Aerial view of the Cross Plains Wastewater Treatment Facility

51st Annual W.W.O.A. Conference
October 17-20
Madison Marriott West, Middleton
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The Clarifier is the publication of the Wisconsin Wastewater Operators’ Association and is intended to inform and educate the membership on issues related to the treatment and control of wastewater. The Clarifier is produced five (5) times each year: February, April, June, September, and December. All members are encouraged to contribute to the mission of the Clarifier.

The Wisconsin Wastewater Operators’ Association is a non-profit organization dedicated to educating, informing, and advancing the wastewater profession. WWOA has approximately 2,000 members divided throughout six regions: Southeast, Southern, Lake Michigan, North Central, Northwest, and West Central.
Presidents message: Education works one person at a time

Winter is upon us and no matter how cold or severe the weather is in Wisconsin, Resource Recovery Professionals continue to work hard to clean the water and recover our natural resources. Winter started blistery cold with lots of snow this year but sadly, there has been little snow in southeastern Wisconsin since the start of 2017. On one hand, I want the fields thawed and dry so we can replenish the nutrients in the soil and reduce our biosolids inventory and on the other hand, I want to see several feet of snow so I can ski until the spring 70 degree Fahrenheit weather arrives! (Ok, I'm not in Kansas anymore so 60 degrees would be a good start.)

No matter your personal outlook on the season, reality is winter in Wisconsin brings special challenges to our profession. Wisconsin operators are a select group of the Resource Recovery Community whom are skilled to handle the adversities which are caused by harsh winters and weather changes.

The WWOA Board of Directors and Regions have been busy organizing and scheduling a host of training opportunities to help you get through winter and into spring. The Events Calendar on the WWOA Website is packed with Regional Meetings, an Expo, Seminars, and Training Events/Classes, including a microscopy workshop and enhanced biological phosphorus removal optimization classes. I encourage you to review the Events Calendar and register to attend one or two meetings.

The WWOA Vice President, Jeff “Juice” Simpson, has been actively working on preparations for the 51st WWOA Annual Conference to be held October 17 – 20, 2017, at the Marriot Madison West Conference Center in Middleton, WI. The Technical Committee is scheduled to meet on February 10 to sort through the abstracts and select the papers and presentations for the 51st Conference. Lodging information for the Conference is on the WWOA website. Unfortunately the WWOA only had a limited number of rooms at the Marriot Madison West Hotel secured at the Conference Rate. Thankfully Executive Secretary, Karen Harter, worked tirelessly and successfully secured a sufficient number of rooms at surrounding hotels. The WWOA will provide shuttles from the hotels not within walking distance to the Conference Center. Please see the WWOA website for the Lodging Information.

As we prepare for the 51st WWOA Annual Conference, please take the time to nominate your deserving colleagues for the various WWOA Awards. And gather your teams for the Operator's Competition as it is never too early to start planning and practicing. I encourage you to go one step further and think about advancing your leadership role by becoming a Director of this great organization. If you have any inclination to submit your nomination, please contact Past President Lyle Lutz.

The WWOA Board of Directors is proud to be able to post an educational video of “The Evolution of Wastewater Regulation, Wastewater Process Progression, and WWOA Evolution Over the Last 50 Years”, by Duane Schuettpelz, Ken Sedmak, and Joe Gehin. This presentation was first delivered at the 50th Annual WWOA Conference in October 2016. Several members requested a video recording of the presentation so the speakers obliged and offered it again at the Lake Michigan Regional Meeting in January 2017. The video will be posted on WWOA's website soon (if not already). A special thank you goes out to Duane, Ken, and Joe for taking the time to educate us all and allow us to preserve this important history. Wisconsin and the WWOA continue to be leaders in treating water and recovering resources in the United States. Perhaps it is time as we lead into the next 50 years that we recognize ourselves and organization as the Wisconsin Resource Recovery Specialists.

As I mentioned in my last message, I strongly believe public education is a primary component to improving our final treated product, reducing maintenance costs, and gaining the trust and respect for our work so that the public ultimately understands and appreciates the true value of water. I’ve recently witnessed the effectiveness of public education working through the City of Sheboygan’s increased efforts of talking to industries, hospitals, and local officials about “No Wipes Down the Pipes.” We have utilized Marshfield’s brochure to create one for Sheboygan’s customers and it is working! We have received several calls from users asking for more brochures to hand out at their town meetings and post in their work place restrooms. Education does work; one person at a time! WATER is our resource to protect, renew, and share!
Cross Plains Wastewater Treatment Facility

PROJECT HISTORY
The Village of Cross Plains completed an upgrade of the wastewater treatment facility in 2007. The planning objectives for the upgrade included additional treatment capacity for future growth, replacement of outdated equipment, and promoting a safer working environment for staff. However, the biggest reason for the upgrade was to guarantee protection of Black Earth Creek, a State of Wisconsin designated exceptional water resource.

The first phase of the upgrade started in 1997 with planning and construction of sludge processing and phosphorus removal systems mandated by the DNR. The scope of work included the addition of mechanical fine screening, increased storm water pumping capacity, enhanced biological phosphorus removal, and installation of solids thickening equipment. At that time a decision was made to transport thickened biosolids for treatment to the Dane-Iowa Regional Wastewater Facility delaying the need for more extensive modifications. The first phase of work extended the life of the existing plant by seven years during which time comprehensive planning could be undertaken for a more thorough upgrade.

PROJECT DESCRIPTION
The work completed at the Cross Plains wastewater plant has resulted in a facility designed to achieve a high degree of water treatment utilizing state of the art equipment and processes. These processes can be grouped into four main categories including preliminary treatment, biological treatment, disinfection, and sludge processing and are described in more detail in the paragraphs that follow. Other improvements in the scope of work included replacement of the main sewer interceptor extending to the plant, updating the main control and monitoring system, remodeling the public works building, and purchasing new equipment for maintenance of the sanitary sewer system. The construction continued on page 6

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continued from page 4

costs for the improvements at the treatment facility came in at $5.9 million with another $1.2 million for the additional work.

PRELIMINARY TREATMENT

The raw wastewater first enters the treatment facility at the new Headworks Building. This structure contains the influent flow meter, raw wastewater lift pumps, screening, RAS/WAS sludge pumps, motor control center (MCC), and emergency generator.

The wastewater flows thru a metering flume and sampling station, and then drops into the wet well where new influent pumps lift the wastewater to the highest point in the plant, and, thus allows the wastewater to flow through the remaining treatment processes by gravity. The metering flume provides measurement of flows for record keeping and for controlling other processes throughout the facility.

The wet well was constructed deep enough to accept gravity interceptor flows from the Village collection system, and has the ability to eliminate several siphons crossing the creek. Eliminating the siphons will reduce maintenance and potential flow restrictions.

The wastewater pumped from the wet well is conveyed to the headworks room, where it passes through mechanical fine screening equipment used to remove such items as rags, plastics and other non-biodegradable

continued on page 8
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materials. Removal of this material improves the secondary treatment process, reduces the possibility of equipment clogging, decreases wear and tear on the equipment and eliminates the plastics from being spread on agricultural land. The screened material is washed, compacted and discharged into bags which are taken to the landfill.

The channels in this building are constructed to allow for the future addition of grit removal treatment if needed. In lieu of grit removal equipment being installed, the Village selected to proceed with the purchase of a new sewer vacuum/jetter vehicle that is used to remove grit from the sanitary sewer system before it flows to the plant. This should provide more versatility for Village Staff.

**BIOLOGICAL TREATMENT**

The flow continues by gravity to the biological treatment process. This process uses selector basins (Structure 33), the oxidation ditches (Structures 35 and 45), and the final clarifiers (Structures 50 and 55).
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The new selector basin and duplicate oxidation ditches and final clarifiers were added during the upgrade to meet duplicate unit requirements by DNR. The wastewater first flows into the first selector basin (Structure 33), which is utilized to generate volatile fatty acids (VFAs), which are crucial in overall promotion of biological phosphorous removal. The wastewater flows into the remaining basins where it provides for a series of anoxic (no dissolved oxygen present, but molecular oxygen present) and anaerobic (no oxygen in any form present) environments that are maintained to condition the biomass and promote biological uptake of phosphorous. In the selector basin, phosphorous is actually temporarily released under the stressful conditions the biomass is placed under, and any remaining molecular oxygen is removed by the micro-organisms. The conditioned wastewater then flows into the new oxidation ditch (Structure 35) and existing oxidation ditch (Structure 45).

The oxidation ditch structure is used in conjunction with the selector basin and uses an activated sludge biological treatment process where dissolved organic materials are removed by micro-organisms feeding on the waste, resulting in generating more micro-organisms. The process promotes biological reduction of pollutants in the wastewater and will typically provide greater than 98% removal of waterborne wastes.

Dissolved oxygen (DO) and oxidation reduction potential (ORP) sensors are installed in the selector basin and oxidation ditch structures to monitor the process conditions. These sensors can also be used to automatically adjust the aeration equipment operations continuously to maintain the desired environments in the respective structures and minimizing the power consumption.

The incoming wastewater and pumped biological floc (Return Activated Sludge, or RAS) are mixed within the selector basins, and the resulting mix of wastewater and micro-organisms is referred to as mixed liquor suspended solids (MLSS). It is this mix of MLSS which circulates in the oxidation ditch where the mechanical surface aerators provide mixing and aeration of the MLSS to allow the micro-organisms to breathe, consume waste, and reproduce.

The mixed liquor suspended solids (MLSS) when exposed to the oxygen rich environment maintained in the oxidation ditch, will absorb the phosphorus released in the upstream selector basins, plus they will absorb an additional amount that they directly remove from the wastewater. This is how biological phosphorous removal
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is accomplished. The aeration equipment in the oxidation ditch is very energy efficient, and the water depth on the aerators can be adjusted to transfer different amounts of oxygen to the MLSS depending on the demand placed on the plant.

After a period of time, the micro-organisms consume most of the waste from the wastewater and the MLSS then flows from the oxidation ditch to the final clarifiers (Structure 50 and 55). In the final clarifier, the MLSS waste enters the center of the tank and the wastewater flows outward to an overflow trough at the perimeter of the tank. The clarifier is designed so that by the time the waste gets to the tank perimeter; the micro-organisms which are heavier than water will settle out of the MLSS waste and collect on the bottom of the tank. Thus, separation of the micro-organisms from the wastewater occurs and the treated “clear” water overflows from the perimeter of the tank and leaves the final clarifier. The settled biomass is collected in the center of the tank, pumped out, and returned to the selector basins which is called returned activated sludge (RAS). The clear water fraction flowing out of the final clarifier (effluent) flows to the final stage of treatment, Disinfection.

In addition to the biological treatment described above, the operators also have the ability to add a variety of chemicals to the wastewater if necessary to achieve process objectives. The chemical addition facilities, originally constructed in 1997, can provide for backup phosphorus removal to the biological process. These facilities were retained for continued use under the current upgrade. These chemical metering pumps are located in the existing blower building (Structure 20).

**DISINFECTION**

Disinfection, post aeration and final monitoring occurs in the new UV disinfection/post aeration structure (Structure 60), with the effluent automatically sampled, disinfected by ultraviolet (UV) light, aerated, and then measured and discharged to outfall at the Black Earth Creek. The UV disinfection system forces the wastewater to pass in close proximity to high intensity bulbs which emit light in the UV wavelengths (UV light is very effective in killing micro-organisms which may be present in the wastewater), thus rendering it safe for discharge. The UV system adjusts to the flow rate through to operate the appropriate number of banks (there are two) in order to save power when the flow is low and ensure the effluent is safe when the flow increases.

The disinfected water then passes through a flow measurement flume and then on to the post aeration tank, which raises the dissolved oxygen level in the effluent to ensure the oxygen levels are high enough to sustain the continued on page 14
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naturally occurring life forms in the creek. The flume is used to measure the effluent flow rate, and this data is automatically recorded for reference.

SLUDGE PROCESSING
As described in the secondary treatment process section, the result of biological treatment is the reproduction of micro-organisms (or sludge production). There is a portion of the activated sludge biomass that is regularly removed from the process called waste activated sludge (WAS). The removal of the WAS flow is used to control and maintain the desired balance of micro-organisms and nutrients within the activated sludge process.

The WAS is pumped to the existing digester (Structure 30), where it is aerated to minimize odors. After a short storage period, the liquid sludge product is periodically pumped to a gravity belt thickener (GBT) equipment unit used to thicken the biosolids prior to hauling off site. The previous upgrade work installed the GBT equipment, solids pumping and loading facilities at the old control / sludge thickening building (Structure 10) which was retained for continued use under this upgrade.

The feed sludge is pumped to the GBT, conditioned with polymer and other chemicals before flowing onto a woven fabric belt, where unrestricted water drains away by means of gravity. The partially drained sludge flows to a hopper where it is then pumped directly to the hauling vehicle or to Structure 30 for temporary storage. This process reduces the volume of sludge by a factor of 4 to 6. Sludge coming off the GBT is an unstabilized sludge which requires further treatment at the Dane-Iowa Treatment Facility. The Dane-Iowa Treatment Facility then adds lime to the sludge and creates a Class A sludge.

OTHER PROJECT IMPROVEMENTS
In addition to the upgrade at the wastewater treatment plant, the scope of work included replacement of the sanitary sewer interceptor on Market Street, remodeling of office space and adding garage storage at the Public Works Building, and providing a new monitoring and control system (SCADA) for the Village utilities.

A sanitary sewer interceptor was constructed from the wet well to the intersection of Market Street/USH 14 to Bourbon Street. Likewise, the sewer work also replaced a problematic section of sewer along Springfield Road (CTH P). Infiltration and inflow studies had identified that Main Street and Springfield Road sewer collectively should be
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considered for replacement. The wastewater plant wet well was constructed at a lower depth and the connected sewer was then replaced at a low enough depth to allow gravity flow from the Bourbon Road and USH 14 connections. An inverted siphon was removed from the Black Earth Creek crossing on Market Street which will reduce the levels of collection system maintenance. The interceptor on Market Street was upsized to an 18” sewer which will minimize the sewer surcharging that periodically occurs at the intersection of Market Street and Highway 14 during major rain storm events. This interceptor on Market Street will allow for complete replacement of the Main Street sewer when Highway 14 is upgraded around 2012 to 2015.

The existing public works service building (Structure 95) was upgraded to provide for the additional office space needed for the operating staff, and added garage space needed for storage for the new sewer vacuum/jetter vehicle. A former garage space within the existing facility was converted to office space, with computer room and SCADA room. In addition, two garage bays were added to the building to provide vehicle storage. The existing building heating, ventilating and electrical systems were upgraded accordingly to provide for these new amenities.

In addition to the changes made at the wastewater treatment facility, a Supervisory Control and Data Acquisition (SCADA) control system was added for the Village utilities. The SCADA control system will allow the operators to monitor operations at the wastewater facility, remote lift stations, water supply well and water reservoirs. The SCADA system records performance data, adjusts equipment operations, responds to alarms remotely by computer modem and assist in system trouble shooting. This allows the Public Works Department to operate more efficiently. This efficiency will result in better operating strategies, reduced energy usage, better opportunities for improved capacity and a quicker response time to problems.
Design Loading and Effluent Limits

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Design Loading</th>
<th>Effluent Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Daily Flow</td>
<td>0.60 MGD</td>
<td>30 mg/L</td>
</tr>
<tr>
<td>Peak Hourly Flow</td>
<td>2.57 MGD</td>
<td>30 mg/L</td>
</tr>
<tr>
<td>Biochemical Oxygen Demand (BOD):</td>
<td>127 lbs/day</td>
<td>5.0 mg/L</td>
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<tr>
<td>Suspended Solids</td>
<td>145 lbs/day</td>
<td>1.0 mg/L</td>
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<tr>
<td>Ammonia – Nitrogen (N)</td>
<td>155 lbs/day</td>
<td>2.0 mg/L</td>
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<tr>
<td>Total Phosphorus</td>
<td>44 lbs/day</td>
<td>0.5 mg/L</td>
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<tr>
<td>pH</td>
<td>n/c</td>
<td>6.8-9.2</td>
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<tr>
<td>Dissolved Oxygen</td>
<td>n/c</td>
<td>7.0 mg/L</td>
</tr>
</tbody>
</table>

* Effluent limits given are for summer months only.

Cross Plains Wastewater Facility

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Office pictures
Hilbert hosts December Lake Michigan district meeting

The December 15th Lake Michigan District meeting in Hilbert was another successful meeting with approximately 90 operators, septage haulers, and DNR personnel in attendance, along with many equipment and process vendors. A special thanks to Peterson & Matz for sponsoring the treats during the breaks.

Dennis DuPrey, Village of Hilbert Administrator/Clerk/Treasurer, welcomed everyone and gave an overview of the Village.

Following the welcome by Dennis DePrey, Duane Schuettpelz, Ken Sedmak, and Joe Gehin redelivered The Evolution of Wastewater Regulation, Wastewater Process Progression, and WWOA Evolution over the Last 50 years. This was the keynote presentation given at the 2016 Annual Conference. The WWOA Executive Board requested the presentation be redelivered at the LMD meeting to allow for it to be recorded.

Next on the agenda was Jim Fischer of Flygt. Jim had a presentation titled Energy-Saving Mixer Pays Bid Dividends in the Bio P Removal Process. Jim first discussed Hilbert WWTP mixer installations and the associated energy savings. Jim stated the mixer installed in the orbal is saving the Hilbert WWTP with reduced electrical usage, reduction in phosphorus removal chemical, and reduced need for maintenance. Jim then went on to explain the reasoning and installation requirements for installing a mixer in the aerobic digester. In addition, Jim covered how Hilbert WWTP operators discovered an unexpected benefit of having the mixer installed in the aerobic digester. The unexpected benefit was to control foaming during plant upsets. Jim provided a list of goals of BNR mixing. Next, Jim explained the basics of mixing and how to properly position mixers in different types of structures. Jim ended...
his presentation by discussing some previous projects where the sizes of the existing mixers were successfully reduced to save even more in electrical costs.

Dustin Jerabek called the WWOA LMD business meeting to order. Last quarter’s minutes and treasurer’s report were approved. Nominations for the 2017 LMD Vice Chair were accepted and Jenny Pagel of Clintonville WWTP was elected. Richard Sachs of the WDNR stated the study guides for subclass N – Total Nitrogen Removal is scheduled to be available within the next few months and the exam will be offered in May, 2017. Richard explained that the DNR continues to implement changes in the Wastewater Program in order to be in compliance with federal rules. Among them are revisions to the procedures for the frequency of testing for the whole effluent toxicity (WET) tests and when WET limits are needed. Lastly, Richard stated the DNR continues to await EPA’s approval of the Phosphorus Multi-Discharge Variance. Following the DNR update, Jeff Smudde and Jeff Bratz gave the WWOA Board of Director update. Registration is open for the February 6th & 7th Midwest Water & Wastewater Operator Expo in Wisconsin Dells. Registration is open for the 2017 Governmental Affairs Seminar in Madison on February 23, 2017.

Registration is open for the 1 day Enhanced Biological Phosphorus Removal Optimization class in Plymouth on March 2, 2017. Registration is open for the 2017 Spring Biosolids Symposium in Stevens Point on March 21, 2017. People are encouraged to start thinking about and submitting 2017 award nominations. If interested in being part of a team for the 2017 Operator Competition, contact Jenny Pagel. Rick Mealy will be taking over on the state board for organizing the operator competition.

The last presentation of the day was by Anna Steinfest of AFF Research. Anna’s presentation was titled Fair Share Goals for projects funded through Safe Drinking Water Loan Program and Clean Water Fund Program starting in 2017. Anna gave an overview of the Disadvantaged Business Enterprise program. Anna explained the major components to ensure that minority and women-owned businesses have the opportunity to participate in procurements funded by EPA financial assistance agreements. In addition, Anna discussed the Green Bay Packers’ Mentor Protégé Program and the impact it has had on the community.
continued from page 19

presentation was wrapped up with Anna providing resources to find additional information. Charley Fochs, Director of Public Works for the Village of Hilbert, gave an introduction of the WWTP history, flows, loadings, current industrial discharge impacts, major processes, and components. A plant tour followed the plant introduction. The next meeting will be in Seymour on February 16, 2017. Special thanks to the Village of Hilbert for hosting this meeting.

Minutes submitted by Josh Steffeck, Lake Michigan District Secretary/Treasurer

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What's the true cost of clean water?

For the past 20 years, MSA Professional Services has been studying the cost of clean water. The firm recently released results of its 8th Wisconsin Cost of Clean Report, which provides comprehensive information on sanitary sewer services in the state. It gives communities the information they need to compare their current and proposed sewer rates with those of communities of a similar size.

This report contains data from 338 Wisconsin communities that operate sanitary sewer treatment and collection systems, which represents approximately 42% of the publicly owned collection systems in the state. Approximately 81% of them include a publicly owned wastewater treatment facility; the other 19% are connected to a regional treatment facility owned by another entity.

Findings
The most consistent relationship observed throughout the past 20 years is between annual sewer rates and population. Even though residents of the largest communities consume the most water, they pay less for their sewer service. The economy of scale works greatly to the advantage of larger communities.

Communities with populations 2,000 or fewer represent the majority of sewered communities in Wisconsin. The highest sewer rates occur in the population range of 1,001-2,000, which can be ascribed to the economy of scale and the more advanced treatment technologies (and project costs) necessary to serve communities of this size. In 2016, the average difference in monthly sewer cost between the smallest and largest communities was nearly $16 per month, based on actual water usage. The difference in high-to-low average costs in 2013 was $20 per month and $15 per month in 2010. Although the difference between small and large community sewer rates continues to be stable, statewide average sewer rates are still increasing at a rate of 4.7% per year since 1996.

Breakdown of respondents by population

Average and median annual sewer service charge by population (based on actual usage)

Average annual sewer cost from 1996 to 2016 (based on 55,000 gallons per year per customer)

Total monetary and average annual percent increase in sewer user charges from 1996 to 2016 (based on 55,000 gallons per year per customer)

continued on page 22
Another trend observed in the data is that the State of Wisconsin continues to show a decrease in average daily potable water usage in all population categories. A statewide average water use reduction of nearly 20% has been observed since 2006, with an 8% decrease from 2013 to 2015. Factors leading to reduced statewide potable water use include the use of water-saving plumbing fixtures and possibly water conservation measures in response to increased water and sewer rates.

While the prime factors influencing sewer charges are population and treatment type, other factors impact the cost of sewer service, including:
- Age of treatment facility
- Use and cost of sewer connection and/or impact fees
- Time since last rate increase
- Charges to industries and hauled wastes

Affordability and Funding
Throughout the past 20 years, funding for wastewater treatment projects has been unpredictable. The 2016 report outlines the decline in grant dollars available from three major state and federal agencies.

Major funding agencies rely upon a measure of the affordability of sewer service to determine grant eligibility. A commonly used affordability threshold is 2% of a community’s Median Household Income (MHI). This study documents that only 7% (23 out of 338) of communities’ sewer rates are at or above 2% of current MHI, suggesting the “affordability threshold” used by some agencies may not be a realistic expectation. In recent years, funding agencies have relaxed this threshold to less than 1.5% of the MHI on a case-by-case basis.

The American Reinvestment and Recovery Act of 2009 or “economic stimulus” funds provided a temporary shake up to this cycle. While this additional funding was a benefit to some utilities in 2010, the amount of grant funding quickly decreased to “pre-stimulus” levels in 2011. Due to the varying trend in availability of grant dollars, it cannot be an expected source of funding for wastewater facility improvements. This will continue to put pressure on municipalities to raise their rates sufficiently to fund an increasing share of the cost to provide sewer service.

Conclusions
Sewer rates are just one reflection of the true cost of water. In Wisconsin, residents have become accustomed to inexpensive water rates and the perception that water is abundant. However, some communities have struggled with water supply. In addition, smaller communities are largely at the mercy of their economy of scale. The generous grant funding that helped pay for infrastructure is no longer available at that level and treatment requirements continue to grow stricter.

Compared to other utilities and services, the cost of clean water is a bargain. The survey indicates that users pay a $153 monthly fee for their mobile phone, but only $37 per month for sewer and $21 per month for water. The study has shown over the past 20 years that sewer and water monthly charges are always among the cheapest utility and service fees.

The price of clean and safe water should include all of the capital, operating and replacement costs necessary to produce, treat and deliver this resource in a manner that is truly sustainable. Many communities are educating their citizens about the true cost of clean water. While rate increases are never easy, providing the rate payers with information on how their rates compare to other communities in the State will make the rate adjustment process easier to manage. With regularly scheduled rate increases, rate payers will be in a better position to meet tomorrow's regulations designed to protect water quality for all.
The explosion that didn’t happen!

By Glenn Smeaton

The day of October 16, 2016 in Madison, Wisconsin began with thunder and lightning. As the employees of Madison Metropolitan Sewerage District arrived at work, lightning struck the fiberglass enclosure of their pressure regulator and flame arrester on top of the digester. A fire was sparked and quickly grew with heat intense enough to melt the lead weights in the pressure regulator. The digester was operating and generating highly flammable methane gas. Employees were evacuating the area as the fire was extinguished, but the big event they were all bracing for never happened. There was no explosion!

Fires and explosions associated with anaerobic digesters and methane storage systems are more common than people realize, mostly because of widespread underreporting. This is especially true in “near miss” situations, where there is no human injury or death. Page 160 of Volume 2 of the Sacramento Course, “Operation of Wastewater Treatment Plants” uses the example of a digester floating cover that had blown off landing on a pickup truck (Fortunately, driver was not in the truck at the time!). A small town in West Central Wisconsin experienced a digester explosion where no one was hurt or killed. It became another unreported incident that left a horrible clean-up job for the operator and multiple repairs before the digester could get back on line. Recently, a cattle manure digester in Dane County, Wisconsin had an explosion resulting $250,000 dollars damage. But as with the West Central Wisconsin case, the event was not recorded as a digester related explosion.(1)

So why didn’t Madison’s digester explode? Madison’s digester did not explode for three primary reasons: 1- proper design, 2- diligent maintenance practices, and 3- proper operation of the anaerobic process preventing an air/gas mixture (which causes methane to become explosive).*

Madison’s gas collection and storage system was designed with the necessary safety equipment. There is a flame arrester between every possible flame source and the stored methane. (Flame arresters have corrugated metal windings that reduce heat below the flash point to prevent ignition

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of the stored gas) It was not just good luck that prevented the explosion; Madison’s planned maintenance program includes inspection and thorough maintenance of all flash arresters. Good maintenance and design are huge steps towards preventing a possible explosion. But maintaining the proper temperature, mixing, and feed rates, is possibly the most important method preventing an explosion.

The world is looking to biogas more and more each day as an energy solution. Anaerobic digesters can handle concentrated high strength wastes and at the same time, produce a usable byproduct – methane gas. With proper treatment and handling, methane can be used like natural gas to generate heat and electric power. Because of this, anaerobic digesters are being built for many new municipal, industrial, and agricultural applications. These anaerobic systems are being designed in a myriad of differing configurations and applications. But this rising popularity doesn’t always provide operators with the whole story. If you look up articles about the upside of using anaerobic digestion, you will find articles like, “Biogas from Energy Crop Digestion”(3). If, however, you do a word search for “hazard” or “safety” in the articles about the anaerobic process – more often than not, the search will report “no matches.” These articles also fail to mention training employees to be able to successfully operate, maintain, and troubleshoot the system to keep it performing as expected. But more importantly, anaerobic proponents fail to mention necessary safety training concerning confined space entry procedures, and prevention of fire and explosions.

Poor training and supervision of operators of anaerobic systems will lead to bad information causing unsafe practices and forgotten maintenance tasks. This can result in burns, explosions, and death by asphyxiation or poisonous hydrogen sulfide (H2S).

Past training efforts on the municipal level have resulted in a pool of well-trained municipal operators. Operators of industrial anaerobic systems and operators of rural cattle manure digesters, however, often do not have the same level of safety training and training in proper operation of anaerobic systems as do state-certified operators. Poor operation of these facilities often won’t become known until someone is killed or injured, or there is a massive fish-kill downstream of the system. That means that when you read or hear of a digester explosion, there are many potential explosions just waiting for a spark!

The biggest risk of explosion results from drawing air into the gas storage creating an explosive air/gas mixture. What are common causes of air/gas mixtures?

1. Drawing sludge down in a fixed cover digester. To prevent crushing from atmospheric pressure, a pressure regulator valve opens letting air into the digester. Solution: Refilling immediately upon completing draw down will force most of the air out of the digester and significantly shorten period of time with an air/gas mixture.

2. Drawing a floating cover down to the corbels and then continuing the draw down will allow air to enter digester. Air is normally kept out of a floating cover digester by the water seal between cover and wall. Solution: Thorough ventilation as digester is being drawn down will take methane levels below the explosive range as well as eventually making safe confined entry procedures possible if special cleaning and repairs are needed. Startup after all mechanical equipment is in working order should involve driving as much air out of the storage area as possible and resuming digester operation to increase methane content above the explosive limit as quickly as possible.

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3. A jammed and tipped floating cover can cause loss of the water seal. This can be caused by failure of the guides, ice in winter, or an excessive foaming event. Solution: This is a potentially dangerous situation and will require specialized equipment like a crane to get cover back into the right position. It is important to know in advance, who to call in the event of a jammed floating cover.

4. An operational change of a chronically “sour” digester resulting in sudden methane production. Solution: Sour digesters produce quantities of carbon dioxide which in itself is a fire extinguisher. When starting up a sour digester, you need to be very careful about checking out gas handling and safety devices. This is to be sure air is not getting into the digester to create an explosive mixture of newly produced methane. Also in correcting a sour digester the use of a strong base like sodium carbonate, can remove the carbon dioxide from the gas storage area. This will result in drawing air into the digester as the vacuum relief valve opens to protect the digester from crushing atmospheric pressure.

Many cases of air/gas mixtures are related to emptying, cleaning, and refilling digesters. It is well worth the investment to hire firms that are experienced and equipped to properly clean and repair digesters. A tragic accident in Pennsylvania (2) resulted in deaths of a father and son working inside a digester. They were working to move thickened sludge to a pump intake. They were using forced air to stir the sludge which released trapped methane while mixing it with forced air. An (unapproved) electric light they were using broke and ignited the gas. Their deaths were caused by air/gas mixture and an ignition source but in reality, the cause was not having an experienced and properly equipped professional crew doing the job. In discussing the explosion that did not happen, I have not
yet addressed the lightning strike that caused the fire in Madison. In researching this topic, I had the opportunity to discuss the strike with Jim Grasty, an engineer systems manager with Alltec. Jim Grasty has had over 30 years of experience in the field of lightning protection, surge suppression, and grounding site surveys. He has led over a hundred surveys and designs for lightning protection and electrostatic hazard mitigation in flammable environments. His experience leads him to believe that lightning strikes in flammable environments are much more common than we realize. At any moment, it is estimated that 1,800 thunderstorms are in progress somewhere on Earth. About 100 lightning bolts hit the ground each second! Alltec recommends a three-tier comprehensive facility approach for lightning protection that includes analysis, surge suppression and grounding.

The three key points I took out of visiting with Jim Grasty are: 1. Lightning strikes are much more common than we realize, 2. If you have containers of flammable gas (like anaerobic digesters), you may need to evaluate and update your lightning protection strategy, 3. The scientific understanding of lightning protection has come a long way from the days of Ben Franklin!

Properly designed and operated anaerobic digester systems offer many advantages over alternative systems. Many believe them to represent the future of energy and waste. But anaerobic digesters need to be safely and properly operated and maintained. They need skilled operators to run them, and operators need to be trained and kept current!

Glenn Smeaton is a Crabtree Award winning water and wastewater operator trainer. He holds a master degree in water resource management from the University of Wisconsin. Most of his training experience was throughout the state of Wisconsin but he also worked for five years in the Metro Plant in St. Paul, MN. Before retiring Glenn worked 11 years as a training manager for the Madison Metropolitan Sewerage District in Madison, WI. Today he works as a consultant to Aquafix, advising on aerobic and anaerobic safety and training.


**Special thanks to Madison Metropolitan Sewerage District for permission to use these photographs**

**Digester Course Announced**

A 2-day course on the Advanced Operation and Maintenance of Anaerobic Digesters will be held on April 11 & 12 at Watertown City Hall. The course is approved for 12 CECs, and is hosted by the Southern District of WWOA, and the City of Watertown. All proceeds, after course costs, will be used for the establishment and continuation of a Southern District scholarship. Registration info will be available soon, and can be obtained through the WWOA website, or by emailing a Southern District officer.

The course was brought together by Glenn Smeaton, and Kevin Ripp of Aquafix, to support the exchange of knowledge and experience in the field of operation and maintenance of anaerobic digesters. Attendees will gain insight into the characteristics and attributes relating to anaerobic digestion systems. Topics include an overview of the anaerobic digestion process; identifying design configurations to facilitate the anaerobic digestion process; an in-depth instruction into the start-up, operation, ongoing monitoring, maintenance, troubleshooting and safety considerations involved with anaerobic digestion systems. The course includes an interactive anaerobic digestion group tabletop exercise, a WWTP facility tour focusing on the digestion processes and equipment; onsite laboratory demonstration of process control monitoring analyses involved with anaerobic digestion systems.
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North Central Steering Committee at Mosinee Dec. 8

Andy Ott called the meeting to order at 11:31 AM. Steering Committee Members Ken Bloom, Travis Dulek, Joe Gehin, Katie Gruber, Chris Helgestad, and Andy Ott were present.

Discussion occurred on the Officer's positions. Andy agreed to remain as Chairperson. Travis agreed to take over as Vice-Chairperson as Katie informed the committee she will not be running for another term. Ken agreed to remain as Treasurer and Chris will remain as Secretary. Joe announced that he would also not be running for another term.

Ken Bloom presented the Treasurer's report. As of the date of the meeting, the Region had a checking account balance of $4130.55 and an escrow account balance of $644.01. There has been no new activity since the last report.

Discussion occurred on the timing of elections. Chris commented that with two open seats to fill this year additional effort will need to be made to encourage members to run. Chris also commented on the handling of ballots. He felt that in the future, when the Secretary is on the ballot, another committee member should collect and count the ballots. Discussion occurred about our future meetings. Travis will contact Nick at Whiting about hosting our spring meeting. Ken agreed to contact NCL about another special lab meeting. Joe agreed to call Roshchild & Rib Mountain Metro. He may also call PCA in Tomahawk.

Andy agreed to talk with Paul McGinley at UWSP.

Discussion occurred about the possibility of selecting semi-permanent sites as venues for the three regular yearly

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Clark Dietz Announces Wausau Office Relocation

Clark Dietz, Inc., a leading Midwest engineering consultancy, has relocated its Wausau office to a new downtown location. The new office space is located at 500 N. Third Street, Suite 703 in the newly renovated City Square Office Center building.

The move signifies the firm's commitment to providing local service to their clients. "We are proud to be in the center of the community we serve," said John Boldt, President/CEO. "Many of our staff members live, work, and play in Wausau and the surrounding communities. We share a strong commitment to ensuring the vitality of the area."

"Client engagement and responsiveness are paramount in providing the service our clients deserve and value," remarked Tonia Speener, PE. "Our new location keeps us in the heart of Northcentral Wisconsin where we can do just that. I'm very proud to be part of a successful business that values culture and supports community."

Clark Dietz is a professional engineering firm specializing in balancing the needs of people, the environment, and the economic well-being of communities through vital infrastructure improvements. The employee-owned firm provides expertise in civil/environmental, transportation, mechanical, electrical, and structural engineering. To learn more about Clark Dietz, their services, or their work in communities, please contact Tonia Speener, PE at (715) 845-1333 or tonia.speener@clarkdietz.com.
North Central Labs/North Central Region co-host lab training

The North Central Region in conjunction with North Central Laboratories (NCL) co-hosted a Laboratory Training Session at the NCL training facility, in Birnamwood, WI, on August 11th. There were approximately 53 people in attendance.

Mike Raynovic, North Central Laboratories, welcomed the attendees and briefly reviewed the agenda, speakers, tours, and housekeeping for the day. Mike introduced the first speaker of the morning, Kenny Smart, from Thermo Orion. Kenny started his presentation with an explanation of how pH measurements and calibrations are internally conducted in an Orion pH Meter. He explained how the meter translates a millivolt reading to a pH unit/value. Kenny went on to discuss the differences, functions, and features, between various Orion pH meters, and single parameter versus multi-parameter meters. Kenny explained that the slope range on the pH meter can show whether the status of the pH probe is good, fair, or poor. An ideal pH slope range should be between 95% and 102%. In conclusion, Kenny reviewed the best practices for pH Calibration Procedures, and stressed the importance of using fresh buffer solutions, with at least 2 calibration points every time a calibration is done. He also briefly reviewed electrode care and maintenance, keys to accuracy, and troubleshooting pH problems.

Laura St. Pierre, YSI, gave a presentation on “Getting the Best Data from your D.O. Meter and D.O. Technology Comparisons”. Laura started by sharing her background at YSI. She went on to explain the variables that affect D.O. measurements such as; temperature, barometric pressure, salinity, and flow dependence. Laura reviewed the different calibration procedures and the pros and cons between continued on page 30

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optical D.O. sensors and membrane D.O. sensors, including typical causes and troubleshooting of error messages. She explained D.O. measurement techniques for the different kinds of sensors, and typical interferences associated with D.O. readings. In conclusion, Laura covered the proper care, cleaning, maintenance, and storage procedures for various D.O. probes.

Paul Stinson, Thermco, followed the break with a presentation on Thermometer Calibration. Paul reviewed common thermometer terms and the anatomy of a thermometer. He discussed the various thermometer types (liquid, dial, digital) and the differences between total, partial, and complete immersions. Paul explained how to read various components of the N.I.S.T. Certificate. He went on to discuss the proper way to make an ice bath for calibration purposes. Paul reviewed the verification/calibration procedures for certifying thermometers. Paul wrapped up his presentation by explaining how to reunite separated columns in mercury filled and spirit filled thermometers.

The morning session concluded with Ken Bloom, NCR Treasurer, giving a brief overview of upcoming events for the North Central Region.

The attendees were treated to a spectacular lunch of Prime Rib and Baked Chicken, provided by NCL/NCR. Mike Raynovic, and the Staff at NCL, always provide a great meal and superb hospitality.

Following lunch, Mike Raynovic, of NCL, gave a presentation on Miscellaneous Laboratory Tips. Mike discussed the shelf life (how long is it “good”) for reagents, buffers, standards, chemicals, and solutions. Powders versus liquids, and whether it is sealed or open. All these factors depend on how long something is “good” to use. Refrigeration can sometimes extend the life of a product. Mike explained that expiration dates are recommendations from experience, not guarantees. He touched on Certificates of Analysis and how some reagents (standards) can be certified, while others (buffers, indicators, acids/bases) cannot. Mike shared the “best practices” for maximizing the shelf life of reagents. Mike also talked about the differences and best practices for spectrophotometers, cuvettes, and what to do when you receive a new probe or meter. Mike finished his presentation explaining common causes and solutions associated with BOD problems, especially GGA and BOD blank failures. Mike reminded the group that if they have problems, call NCL for help.
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Following Mike’s presentation, a short video produced by Mark Mahoney, NCL, was played. The video, “A Short Course on the Genesys 10S Spectrophotometer”, explained the features and functions of the unit. The video explained the procedure on how to properly set up a phosphorus standard curve on the Genesys 10S Spectrophotometer. The video also talked about the procedure for recalling a stored curve within the spectrophotometer and how to delete a previously stored curve.

The last session of the day was “Stump the Experts”. The panel of experts consisting of Mike, Laura, and Paul, fielded questions from the audience. A wide variety of topics were covered, including; ammonia, phosphorus, BOD, pH, and temperature related questions.

The day concluded with an optional tour of the North Central Laboratory facility. Many thanks to Mike Raynovic, the staff at NCL, the speakers, and the attendees, for all their preparation and hard work that went into hosting and making this Laboratory Training Session a success!

Submitted by: Ken Bloom, NCR Treasurer

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**Annual conference awards**

It is time to start filling out the nomination papers for the Annual Conference Awards.

There are many people in our industry that are deserving of these awards.

I am looking for nominees for the following awards:

1) **George F. Bernauer Award**: Criteria include successful plant performance, and/or successful solution of important or complicated operational problems, and/or outstanding contributions in the field of wastewater technology in the State of Wisconsin. The nominee may be a municipal, industrial, or institutional operator, administrator, or educator in Wisconsin. It is not limited to WWOA members.

2) **Koby Crabtree Award**: Presented to a WWOA member for excellence in technical support provided to others in the field of wastewater treatment. The individual should be a recognized authority in wastewater, share knowledge through presentation, contribute to problem solving, and provide service regardless of compensation.

3) **Service Award**: Presented to a person who has made an outstanding contribution to the WWOA in the areas of promotion, operation, management, program participation, or education. The nominee must be an active member of WWOA for a period of ten years.

4) **Newcomer of the Year Award**: Recognizes an operator, support staffer, or environmental technician with less than three years of experience as of August 1st of the year nominated. The nominee should demonstrate higher than average growth in their place of employment, a willingness to learn, innovation on the job, and exceptional enthusiasm for their profession. The nominator should be a supervisor, manager, peer, co-worker, or DNR personnel familiar with the day-to-day efforts of the nominee. WWOA membership is not required, and a two year membership or renewal is included in the award.

5) **Regional Operator of the Year Awards**: Given out to someone who has demonstrated excellent plant performance, and/or successful solution to a problem, and/or contributions to the wastewater field. It is open to Wisconsin Certified operators of municipal, industrial, or institutional wastewater treatment facilities. The nominee must be a five year member of WWOA.

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**continued from page 28**

meetings. Chris felt it might make things easier to pick the same sites and the same dates every year, and then find speakers and tour sites after. He felt this could move the focus away from the need to find a “host” site before making more timely meeting arrangements.

Discussion occurred on a list of potential presentation topics. Andy had a list of previous and potential topics. Katie shared a list of out-of-the-ordinary topics including meth use, waste hauling regulations, both with potential law enforcement speakers, physical therapy, and weather.

Discussion occurred about the Operator’s Competition at the annual conference. Chris Lefebvre at the City of Stevens Point handled everything for the recent competition with no real help from the committee. Andy agreed to thank Chris for his help and to encourage his participation next year, with whatever support he needs from the region. It was agreed to continue the practice of sending gift cards to the competitors as a thankyou from the region.

Discussion occurred about Facebook and its potential to promote the region. Chris agreed to be added as an admin. Discussion occurred about door prizes at meetings. The continued on page 34
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The nomination form and instructions for all the awards can be found on the WWOA website or by contacting Jeff Bratz, Awards Committee Chair, at (262)206-1323 or email at wrscdl@tds.net. Please note, the Regional Operator of the Year Award nominations should be submitted to the Regional officers listed on the nomination form by July 7, 2017. All other awards need to be submitted to Jeff Bratz by August 1, 2017 for consideration.

Feel free to contact me if you would like any further information on the awards, the nomination procedure, or if you have a question if a potential nominee meets specific award criteria. Thank you in advance for taking the time and effort to nominate individuals and allowing WWOA to recognize these deserving recipients!

Sincerely,
Jeff Bratz Award Committee Chair

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**Renew Your Membership**
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