, greatly reducing the risk of falling and injuries. While such an improved safety feature makes the equipment cost more, it was felt that the extra cost was justified from this safety standpoint. When demonstrating competing machines to village board members, the entire board agreed on this.

Sweet Smell of Success

So, how are local residents reacting to the new composting facility? Considering the fact that the plant has no leftover compost – even having a waiting list at times for its compost – the facility has been met with resounding approval. Residents wanting compost for their yards and flower gardens come down to the facility, and operators provide them with information about the mandatory testing that's been done for metals and salmonella. Residents can come in with their own containers or trucks, specify how many yards of compost they want, and the workers load them up. Each will then have to sign a release form that tells how the compost was made, what metals are in the compost, and the quantity taken.

The plant has been very proactive at getting the community involved in the success of the composting facility. It's been advertised and a Facebook page created about it. The facility worked with the school district's seventh grade class on a village-wide flower planting project that demonstrated the quality of the compost to village residents. The WPCP even started a tree nursery onsite using the compost. Inexpensive saplings are bought and grown in compost for future street tree replacement around the village.

Plant workers are pleased with the way the entire project has turned out so far. Besides saving the community money in the future, they're also creating an environmentally-friendly product that provides a much needed, beneficial alternative to chemical fertilizers, the use of which many municipalities are limiting or prohibiting. The Marcellus school district can't use non-natural fertilizers, so they may become a customer. One of the town's parks wants to rehabilitate all of its softball fields with this compost. There's definitely a demand, and the facility's staff members were pleased that they were able to put their heads together and come up with this sustainable, less expensive solution. It really is the wave of the future.

Holding the finished Class A compost product.

Photo by Ryan Riefler

Ryan Riefler is Assistant Operator at the Water Pollution Control Plant and Compost Facility for the Village of Marcellus, New York. The facility may be contacted at: wpcpoper@centralny.twcbc.com, or through Facebook under the Village of Marcellus Compost Facility.

Job Postings | Job Postings | Job Postings

Water Quality Division Manager

The Development Authority of the North Country (DANC) is a multi-faceted New York State public benefit corporation created in 1985. Since its establishment, DANC has constructed regional water and sewer utilities that serve multiple communities in Jefferson County. In addition to owning/operating these facilities, DANC provides contracted water/wastewater services to municipalities in Jefferson, Lewis and St. Lawrence Counties. DANC is seeking a Water Quality Division Manager to direct the operations of the division, including budget development and administration; regulatory compliance; asset management; development, leadership, and evaluation of operations staff; service proposal development and customer care; and implementation of Authority policy at the division. The Authority is seeking an individual with strong management credentials, and internal and external communications strengths. The position works closely with state regulators and local government officials.

Applicants must have a Bachelor's Degree in administration, business, environmental science or engineering; an advanced degree is desired. The ideal candidate will be highly skilled in municipal operations management, environmental compliance, project management and financial analysis. The ideal candidate will have an understanding of public grant sources for capital projects, and possess excellent technology, HR, communications and customer relations skills. Applicants must have 10 years of progressively responsible water quality management experience in the public sector.

The Development Authority offers a competitive compensation package including participation in the NYS Retirement System, tax deferred compensation plan, paid holidays, vacation, sick time, medical insurance, and tuition reimbursement. Please submit cover letter, resume, application for employment, three professional references, and salary requirement to info@danc.org. Employment applications are available for download at www.danc.org. Review of applications will begin immediately and continue until the position is filled.

The Development Authority of the North Country is an Equal Opportunity Employer.

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Project Manager – Water Resources, New York, NY

Hatch Mott MacDonald (HMM) is an award-winning consulting engineering firm with major success in the fields of rail and transit; highways and bridges; water and water resources; wastewater; tunnels; environment; municipal engineering; aviation; ports and harbors; architectural services; and pipeline services. **Candidate Specification:** NY State P.E. license; B.S. degree in civil or environmental engineering; minimum 10 years experience in planning, design, and construction of water supply facilities; minimum of 5 years project management experience; experience on New York City water projects.

Job Description: 1. Management and delivery of a variety of projects in the water supply field. Responsibilities will include proposal development, management of project budgets, supervision of project teams, communications with clients and other outside stakeholders. 2. Periodically reviews project schedule and progress on the projects he or she is assigned. 3. May outline problems and methods of approach for other engineers. 4. Assists in the completion and execution of several varied assignments simultaneously. 5. Maintains liaison with individuals outside the firm. 6. Reviews and analyzes a variety of scientific data to determine requirements to meet objectives. 7. May assist client as required to monitor performance of contractors. 8. May perform non-routine and complex assignments. 9. Applies knowledge of engineering or scientific principals and practices in broad areas of assignment and related fields.

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Job postings continued

Visit www.nywea.org for more job postings.

Spring 2013, Vol. 43, No. 1

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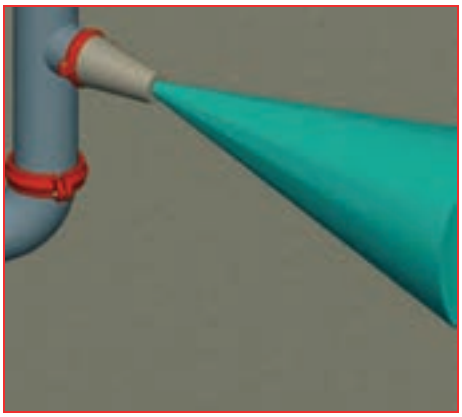

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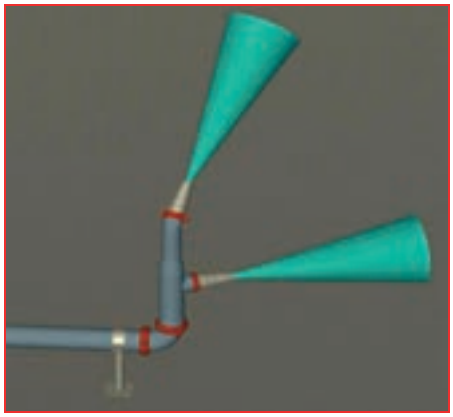

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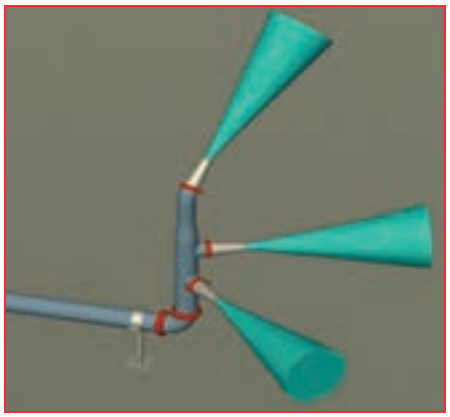

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Town of Pendleton Water/Sewer Superintendent Jim Argo (far left), along with Pendleton Field Technicians Jeff Jarvis (center) and Rick Geltz (right), with one of the Town's 400 E/One Upgrade grinder pump control panels.

Located in Niagara County, the **Town of Pendleton, NY** currently has 900 pressure sewer stations, dating back to 1979. The Town saved significant capital cost by selecting pressure sewer over gravity.

The existing grinder pumps had a history of jamming when trying to grind and pump personal hygiene products, cloth items, and baby wipes. Grease build-up on the floats caused dozens of false alarms, which led to unnecessary and wasted labor costs.

The Town first tried an E/One grinder pump as a retrofit in 2000. After two years of successful operation with no jams or other operational issues, the Town began a planned retrofit program using E/One Upgrade pumps.

To date, roughly 400 old grinder pumps have been replaced with the E/One Upgrade pumps. By the end of 2014, another 250 will be retrofitted.

> "We really like the E/One pumps. There are no rails, which can be troublesome; we can work on them in our shop; grease is no problem; and best of all, we have not had one jam in the 13 years that we have been using them. In addition, the support by **Jim Bell**, **the Siewert Team** and **E/One** has all been top notch."
>
> *- Jim Argo, Water and Sewer Superintendent, Town of Pendleton*

Jim Argo of the Town of Pendleton with Jim Bell, Service Sales Engineer for Siewert Equipment.

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